



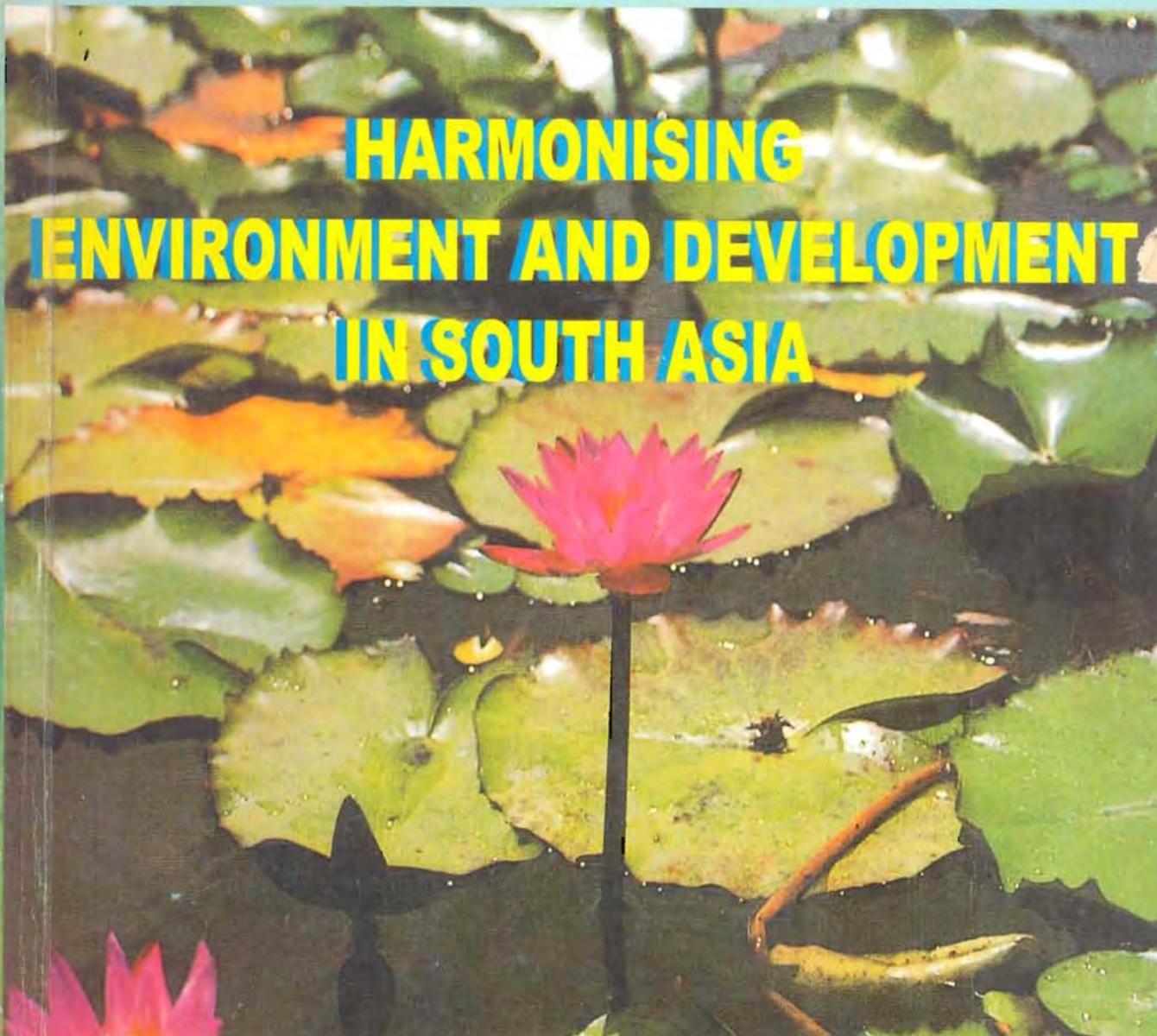
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A photograph of a pond with large green lily pads and a single pink water lily flower in bloom. The water is dark, and the scene is brightly lit, creating a natural and serene atmosphere.

HARMONISING ENVIRONMENT AND DEVELOPMENT IN SOUTH ASIA

**Harmonising Environment and
Development in South Asia**

A PUBLICATION OF SOUTH ASIA CO-OPERATIVE ENVIRONMENT PROGRAMME
IN COLLABORATION WITH UNEP AND NORAD

**Edited by
K.H.J. Wijayadasa**

HARMONISING
ENVIRONMENT AND DEVELOPMENT
IN
SOUTH ASIA

Sustainable Development Issues
Policy Considerations
Management of Ecosystems and Biodiversity
Integrated Environmental Management
Abatement of Pollution
Regional Co-operation
Capacity Building

Edited By

K.H.J. WIJAYADASA



A publication of the
South Asia Co-operative Environment Programme

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First Edition 1997

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This is a Publication of the:

South Asia Co-operative Environment Programme,
10, Anderson Road,
Colombo 5
Sri Lanka.

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FOREWORD

The Report of the World Commission on Environment and Development, also known as the Brundtland Commission, directed the attention of the international community to the imperatives of sustainable development. Thereafter, the United Nations Conference on Environment and Development of 1992; also known as the Earth Summit unequivocally reaffirmed the urgency and the high priority that should be accorded to the pursuit of environmentally sound and sustainable development. Motivated by these initiatives the South Asia Co-operative Environment Programme (SACEP) convened the first ever Environmental Management Seminar for South Asia (EMS-SA) in close collaboration with the United Nations Environment Programme (UNEP), the Norwegian Agency for Development Co-operation (NORAD) and the Government of Sri Lanka (GOSL) at Hotel Ceysands Bentota, Sri Lanka from the 16th - 27th of September 1996.

The objectives of the Seminar were fourfold. Firstly, to heighten the awareness and commitment of high level governmental and non governmental participants from South Asia in environmental protection and management. Secondly, to disseminate information and exchange knowledge and experiences gained in the pursuit of the goal of sustainable development. Thirdly, to strengthen sub-regional co-operation in environmental capacity building especially in the area of environmental management. Fourthly, to develop a cadre of decision makers, planners, managers and scientists capable of integrating environmental considerations into the development process in South Asia.

The seminar design was developed in an over arching manner having in mind the fact that sustainable development has several long standing priority goals such as economic growth, human development and resource management. The need for a calculated causative approach as against the popular symptomatic approach in which the root causes of environmental degradation such as poverty, population pressure, over consumption and wasteful production are taken care of was also recognised. Ironically, environmental problems are caused both in the pursuit of haphazard development as well as due to lack of development. When development projects are undertaken without incorporating environmental safeguards the negative impacts on the environment would far outweigh the positive benefits. Accordingly the theme of the Seminar was appropriately determined as "Harmonising Environment and Development in South Asia."

Harmonising Environment and Development in South Asia

The seminar was an unqualified success. It was made possible by generous funding from UNEP and NORAD, logistical assistance of GOSL and the organisational support of SACEP. I am indebted to the many participants who contributed to the success of the numerous sessions, especially the paper writers and presenters. Special thanks are owed to those who helped organise and manage the seminar including Mr. K.H.J. Wijayadasa, Dr. Wimala Ponniah, Ms. Berna Bayindir, Mr. Prasantha Dias Abeyegunawardene, Ms. Marlene Pereira and Mr. Kumar Kotta as well as to Ms. Chandima Jayasuriya for her assistance in assembling this volume so neatly. Last but not the least, I wish to place on record the abiding interest displayed by the Director of UNEP-ROAP, Dr. Suvit Yodmani, in seeing this project through to its logical conclusion.

Hussain Shihab

Director

South Asia Co-operative Environment Programme

12th August 1997

INTRODUCTION

The South Asian Sub-region extends from Afghanistan in the North to the Maldives in the South and from Iran in the West to Bangladesh in the East. Even though the sub-region covers only 5.38 percent of the total land area of the world it carries around 20 percent of the worlds population totalling nearly 1200 million. Approximately 30 percent of the population live below the poverty line. Acute population pressure, abject poverty and development devoid of environmental safeguards have resulted in irreparable environmental degradation and depletion of natural resources. Consequently, in South Asia, the highest priorities are poverty alleviation, population management and pursuing the goal of Environmentally Sound and Sustainable Development.

The key to environmentally sound and sustainable development is the management of the environment and its resources on a sustainable basis. Therefore, it naturally follows that Environmental Management should take into account the carrying capacity of the environment, the goals of development and the allowable limits of resource depletion, without compromising the regenerative capacity of the natural resource base. The answer to the question of how soon sustainable development can be achieved lies in the speed with which environment and development could be harmonised and integrated.

Quite often sound environmental management is hampered by inadequate priority setting, inappropriate policies, weak institutions and erratic implementation. Even though there is an overwhelmingly large amount of regulations, the effectiveness of these regulations in reducing pollution has been limited. The existing environmental management structures are not the most effective. The colonial model of environmental management by regulation, enforcement and application of punitive measures is rapidly giving way to the use of modern management tools and techniques and economic instruments.

If sustainable development is to be achieved environmental considerations should be fully integrated into the development process. To stimulate growth, reduce poverty and achieve other social objectives, South Asian countries have adopted certain policies that interfere with the functioning of the market economy. These include subsidies, tariffs and other disincentives causing policy distortions and market failures. Attempts have been made to correct these distortions through further regulation and control thus setting in motion the vicious circle of regulations, controls, subsidies and disincentives, A chaotic state of affairs indeed.

Harmonising Environment and Development In South Asia

Embracing the market oriented economic system and gradually phasing out the command and control system is a sine qua non for the rapid transition to the path of sustainable development. In this process the use of economic instruments and management tools and techniques should be actively promoted. EIA has made a big impact in South Asia in integrating environmental considerations into the development process. However, the full potentialities of EIA have not been exploited so far.

The 40 papers contained in this volume have been grouped into 7 sections as follows; (a) Sustainable Development Issues; (b) Policy Considerations; (c) Management of Ecosystems and Biodiversity; (d) Integrated Environmental Management; (e) Abatement of Pollution; (f) Regional Co-operation and (g) Capacity Building. The contributing authors have adequately focused on the theme of the seminar namely; "Harmonising Environment and Development in South Asia." They have succeeded in bringing out issues, concepts, principles and methodologies which would be invaluable in forcing the pace of Sustainable Development in South Asia.

K H J Wijayadasa
Editor

12th August 1997

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SUSTAINABLE DEVELOPMENT ISSUES

Vision of a Sustainable World

Population, Consumption and Poverty

Trade, Investment and Technology Transfer

Environmentally Sustainable Industrial Development

Harmonising Environment and Development

1

VISION OF A SUSTAINABLE WORLD

K. H. J. Wijayadasa

A sustainable world can be defined as one that is environmentally regenerative, economically stable and having the capacity and the resilience to endure the rigorous impacts of human activity. Growth oriented economic development has hitherto focused on increasing the production of goods and services without ensuring the long term sustainability of the world. Sustainable development is a process. There are three basic conditions to be satisfied before the process is set in motion, namely; changes in thinking, deciding and executing.

A Sustainable World is feasible and achievable provided the world community could bring about the correct mix between environment and development. The crusade for sustainability should be fought in four fronts; namely minimising environmental degradation and pollution; eliminating the root causes of environmental degradation; integrating environment and development; and vigorously pursuing the path of sustainable development.

Human development is an essential prerequisite to achieving the goal of a sustainable world. A comprehensive programme of human development should be launched, which will empower people, provide them with skills, improve their morals and motivate them to adopt environmentally compatible lifestyles.

VISION OF A SUSTAINABLE WORLD

K H J Wijayadasa

In just a little over three years and three months from now the world will witness the dawn of the twenty first century. It is taking place at a time when mankind is facing the greatest ever threat to its common security. It is the threat of our planet to sustain life in the face of the rapid depletion of natural resources, degradation of ecosystems, loss of biodiversity and the high incidence of environmental pollution. *All these environmental problems have their roots in poverty, population pressure, over consumption and wasteful production. It is indeed paradoxical that under development as well as the development process itself are also responsible for this precarious situation. This paper examines both the symptomatic and the causative factors governing environmental degradation and the means of eliminating them through the integration of environment and development and the pursuit of the path of sustainable development to the ultimate goal of a sustainable world.*

What is a Sustainable World

A sustainable world can be defined as one that is environmentally regenerative, economically stable and having the capacity and the resilience to endure the rigorous impacts of human activity. Growth oriented economic development has hitherto focused on increasing the production of goods and services without ensuring the long term sustainability of the world. Sustainability is feasible and achievable provided policy makers and development planners work hand in hand to bring about the correct mix between conservation and protection imperatives and the utilisation and management realities of earth's resources.

The vision of a sustainable world is clouded by four factors. Firstly, we have before our own eyes an end of the world scenario in which the ability of the essential ecological processes and life support systems to regenerate themselves is hitting the rock bottom. Secondly, the economic and social disparities between the rich and the poor are for ever widening giving credence to the theory that the poor are called upon to make all the sacrifices both environmentally and economically. Thirdly, the world economic order is such that through, investment, trade and technology the developed countries continue to stifle the sustainable development initiatives of the developing countries. Fourthly, our vision of a sustainable world will remain clouded until such time we forge a new global alliance of greater magnitude than even the Marshal Plan for the Environmentally Sound and Sustainable Development (ESSD) of our planet.

How soon the world could achieve sustainability depends on how effectively and expeditiously the world community could muster all the resources at its command and formulate and implement a "Global Action Plan of Stability and Sustainability" and steer it to the goal of sustainability. There is very little time left to reverse these adverse trends and set in motion positive forces which are environmentally sound and sustainable. There is a general consensus among environmentalists that the point of no return would be reached by the year 2035; that is in four decades from now. Therefore, at least by the year 2015, the world should reach the half way point in its march to sustainability. "The Global Action Plan of Stability and Sustainability" will have to be founded on four fundamental strategies; namely;

- (a) Minimising environmental degradation and pollution;
- (b) Eliminating the root causes of environmental degradation;
- (c) Integrating environment and development; and
- (d) Vigorously pursuing the path of sustainable development.

Minimising Environmental Degradation and Pollution

Minimising environmental degradation and pollution is an essential prerequisite to achieving the goal of sustainability. In this regard the drastic reduction of the rates of deforestation, land degradation, desertification and air, water, and soil pollution is of critical importance. In 1993, the deforestation rate in the world was around 18 million hectares per year. The major causes of deforestation are commercial logging, land clearing for cultivation and settlement and fuel wood production. Deforestation has done irreparable damage to biodiversity, watersheds and water resources. In Asia two third of the land area is already deforested. In South Asia it is almost beyond redemption. In fact Bangladesh, India and Sri Lanka have already lost all their primary rain forests outside parks and reserves.

The current rate of desertification in the world is estimated to be 6 million hectares per year. The main causes of desertification in order of magnitude are droughts, deforestation, over grazing and land degradation. In certain regions, over irrigation has resulted in salinisation, water logging and water stress. Also, the deteriorating quality and the diminishing quantity of freshwater is emerging as one of the most critical factors in the sustainability equation. In the face of increasing demand for food, soil erosion and land degradation are accelerating at an unprecedented pace. The loss of fertility and diminishing productivity are pushing farmers into opening up highly erodible hill slopes, marginal lands and even protected areas.

In this context, drastic and decisive steps must be taken to maintain the essential ecological processes and life support systems, preserve genetic diversity and prevent desertification. Also urgent action is necessary to conserve and maintain genes, species and ecosystems, protect natural habitats and develop and disseminate sustainable uses of biotechnology. There is no alternative to the conservation and upgrading of all remaining natural forests, protecting all watersheds and erodible hill slopes.

Urbanisation, and Industrialisation are the major causes of air, water, soil and marine pollution. They have not only been polluting but also dehumanising and morally destabilising. In 1870 only 3% of the world's population lived in cities. By the year 2000 half the world's population will crowd into cities, exerting pressure on the already over loaded infrastructure.

The major sources of air pollution are transport, power and industry. In the megacities of Asia pollution caused by vehicle emissions has become a serious threat to human health. Global warming and climate change are a product of the burning of fossil fuels and biomass and the use of chlorofluorocarbons (cfc's). The discharge of untreated industrial effluents into soil and water, especially in the developing countries is assuming catastrophic proportions. The mounting tide of hazardous and solid waste is threatening to engulf our civilisation. Marine pollution from land based sources especially in and around megacities is causing serious concern. Lack of proper sewerage, sanitation and waste water treatment in the developing countries in particular is polluting waterways and ground water resources.

All programmes for minimising environmental degradation and pollution should be undertaken and completed at least by the year 2005. Now that market and policy failures are said to be the major underlying causes of environmental degradation and pollution, they

should be remedied as early as possible. There are many contradictions which must be removed. In the face of a growing scarcity of resources there is over use, waste and inefficiency. There are instances where a resource is exploited to extinction when it could be renewably managed. Sometimes a scarce resource is put into inferior, low return and unsustainable use or is put into a single use when it could be put into multiple uses. Quite often recycling of resources and by products is not undertaken even though it could generate both economic and environmental benefits.

Eliminating the Root Causes of Environmental Degradation and Pollution

Countries desirous of achieving the goal of sustainability should embark on a programme for the elimination of the root causes of environmental degradation; namely, poverty, population pressure, over consumption and wasteful production. Poverty can be defined as lack of income or livelihood. It is unmistakably toxic to the environment. Approximately one fourth of the world's population is living below the poverty line; with the vast majority concentrated in Asia, Africa and Latin America.

The physical environment surrounding the poor is inevitably abused. People living at the margins of existence cannot afford the luxury of conserving for the future, but must take wood for fuel from the nearest source, let livestock graze on whatever pasture there is within their range and work the land to exhaustion in their struggle for food. *No amount of public assistance, food subsidies or foreign aid could alleviate poverty. The poor should be taught how to stand on their own feet by becoming increasingly self reliant and self supporting. The essential elements of a poverty alleviation programme are; elimination of hunger, malnutrition, disease, illiteracy and unemployment through the creation of sustainable livelihoods and not through charity. It is now firmly established that higher incomes contribute to the slowing down of population growth. It also relieves pressure on the already over exploited natural resources.*

No country can succeed in its march to sustainability unless it is deeply conscious of the optimum population it can support in relation to its carrying capacity. The world's population which was 2.5 billion in 1950 increased to 5.5 billion in 1995; and is expected to reach the 10 billion mark by the year 2030. Hopefully it will stabilise at around 12 billion by the year 2050. The bulk of this increase will take place in the developing countries of Asia, Africa and Latin America; exerting further pressure on the already saturated resource base and the woefully inadequate infrastructure. Stabilising population both nationally and globally is a critical imperative in achieving sustainability by the year 2035. Population planning along with poverty alleviation should receive the highest priority in the sustainable development master plans of the developing countries. All developing countries should strive to achieve a population growth rate of one percent or less by the year 2015; so as to prevent the retardation of the sustainable development process, which by then would have gathered full speed. It is somewhat demoralising to note that almost four years after the Earth Summit in Rio only a handful of countries have seriously attempted the integration of poverty, population and environment into the development process.

The other two root causes of environmental degradation are the unsustainable patterns of consumption and production especially in the developed countries and in the newly industrialising countries. While the poorer segments of society are unable to meet their basic needs of food, shelter, clothing, health and sanitation; the unsustainable lifestyles of the richer segments place a severe stress on the environment. In fact, a considerable proportion of natural resource depletion can be attributed to over consumption, luxurious living and

wasteful production. This is further compounded by the lopsided world economic order; which perpetuates the slaughter tapping of the natural resources and primary commodities of the poor countries, under a captive pricing structure which has no bearing on environmental costs.

One of the essential prerequisites in achieving sustainability is the integration of sustainable consumption and production strategies into the development process. In the first place all wasteful and inefficient production processes should be phased out. Low waste technologies and recycling should be encouraged. Wasteful packaging especially those that are environmentally unfriendly should be replaced. Achieving optimum energy efficiency, applying cleaner production technologies, substitution of renewable raw materials in place of those that are nonrenewable should constitute an integral part of sustainable development policy .

Reaching the goal of sustainability by the year 2035 will be made easier if we can find new lifestyles that are less dependent on the earth's finite resources and more in line with its carrying capacity. In switching over to new lifestyles the rich could and should give the lead. The biggest savings can come in the areas of food, clothing, shelter and transportation through more frugal living. Vegetarian diets, rural livelihoods, energy saving shelter, energy efficient transport and reusing and recycling of almost everything the way our forefathers did; not so long ago, can quicken the pace to the goal of sustainability. In other words we must immediately put into practice new concepts of wealth and prosperity which allow higher standards of living through changed lifestyles. This is not a sacrifice. Even if it is so, it is only a simple sacrifice that our generation and the next one should make for the benefit of thousands of generations yet to be born.

Integrating Environment and Development

Integrating environment and development in all relevant areas and at all levels and stages is a *sine qua non* for reaching the goal of sustainability. Environment constitutes a wide range of resources which are essential for the survival of mankind on planet earth. Among them air, soil, water, vegetation and animal life take pride of place. Associated with them are an extensive range of natural resources and biological processes which have been put together in nature's own ingenious way to give character, form and definition to the environment. Development represents the principal means of meeting human needs and improving the quality of life of the people. It entails the use of both renewable and non renewable resources as well as the modification of the environment in many different ways.

For nearly five decades from the 1920's environmental conservationists had engaged themselves in a losing battle against the developers. Very soon they realized that development was a necessary evil; as lack of development itself was environmentally destructive. The crusade for harmonising environment and development commenced in the 1970's following on the United Nations Conference on the Human Environment in 1972. Before long environment and development came to be recognised as two sides of the same coin; in that both could coexist harmoniously side by side. Obviously, slowing down the tempo of development was not the answer to the environment and development paradox. Indeed, given appropriate policies the pace of economic development determines the rate of poverty alleviation, as well as the quantum of resources directed to achieving environmental goals. Consequently, Sound and Sustainable economic growth is an essential precondition to overcoming the serious threats to the environment.

Integration of environmental considerations into the development process should take place in 3 critical areas; namely policy, planning and management and at three levels namely; national, regional and local. Policy formulation for sustainable development, their implementation and periodic review are extremely important and indispensable. Strategic, physical and regional planning are the three vital components of planning for sustainable development. In South Asia much attention has been paid to the integration of environmental considerations into the national planning process through the commissioning of national development plans, national conservation strategies and national environmental action plans. Also, much progress has been made in the integration of environmental concerns into the development process through the application of environmental impact assessment procedures. In the area of environmental management; economic liberalisation, use of economic instruments and other management tools and techniques should take precedence over command, control and regulatory systems.

The Path to Sustainability

There is only one path to sustainability. That is the path of Sustainable Development. Nations desirous of reaching the goal of sustainability must necessarily follow that path. The World Commission on Environment and Development has defined sustainable development as " a process in which the exploitation of resources, the direction of investment and the orientation of technological development and institutional change meet the needs of the present generation without compromising the ability of future generations to meet their own needs." The concept of sustainable development is firmly rooted in the principle that environmental protection and economic development are mutually supportive, interdependent and indivisible. It has several long standing priority goals such as economic growth, human development, resource management and technological advancement.

It has been found that long term interventions are necessary to support sustainable policy processes. Short term interventions which are usually piece meal are not sustainable. Sustainable development is multisectoral and multidisciplinary in character. Therefore, in sustainable development policy planning an intersectoral and integrated approach is necessary.

Sustainable development is a process. There are three basic conditions to be satisfied before the process is set in motion, namely; changes in thinking, deciding and executing. In thinking we have to break away from old concepts, attitudes and approaches. Sustainable development has more to do with the human psyche than any kind of environmental management break through. Today, our understanding of human development is highly materialistic. We should now change the direction of our thinking to higher realms of moral and spiritual upliftment. It has been said that there is enough to satisfy human need but not human greed. How can we build a new global society that is "Caring and Sharing?". We must recognise that equity and social justice are also essential prerequisites to achieving the goal of sustainability. A global human crusade for balanced human development must be launched; which will empower people, provide them with skills, improve their morals and make them more humane in outlook.

In deciding, a totally integrated, cross sectoral approach is absolutely necessary in order to ensure the balanced and sustainable development of the economy, the people, the resources and the environment. We have to transcend the arbitrary boundaries between institutions that tend to be independent, fragmented and working in watertight, compartments resorting to closed decision making processes. The interrelated and interdependent issues of environment

and development require comprehensive and overarching approaches, more public participation and better institutional arrangements.

In executing, methodologies, technologies, systems and procedures which improve the natural resource base, the quality of the environment and harmonise environment and development should be evolved. The top down approach should be discarded in favour of the bottom up approach. Coordination, monitoring and evaluation are indispensable tools and techniques of efficient and results oriented implementation. *Countries desirous of achieving the goal of sustainability should immediately get down to the task of making an assessment of the state of the environment and stage of development; set overall objectives, goals and priorities for sustainable development; and formulate and implement national agenda 21 action plans.*

The Vision of a Sustainable World

In its march to sustainability by the year 2035 humanity will face three major challenges; namely; supplying better quality food for over 10 billion people, doubling agricultural production mainly through productivity increases and bridging the energy gap through the development of renewable sources of energy.

Food and agriculture are intricately interwoven. In fact they are two sides of the same coin. Agriculture including lumbering and fishing occupies one third of the surface of the earth. It is also the main source of livelihood of nearly half of the world's population. Agriculture today is highly vulnerable to over exploitation of soil and water, bad management practices and the over use of fertiliser and agro chemicals. The world cannot afford to clear any more forests and destroy natural habitats for the sake of feeding its population without seriously endangering humanity itself.

In the years ahead, making agriculture sustainable and increasing food production in keeping with population growth will face three new challenges. Firstly, for another two decades or more a further intensification of air pollution, depletion of freshwater resources and a worsening of weather patterns as a result of global warming are inevitable. This obviously means a lowering of agricultural productivity and production itself. Secondly, soaring per capita incomes will bring about changes in consumption patterns. Invariably, the more affluent people will switch over to meat based high protein diets, engage in conspicuous over consumption and indulge in luxurious living causing further pressure on the fast vanishing natural resources. Thirdly, in the developing countries in particular with rapid economic development the gap between the rich and the poor would widen forcing the poor to abuse the natural environment with greater intensity. *The answer to these challenges lies in placing sustainable agriculture on a war footing, switching over to environmentally sound and sustainable food habits and doubling agricultural output per unit of existing farmlands over the next four decades; systematically and progressively to match the population of 10 billion by the year 2035.*

What is urgently necessary is a global strategy for the development of sustainable farming systems, practices and technologies that improve yields, maintain land quality, recycle nutrients, conserve water and control pests and diseases using biotechnology and indigenous technology to the maximum extent possible. The promotion of integrated organic farming combining crop and animal husbandry would enable a reduction in the use of chemical fertilizer and enable soil regeneration. A concerted effort should be made to develop low nutrient tolerant drought resistant high yielding varieties of food crops. Indigenous practices which make optimal use of labour, animal power and renewable energy should be

Vision of a Sustainable World

encouraged. The world should return to the age of organic manure use based on biomass, animal dung and human waste. Sustainable agriculture should rely heavily on conservation farming combined with agro forestry which could provide food, fodder, biomass and energy to sustain agriculture both in the context of population pressure and climate change. *The production and consumption of meat is environmentally wasteful and unwarrantedly costly. Today, we are feeding one third of the world's grain harvest to livestock and poultry. There is a strong case to reduce the global livestock herd drastically and at the same time integrate crop and animal husbandry.*

Sustainable agriculture is highly complex and extremely challenging. Yet, it is feasible and achievable. No simple solution is good enough, a well co-ordinated and integrated global action plan as envisaged in Agenda 21 or even more dynamic should be put into operation. In other words an eco-agricultural revolution of the type and magnitude hitherto not experienced by mankind must be launched. Eco-efficiency is the key to the creation of a sustainable world. Such an eco-agricultural revolution should make full use of economic instruments such as pollution levies, taxes, deposit and refund systems and eco-labeling. The dilemma of the destruction of the earth's biological resources must be resolved by attaching economic values to the diminishing biological resources. *All environmental costs must be integrated into the costs of goods and services so that their full and real costs are accounted for and audited accordingly.*

In the sustainability equation agriculture and food appears to be more manageable than power and energy. Energy is essential for economic and social development as well as for improved quality of life. Rapid Industrialisation and Urbanisation have contributed to an unprecedented increase in energy use, especially in the developed countries and now in the newly industrialising economies. The biggest consumers of energy are the industrial, transportation, and residential sectors. As a rule, the supply and use of energy has major environmental consequences, contributing to air pollution, depletion of the ozone layer and global warming; eventually leading to sea level rise.

The energy sector is inhibited by three major constraints. Firstly, the major sources of energy in use today such as oil, natural gas and coal are exhaustible. Secondly, much of the world's energy is produced and consumed in an unsustainable manner contributing to pollution and waste. Thirdly, there is no major break through in alternative sources of energy; other than nuclear; which is also questionable with several safety factors remaining unanswered. In formulating a sustainable energy policy high priority should be accorded to optimum conservation as against uncontrolled exploitation of the non-renewable fossil fuels in particular. In the short term achieving energy efficiency can make a big dent. Today, there are a whole host of improved technologies available that use far less energy than those now in place.

The share of the transport sector in total energy consumption is around 40 percent. It is steadily increasing following unprecedented increases in the vehicle population fueled by stable and cheaper oil prices. By using light weight materials and other energy saving technologies in car manufacture, it is possible to increase energy efficiency by 60 percent. The most sensible alternative to the motor vehicle in urban transport is the mass transit mode. Improved traffic management and punitive taxation are some of the short term solutions that are available. We cannot summarily dismiss the hypothesis that continuing heavy reliance on fossil fuels will cause catastrophic changes in climate. Stabilising the climate depends on cutting annual carbon dioxide emissions to around 2 billion tons per year; about one third the

current level. How can this be achieved? How far can we go with renewable sources of energy? What will be the share of solar and nuclear in our energy systems?

As for renewable sources of energy, in 1990, hydro power supplied nearly 20 percent of the world's electricity. In Sri Lanka, hydro power constitutes 76 percent of the total installed capacity. The hydro power projections for the future are that by the year 2025, it would settle at around 30 percent of the world's electricity supply, with mini hydro making a substantial contribution; provided there is no drastic change in rainfall patterns. Today, wood provides 12 percent of the world's energy. In Sri Lanka, 75 percent of the rural energy requirements is met by wood and agricultural residue. There is an urgent need to develop new technologies for conversion of biomass to heat, electricity and gas for industrial and residential uses in particular.

From ancient times wind power had been harnessed as a source of energy. Already improved wind turbines have been developed to generate electricity. Current projections are that wind power would provide around 5 percent of the world's energy requirements by the year 2025. *Scientists have predicted that the dawn of the solar age would take place within the next 3 decades. it would be as dramatic as the dawn of the coal age, 300 years ago. A typical urban landscape will be dotted with thousands of solar collectors sprouting from roof tops. Also large scale solar thermal plants located in the hot deserts of the world will be generating at least 15 percent of the world's electricity by the year 2025. What will be the share of nuclear power in the world's electricity generation capacity in 2025? The future growth and expansion of nuclear power cannot be predicated unless we make a revolutionary break through in the areas of human and environmental safety and safe storage of nuclear waste. It should be noted that in the last 10 years there has been a retardation in the expansion of nuclear power generation.*

A Sustainable World

A Sustainable World by the year 2035 is feasible and achievable provided the world community could bring about the correct mix between environment and development. The crusade on sustainability should be fought in four fronts; namely minimising environmental degradation and pollution; eliminating the root causes of environmental degradation; integrating environmental and development; and vigorously pursuing the path of sustainable development. In its march to sustainability by the year 2035, humanity will face 3 major challenges namely; supplying better quality food for over 10 billion people, doubling agricultural production through productivity increases and bridging the energy gap through renewable sources.

The primary sources of added value and competitive advantage in modern industrial economies are capital and knowledge applied through technology, management, information and marketing. They provide the principal tools for an effective transition from unsustainability to sustainability. All countries desirous of reaching the goal of sustainability should embark on an extensive evaluation and restructuring of the system of incentives and penalties that motivate the economic behavior of enterprises and individuals.

The experience of industrialised countries such as Japan and Germany shows that environmental improvement is compatible with economic growth. Sustainable development has in fact opened up new opportunities for innovation, creativity and enterprise.

Vision of a Sustainable World

Our march to sustainability will be made easier if we can find new lifestyles that are less dependent on the earth's finite resources and more in line with its carrying capacity. Economic liberalisation, use of economic instruments and other management tools and techniques should take precedence over command, control and regulatory systems.

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2

POPULATION, CONSUMPTION AND POVERTY

G. K. Amaratunga

Current population growth trends give rise to both optimism and concern. The growth rate has slowed down almost to zero in some countries in the developed world. The main concern is the rapid growth of population in the developing countries.

Rapid population growth will have a big impact on the world food supply. One cannot be satisfied with the present grain supply of the world because it fluctuates. The seafood supplies are fast declining. However, it has been said that over the next 15 - 20 years the grain supply will be able to meet the demand.

The world is not only losing its land resources but also the water resources which are essential prerequisites for the production of food. Many water consuming patterns are unsustainable. Many countries facing water scarcities may not be able to support irrigated agriculture at levels necessary to feed their future populations.

Poverty will manifest itself if the people cannot find the basic requirements for their living. Alleviation of poverty and controlling population growth are the key factors in sustainable development. In addition the people in both developed and developing countries should adjust their consumption patterns and reduce adverse environmental impacts on the natural resource base.

POPULATION, CONSUMPTION & POVERTY

G K Amaratunga

Population, consumption and poverty are intricately interwoven. They constitute a vicious circle. Increase in population will result in greater pressure on natural resources through increased demand for basic needs. Higher consumption leads to a further depletion of natural resources. Pressure of population and consumption on diminishing natural resources breeds poverty.

Natural resources are limited. Unless we use these resources wisely human existence will be threatened. It is said that mankind has appropriated nearly 40% of the terrestrial food supply leaving only 60% for the millions of other land-based plants and animals. In our greed to live comfortably we have gradually converted diverse and complex biological systems to suit our requirements. A number of international conferences held since 1970 addressed the issues of population, resources and environment. Initially these issues surfaced at the first World Population conference held in 1974 in Bucharest. They came to be highlighted thereafter at the International Conference on Population held in 1984 and the United Nations Conference on Environment and Development in 1992. At these global gatherings the world leaders recognised that population, consumption and poverty were the root causes of environmental degradation which stand in the way of sustainable development.

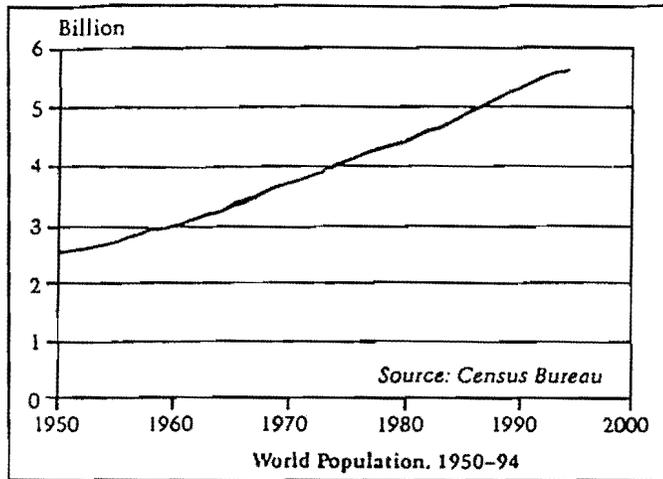
The Rio Declaration inter alia states that "Human beings are at the Centre of concerns for Sustainable Development and that they are entitled to a healthy and productive life in harmony with nature"; and that "all states and all people should co-operate in the essential task of eradicating poverty as an indispensable requirement for sustainable development". It further states that to achieve sustainable development, and a higher quality of life for all, "states should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies".

Population and Carrying Capacity

One of the biggest concerns of the world community today is the alarming rate of population growth. Rapid population growth often contributes to environmental degradation. Most governments are not able to keep pace with the provision of infrastructural and basic needs of fast growing populations. The world population kept on increasing steadily especially during the latter half of the 20th century. In the 1st century A.D. the world population had been around 300 million. This has increased to 1 billion in 1800, it was doubled to 2 billion in 1930, It was once more doubled to 5 billion in 1987 and now it stands at 5.8 billion. [See Fig. 1].

According to recent estimates world population is expected to reach 8.5 billion in the year 2025 and 10 billion in 2050. Some estimate that this would reach 12 billion by the year 2050 unless some concerted effort is made to control the growth rate. During the next decade nearly 100 million people will be added to our planet, equivalent of almost four Canadas or another Mexico. Over 90% of this growth are taking place in Africa and South Asia where land degradation is most severe.

Figure 1



Dr. Nafis Sadik, Ex. Director of UNFPA has stated that " the world could be heading towards an eventual total of 14 billion." He predicts that of this total 12.5 billion would be in the developing countries compared to 4.2 billion today. Therefore, the most daunting question is can planet earth sustain such a population?

There is a limit to the carrying capacity of the earth. What is meant by carrying capacity is the level of population which may be supported by the earth's resources at a given level of welfare. In other words how many people could share the earth; while maintaining a given physical standard of living utilising the available reserves of energy and other natural resources. Unfortunately as the numbers increase and with economic development taking place all around the world, the needs of the human beings are also on the increase (fig. 2) which ultimately results in increased in consumption.

Figure 2

Carrying Capacity: Earth's Bottom Line
Table 1-4. Population Size and Availability of Renewable Resources, Circa 1990, Projections for 2010

	(million)		(percent)	
Population	5,290	7,030	+33	-
Fish Catch (tons) ¹	85	102	+20	-10
Irrigated Land (hectares)	237	277	+17	-12
Cropland (hectares)	1,444	1,516	+ 5	-21
Rangeland and Pasture (hectares)	3,402	3,540	+ 4	-22
Forests (hectares) ²	3,413	3,165	- 7	-30

The relationship amongst population, consumption and environmental damage has been expressed in the form of an equation,

Ed = $P \gg C \gg D$
 here Ed = Environmental damage
 P = Population
 C = Consumption
 D = Environmental damage per unit of consumption

Consumption Trends

Population increase invariably increases the consumption levels whether the people are poor or rich. Hence both these together will contribute to an incremental environmental damage. It is estimated that a person in the developing world consumes around 250 kgs .of grains per capita per year as against 860 kgs. in the U.S.A.(Fig. 3) this relationship would not be static. As the economic levels of the developing world increases the per capita consumption also will increase.

Grain Consumption Per Person in Selected Countries, 1990	
Country	Grain Consumption Per Person (Kilograms)
Canada	974
United States	860
Soviet Union	843
Australia	503
France	465
Turkey	419
Mexico	309
Japan	297
China	292
Brazil	277
India	186
Bangladesh	176
Kenya	145
Tanzania	145
Haiti	100
World Average	323

Sources: Worldwatch Institute estimate, based on U.S. Department of Agriculture, *World Grain Database* (unpublished printout) (Washington, D.C: 1992); Population Reference Bureau, *1990 World Population Data Sheet* (Washington, D.C.:1990).

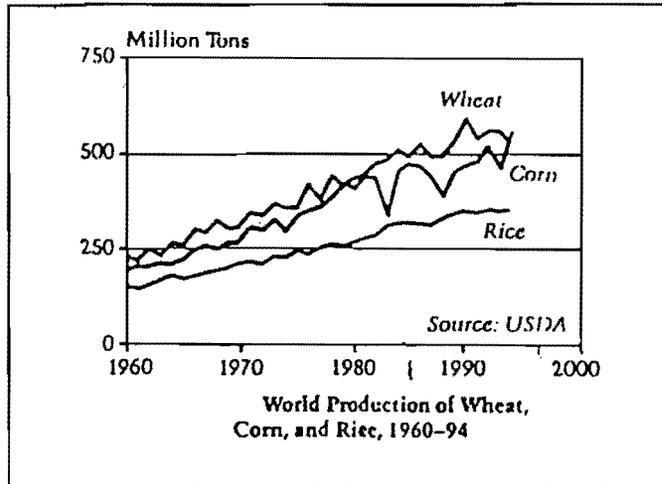
Figure 3 →

If the per capita increase in the developing world increases by about 50% then the world would require nearly four times today's production. It is not possible to maintain such an increase in the production of grain. An analysis of the global trends of the three major cereals, namely, wheat, rice and corn shows that since 1990 neither wheat nor rice yields have shown much of an upward trend. If at all, only corn shows a substantial increase. Rice and wheat have almost the same yield of (2.4 tons) per hectare. (Figure 4)

During the period 1965 to 1990 cereal production grew by 90% to 1.7 billion tons while population rose by 60% to 5.3 billion people. This was mainly due to the green revolution of the 1960's which saw the popularisation of the use of high yielding seeds, chemical fertilisers, pesticides, and irrigation which greatly benefited the developing countries. It will be seen that this trend in increased productivity is beginning to change due to higher rates of

fertilisers and pesticides. Soil degradation has been strongly felt in countries such as India, Ethiopia, Indonesia and China. Due to unscientific agricultural practices desertification is gradually increasing and it has been estimated that annually the world loses 6 million hectares of arable land due to desertification.

Figure 4

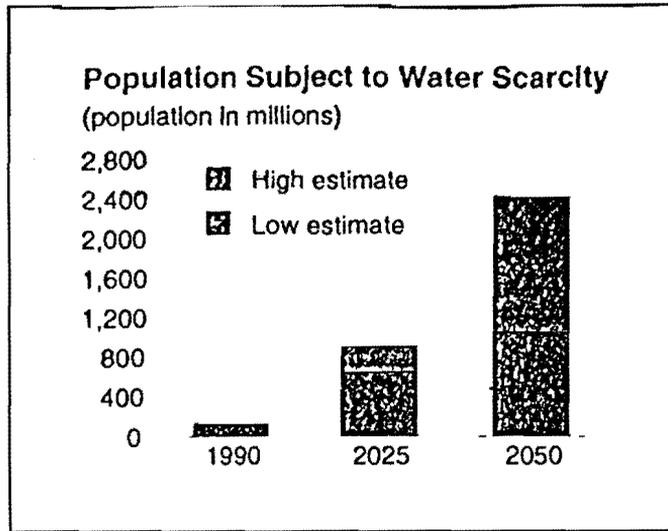


Fresh Water Supply

The world is losing not only land resources but also soil and water resources which are essential pre-requisites to the production of food required to feed a population of 10 billion people by the year 2050. Demand for water is increasing rapidly as population and industrial activities expand and as irrigated agriculture continues to grow. Many of the existing water consumption patterns are unsustainable, such as pumping water from subterranean aquifers at rates greater than the recharging rates. Future availability of water for humans will depend on the way it is managed. In fact water can be and must be recycled or reused. According to the present statistics between 1 billion and 2.4 billion people will live in water scarce countries by the year 2050. (Graph on water scarcity - World Resources pg. xii) (figure 5)

Pollution of surface waters, over use and contamination of the ground water resources will also seriously affect the grain production of the world. All these are factors to be reckoned with when one considers the living standards of the people. On the one hand population keeps on rising while on the other hand food production decreases. Water scarcity also has a direct impact on the food supply. Many countries facing water scarcities may not be able to support irrigated agriculture at levels necessary to feed the future populations. Added to this imbalance the consumption rate also keeps on increasing. Therefore, in the next couple of decades the very survival of the human race may turn out to be an insurmountable challenge.

Figure 5



Poverty

If the basic needs cannot be satisfied abject poverty will be the result. If the produce from the land decreases and if the demand for the produce increases with the increase in the number of mouths to feed, then the cost of basic food items will increase sometimes beyond the purchasing power of some people. If the income is less than what is required to procure the basic needs such persons are classified as poor people. According to the World Bank report on " World Development" poor people are those whose income is less than US\$ 370 per person per year (at 1985 purchasing power parity) while those with an income of less than US\$ 275 are considered extremely poor. In 1994, 1390 million people were estimated to fall into the poor category.

There is no hard and fast definition of the term poverty. The conventional economic definition is that poverty is lack of income (or consumption). The protagonists of integrated development are of the view that the causes of poverty are interlinked with environment, housing, health, education, income generation etc. Poor can again be classified as rural poor and urban poor. The majority of the urban poor have a low standard of living as against an average citizen in an industrialised country. But most of the urban poor are better off than the rural poor, though some of them have no shelter while the others barely clothe themselves.

Malnutrition is common amongst both urban and rural poor. On the other hand the rural poor do not have an income level as that of his urban counterpart but would have the basic wherewithal to live on. As they are so backward in their technology they maximise the use of natural resources to eke out a living. Land hungry farmers resort to cultivating erosion-prone hill sides and move to forest areas and clear them to get better yields. Since 1950, the number of people living in urban areas has increased from 737 million to 2.6 billion thus increasing the urban population share from 29 percent to 45 per cent of the total population.

Urban population is growing at a rate of 3.5% in the developing world as opposed to 1% in the industrialised countries. This is mainly due to migration from rural to urban areas, internal population growth and the addition of new urban areas. In 1950 only 5 cities in the

developing countries had populations of over 4 million. Today there are at least 40 such cities. (figure 6).

Figure 6

The World's Twenty-Five Largest Cities, 1995		
	Average Annual Growth Rate Population 1990-95 (millions)	(Percent)
Tokyo, Japan	26.8	1.41
Sao Paulo, Brazil	16.4	2.01
New York, USA	16.3	0.34
Mexico City, Mexico	15.6	0.73
Bombay, India	15.1	4.22
Shanghai, China	15.1	2.29
Los Angeles, United States of America	12.4	1.60
Beijing, China	12.4	2.57
Calcutta, India	11.7	1.67
Seoul, Republic of Korea	11.6	1.95
Jakarta, Indonesia	11.5	4.35
Buenos Aires, Argentina	11.0	0.68
Tianjin, China	10.7	2.88
Osaka, Japan	10.6	0.23
Lagos, Nigeria	10.3	5.68
Rio de Janeiro, Brazil	9.9	0.77
Delhi, India	9.9	3.80
Karachi, Pakistan	9.9	4.27
Cairo, Egypt	9.7	2.24
Paris, France	9.5	0.29
Metro Manila, Philippines	9.3	3.05
Moscow, Russian Federation	9.2	0.40
Dhaka, Bangladesh	7.8	5.74
Istanbul, Turkey	7.8	3.67
Lima, Peru	7.5	2.81

Source: United Nations(U.N.) Population Division, World Urbanization Prospects, 1994 Revision (U.N New York 1995) Table A 12 pp 132-139, and Table A 14, pp 143-150

It is said that cities in the developing countries will grow by 160% during the next four decades. According to the World Bank's estimates as much as 80% of the future economic growth in the developing world will occur in cities and towns. Small cities are growing fast in numbers but resource scarcity is a major drawback. The wealthier cities on the other hand can cope up with the major environmental problems such as provision of potable water and solid waste disposal in an acceptable manner. Inadequate water supply and lack of sewage and waste disposal systems contribute to many diseases such as diarrhoea and malaria.

It is estimated that 220 million urban dwellers lack access to clean drinking water; more than 420 million do not have access to even the simplest forms of latrines. Between one to two thirds of solid wastes generated are not collected and allowed to pile up on streets and drains contributing to flooding and diseases. The problem of urban poverty takes an enormous toll in the form of largely preventable deaths and diseases. In the wealthiest cities of the world

environmental problems are not so much due to rapid growth but due to high consumption of resources (see figure on the world's 25 largest cities).

Air pollution is another growing concern in the cities especially in the mega cities where public transport is not at its best. The rich travel in airconditioned vehicles whereas the poor have to depend on public transport systems where smoke from belching vehicles and dust on the streets create immense respiratory problems. Even at home the poor suffer from inhaling the smoke of burning biomass which supply the required energy for their day to day cooking and heating. The poor are exposed to the environmental degradation more easily than the rich. This is mainly due to their habitation in environmentally degraded or vulnerable areas and the lack of resources to buy out of exposure to environmental risks let alone having the means to invest in alleviating the causes of environmental degradation.

It is said that at least one third of the world's population has inadequate sanitation while over 1 million do not have safe water for their use. 1.3 billion people are exposed to unsafe conditions caused by soot and smoke. Unlike the rich the poor cannot afford to protect themselves from contaminated water. In cities they spend most of their time on the streets breathing polluted air. The counterparts in the rural areas use common grazing lands or forests for their food, fuel or building materials. Over exploitation of these resources will ultimately lead to the total destruction of such resources.

Current population trends give rise to both optimism and concern. On the one hand the population of the developed and transition economies are growing relatively slowly or has negative or zero growth as in Scandinavian countries. In some of the developing countries the population growth is reaching or approaching stability. On the other hand in most developing countries population growth continues at high levels usually accompanied by worsening poverty. One way to control population growth is to bring down the fertility rate which has to be done carefully or else later on the country will be saddled with a large percentage of old people whose social welfare costs will be very high. If the fertility rate drops to 2 children, it means that each couple will replace itself without adding to the size of the population. Fertility rates have generally been declining since 1960 in spite of some protests from various religious groups on the use of birth control methods. Worldwide the current population growth rate is estimated to be 3 percent. In developed countries it has come down to 1.7 while it is high as 3.4 in some developing countries.

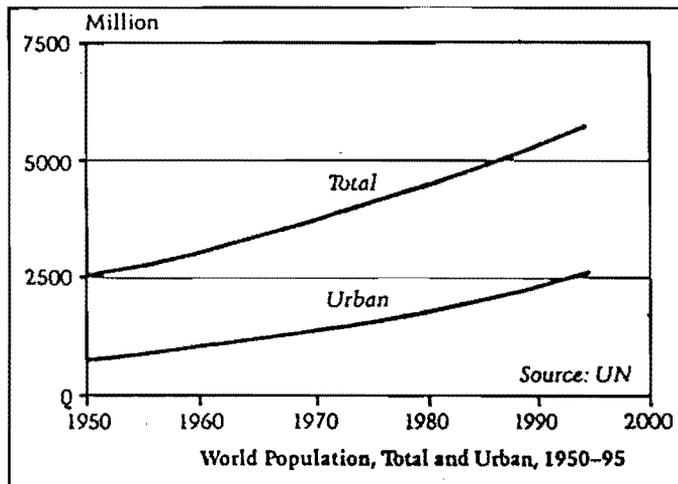
In the poorest developing countries it is still in the region of 3.5 percent. Hence if the world is to stabilise the population, the developing nations should act now. The populations stabilise when total fertility rates reach replacement levels (approx. 2.1) and when age distribution of a population stabilises. Fertility rate can be reduced only if;

- (a) the pace of economic and social advancement is accelerated,
- (b) policies are designed to improve the well being of women, and
- (c) comprehensive family planning programmes are introduced

The other major problem the world community is confronted with is rapid urbanisation. If the present trend of urbanisation continues, it will lead to the creation of slums and shanties, poor sanitation conditions and ultimately to chronic diseases. (Fig. 7) Much work has to be done to create better living conditions in the fast growing cities and towns. Building up a good community network will mobilise labour which in turn will reduce costs of basic goods. Another way is to get the city dwellers involved in income generating activities. This will not only help to acquire sizable income but also will help to manage the resources wisely.

only help to acquire sizable income but also will help to manage the resources wisely.

Figure 7



As pointed out rapid population growth will have a big impact on the world's food supply. With the new information available it would be possible to project future output of the three main food production systems - fisheries, rangelands and croplands. Overfishing and overgrazing are placing limits on the carrying capacity of fisheries and range lands. If the fisheries cannot improve the catch, additional grains will not be able to sustain the future growth in aquaculture. Sea-food supply is fast declining and within the next 30-40 years the supply level will come down to the 1950 level.

With extensive overgrazing, rangelands are also facing the same situation as fisheries. There is no guarantee that grain supply will increase sharply. An analysis of the global trends for each of the three major cereals, shows a gradual downward trend in the yield. As mentioned earlier, only corn shows a substantial improvement in yield. With advanced technology and opening up new farming areas, wheat production increased considerably during 1972 - 1981 but now this has slowed down. The rice yields also have been on the decline. Most of the poor people live in the rice producing countries and it is in these countries that the population growth rate is also high, Unless rice production increases or new cereals are found, production alone will not be able to match the number of increasing mouths to feed. Since mid 1980s, increases in worldwide food production have lagged behind population growth. If we consider a population of 14 billion, then it would require nearly a three-fold increase over today's production. Bernard Gilland in his article on "Consideration of World Population and Food Supply" argues that this would be impossible.

However, it has been said that for the next 15-20 years, with advanced technology, introducing new varieties and expanding the cultivable area, the grain supply would be able to meet the demand. Even so, many developing countries are faced with a food security crisis now and into the foreseeable future. The numbers of undernourished people will continue to increase, unless adequate precautions are not taken immediately.

Accordingly, it would be seen that controlling of population growth will be the key factor in containing consumption patterns at manageable levels and reducing poverty throughout the

to battle with the immense pressures on natural resources. It will help the governments of developing countries to devote more resources to human development by increasing investment in education, health, social welfare and job creation. Placing the subject of population on the agenda of the United Nations Conference on Environment and Development held in 1992 at Rio indicated the importance attached to population growth in relation to natural resource conservation and management. People of both developed and developing countries should adjust their consumption patterns and reduce environmental impacts on each and every unit of consumption so as to attain a sustainable path of development for all the inhabitants of planet "earth".

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R S McNamara

3

TRADE, INVESTMENT AND TECHNOLOGY TRANSFER

Dr. Nimal Sandaratne

Trade, investment and technology transfer are three closely inter-related vital elements for rapid economic development in South Asia. Each of these has both positive and negative potential impacts on the environment.

Scarcity of capital and the urgency of rapid industrialisation could tempt South Asian countries to import lower cost polluting industrial technologies, to establish polluting industries which are not permitted in developed countries, and to import dismantled high polluting industrial machinery. There is an increasing realisation that environmentally sound technologies could have economic advantages. The thrust of engineering research is now towards the development of such environmentally sound technology.

Trade liberalisation is generally expected to have a beneficial impact on the environment. Yet, there are several ways in which such liberalisation would have adverse impacts. Increased imports of products using non-renewable natural resources could lead to unsustainable exploitation of such resources. Increased export growth could also lead to the import of cheaper technology which is more polluting. The use of trade policies to achieve environmental objectives is arguable. There are instances where such policies have had an adverse impact in the long run.

The harmonisation of environment and development in South Asia requires action on a large number of policy fronts. Trade, investment and technology transfer are among such economic variables which require to be tailored to suit environmental concerns and ensure sustainable development. The trade, investment and technology transfer policies in themselves cannot harmonise environment and development, but require to be used together with other macro economic and micro economic policies, as well as regulatory systems.

TRADE, INVESTMENT AND TECHNOLOGY TRANSFER

Dr. Nimal Sandaratne

Inter-dependence of trade, investment and technology transfer

The inter-dependence and close connection between trade, investment and technology transfer are evident in several ways. It is a fact of modern economic development that investment follows trade, and that investment is both necessary and desirable for enhancing international trade. Conversely, international investment follows those countries which have a capacity to be competitive in international trade. Both trade and investment are in turn highly dependent on technology transfer. One of the most important arguments for foreign investment lies in the fact that such investments bring with them both marketing channels and technology transfers. Therefore the inter-relationships are quite clear.

Importance of trade, investment and technology transfer for South Asia

The importance of trade for economic development has been tritely expressed in the phrase 'Export or Perish'. There is little doubt that small countries have little option of achieving their economic and social objectives without substantial export growth. The economic development experience of the last three decades, in particular, demonstrates that economic growth was closely related to export growth. The fast developing countries of Asia have demonstrated that export was the engine of their growth and development.

The small countries of South Asia, Bhutan, Bangladesh, Maldives, Nepal and Sri Lanka would of necessity have to depend heavily on exports for their growth. The case for export led growth is less significant in the case of the big countries. Yet, there is little doubt now, that even a large country like India, requires to increase her exports to generate a faster momentum of economic growth. Even if the slogan 'Export or Perish' is not appropriate for India, 'Export or Stagnate' is applicable.

In all South Asian countries the economic objectives of increasing per capita incomes, creating adequate employment opportunities and reducing poverty, require higher export growth. And to generate this higher growth there is a need for increased investment, especially foreign direct investment. In 1995 India obtained about US\$ 2 billion of foreign investment. The goal of the present government is to obtain US\$ 10 billion. In a highly competitive global market, these foreign investments and the technology transfers, which accompany such investment, are essential ingredients for enabling trade and growth.

Foreign investments are also essential as domestic savings are inadequate to generate the needed levels of economic growth. For instance Sri Lanka's domestic savings are about 16 per cent of GDP. The country requires an investment ratio of about 40 per cent of GDP to achieve the desired 8 per cent rate of GDP growth. With little prospects of increasing domestic savings substantially in the short run, all South Asian countries require increased foreign investment to bridge the savings - investment gap.

Impacts of trade, investment and technology transfer on environment

How does trade have a bearing on the environment? There are both positive and negative factors of international trade on the environment. The emerging situation is one in which an increasing number of factors are becoming supportive of environmental protection. Yet there are possibilities of trade impacting negatively on the environment in several ways.

International trade is dependent on competitive advantage. This in turn depends on three inter-related factors. The development of quality products having an international demand, the ability to produce the export products at a unit cost which is price competitive and the ability to market the products successfully. Since it is most important that an export firm produces goods at internationally competitive prices, there are strong influences for the adoption of technology which would be less costly. High polluting technology could be less costly than more advanced and newer environmentally sound technology. Therefore there is a strong tendency, in an increasingly competitive international market, for developing countries to adopt the less costly technology, whose environmental impact is adverse, in order to produce export goods cheaply.

The second influence arises owing to environmental codes of developed countries requiring the replacement of old technology. The discarded polluting technology may be shipped out at low cost. The cost differential between the less polluting new technology and the high polluting discarded technology could be large. This provides an immediate economic advantage to the less developed countries to import the cheaper high polluting technology. The cost differential would be further accentuated if the developing country has high tariff protection. By adopting such technology the capital costs of investment and thereby the unit costs of production could be reduced. However, according to the World Bank, developing countries do not compete for "dirty" industries as pollution costs are only a small proportion of total value. (WBR 1992 : p.67).

Added to these factors is another strong current to locate high polluting industry in less developed countries. There are products which are marketable in developed countries, but not produced in them, due to environmental hazards. This arises owing to policies of developed countries to discourage high polluting industries in their countries. This provides an impetus to shift these industries to third world countries. Such industries would tend to be located in third world countries, but produce commodities for developed industrial countries.

Therefore it is clear that there are several trade, investment and technology transfer forces against the harmonising of environment with development. These include the possibility of lesser cost, higher polluting technology being used to produce export products, the availability of low cost high polluting second hand machinery from developed countries and the shift of high polluting industry from developed countries to developing countries. All three of these economic forces would tend to make it more difficult for the developing countries of South Asia to adopt an economic strategy which would harmonise environment with development.

A very clear and conspicuous instance of adopting polluting technology is the import of second hand cars and commercial vehicles by third world countries and the use of diesel vehicles, particularly commercial vehicles, which are more polluting. The same applies to industrial machinery imports. The eagerness to industrialise rapidly, the higher profitability of cheaper technology and capital scarcity promotes a technology transfer strategy which would tend to be more polluting.

There are however several environmentally positive factors with respect to technology development which are emerging. The first of these is that new environmental friendly technologies are being developed. It is only in recent years that environmentally sound technologies were deemed necessary. Since the industrial revolution the goal of technological development has been to produce more efficient machines. Technological efficiency in the past has been guided by three principles: the production of more units with the same resources (inputs), the production of qualitatively better products and the technological efficiency translated into economic terms - economic efficiency.

With the relatively new concern for the environment, the objective of producing environmentally sound technologies has also arisen. Environmentally sound technologies are those technologies which are less polluting, use less of resource depleting and non-renewable materials use, recycled wastes and disposal of waste materials with minimal damage to the environment. (Swaminathan and Gowri 1995 p.8). Generally such technologies are more costly to the individual firm in conventional non-environmental costing terms. But if their total costs and benefits to the community over time are included, environmentally friendly technologies would be more beneficial in the long run.

Since the thrust of engineering research is now well on the way towards finding technologies which are less polluting, the emerging technologies would be less polluting and the availability of the older polluting technology for export to developing countries would be a diminishing phenomenon. Increasingly there is a realisation that environmentally sound technologies are not necessarily uneconomic in conventional economic terms either. A case study, which illustrates this is the development of an environmentally friendly motor car technology in Japan, in response to impending implementation of legislation to control the level of fume emissions in California. Japanese motor car firms produced not only a less polluting car but also a fuel efficient vehicle. (Katayama 1996).

Advanced technology offers the prospects of both lesser pollution and higher efficiency. Therefore new industries in South Asian countries could benefit by commencing industries with such modern technology, and benefit both economically and environmentally. There is a possibility that in the longer run third world countries would benefit from these technology advances. The development of environmentally sound technologies in developed countries and the transfer of this technology through international investment, as well as trade, augurs well for harmonising economic development with the environment.

The general impression is that multi-national corporations are damaging the environment. This bad impression has been created mainly due to huge disasters like that of Bhopal in India. Recent studies have shown that multi-nationals are becoming increasingly protective of the environment. (U.N. 1993). The reasons why multi-nationals tend to harmonise development with the environment are threefold. First, multi-nationals with their long run vision of profits and growth, have accepted the need for environment friendly technology as essential for sustainable development. Second, they spend a high proportion of their budgets for the development of environment friendly technology, as well as for the repair of environmental damage.

This is again possible as they can afford such expenditure, which could bring in returns over the long run, and are good for their image building. Third, multi-national corporations adopt the same technology the world over as such uniform adoption is more economical than the development and adoption of different technologies. Therefore the environmental standards of developed countries are likely to be adopted in developing countries through their investment and technology transfer. (U.N. 1993; Dean 1992).

Another important development, which augurs well for the improvement of the environment, is that countries of South Asia are themselves recognising the need to protect their environment and imposing conditions which require new industries to comply with environment codes. Therefore there is an impetus for the establishment of industries which use environment friendly technology. Further, many international agencies and western donors fund only those industries which adopt technologies which protect the environment. This strengthens and reinforces the national concern. There are also aid programmes to fund the adoption of technology, which reduce pollution of already adopted industrial technology or provide subsidies for the adoption of environment friendly technology. The Pollution Abatement Fund in Sri Lanka to subsidise interest costs of equipment which reduce pollution is a case in point. These factors are certainly in the direction of harmonising development with the environment.

Trade policies and environment

There are two issues relating to trade and the harmonisation of the environment with development, which require to be discussed. First, does liberalised trade have a beneficial impact on the environment? Second, should trade policies be used to achieve environmental goals?

There are several ways in which liberalised trade policies assist in improving the environment. Liberalised trade implies a fairly free flow of goods and services without non tariff barriers and with low tariffs. The process of trade liberalisation, which has been undertaken around the world, has tended to reduce tariffs and eliminate systems of quotas, licences and other restrictions. The reduction in tariffs implies that the cost of higher value imports would be relatively less, especially if the earlier system of tariffs was an ad valorem tax. Therefore the argument adduced earlier that there would be a tendency for developing countries to import lower cost higher polluting technology would lose some of its force in a liberalised trade regime. A high tariff trade regime also confers benefits on imports of used equipment owing to the possibility of reducing the import value by under invoicing for customs purposes and encourages the import of used and reconditioned equipment. Such imports would not be as attractive in a liberalised trade regime.

The argument is also made that a liberalised trade fosters greater efficiency and higher productivity and therefore reduces pollution by encouraging less polluting industries. It is argued that the imperatives of efficiency drive industries to adopt cleaner and more modern technologies. The modern technologies could be both more efficient, of higher productivity and be less polluting. The World Bank has argued :

*Liberalised trade poses greater efficiency and higher productivity and may actually reduce pollution by encouraging the growth of less polluting industries and the adoption and diffusion of cleaner technologies.
(World Bank Report 1992 p.67)*

Arguments that liberalised trade is conducive to the improvement of the environment presupposes that natural resources are priced according to their actual scarcity value. Further, the scarcity of capital and low per capita incomes of poor countries would drive them to imports of cheaper capital goods and intermediate inputs which are polluting. It must be recognised that liberalised trade policies could be more effective in an overall economic environment whose other facets of economic policies buttress and strengthen the trade liberalisation policies with environmental concerns.

The contrary view gets to the root of the problem of the contradiction between increased consumption and environment protection. David Runnalls argues :

The rapid expansion of trade without adequate environmental safeguards would pose enormous problems. We must remember that concerns over sustainable development arose from the growing judgment that a planetary increase in production and consumption to meet the needs of the 10 billion who will be on earth by the middle of the next century is simply not supportable by the earth's natural systems given current patterns of resources use and technology.
(Runnalls 1994 p.19)

Liberalised trade could run counter to the conservation of scarce and non-renewable or slow renewable resources and the concept of sustainable growth. Liberalised trade could, in certain cases, lead to an excessive exploitation of natural resources. A case in point is the liberalised trade in timber and wood products. Reduced tariffs on timber imports increase the demand for timber and developing countries are prone to exploit such market access. This is particularly so as timber is not priced according to its true scarcity value.

Subsidies for logging, inadequate collection of rents and free availability of timber from forests, compound this problem. Liberal trade in other natural resources, such as ornamental fish, corals, granite, marble and exotic varieties, could deplete these resources, degrade the environment, lead to sea and coastal erosion and endanger biodiversity.

The issue as to whether trade policies should be used to achieve environmental objectives is a controversial one. There have been several trade measures or agreements, to implement environmental concerns. These include the Montreal Protocol, which phases out the use of ozone depleting substances, the Basel Convention of 1992 controlling the international movement and disposal of hazardous material and the Convention on International Trade in Endangered Species (CITES). The latest such requirements are the agreements in the GATT Uruguay Round.

The World Bank has argued that the effects of trade policies on environmental concerns are uncertain; where they achieve results, such effects could be short-term; that in the long run, they could be counter-productive; and that trade policies must be used together with other policies if they are to achieve an environmental gain. The World Bank Report for 1992 made this assessment :

Trade policies are a blunt and uncertain tool for environmental management because they influence the use of environmental resources only indirectly. Indeed, modified trade policies to deal with environmental problems may worsen degradation.
(World Bank Report 1992 : p.67)

Where trade policies are used to achieve specific environmental goals there may be a quick impact, but economic forces could reverse these results in the long run. An example of such an instance is the policy adopted to ban trade in ivory. The immediate impact was to reduce the hunting of tusked elephants and achieve the goal of preserving elephant herds. But in due course, with the ban on ivory trade, the price of ivory rose and this provided a strong

incentive to hunt elephants again. Also, such measures tend to encourage smuggling and circumvention of normal trade channels.

Developed countries are adopting trade policies which require that commodities imported to their countries should be produced in an environmentally friendly manner. There are provisions under the latest GATT Agreement, known as the Uruguay Round, for products to have certification that the technology used is non polluting.

There is a danger in using trade policies for environmental objectives. Under the Uruguay Round the World Trade Organisation is empowered to prohibit the trade of goods which are not produced under acceptable sanitary standards. This has become a very controversial issue as developing countries have argued that the imposition of these standards could be a subtle means of imposing non-tariff barriers on their exports. There is also the fear that such conditions would discriminate between countries.

Conclusion

Trade, investment and technology transfer are three vital elements for rapid economic development of South Asia. These three phenomena are also closely inter-related. Each of them have both positive and negative potential impacts on the environment. The growing concern for the environment and a commitment to the concept of sustainable development in recent years have promoted policies which are more conducive to the harmonisation of their impacts with the environment. Yet, the efficacy of that harmonisation depends very much on the whole gamut of domestic economic policies which must ensure that the regulatory mechanisms are in place to mitigate any adverse impacts that may arise from trade, investment or technology transfers.

With respect to trade policies, while the current trend of trade liberalisation is generally expected to have a beneficial impact on the environment, there are several ways in which such liberalisation itself could have adverse impacts. Liberalised imports into developed countries of products using non renewable natural resources could pose a threat to exporting countries owing to excessive and non sustainable exploitation of these resources to meet international demand. Therefore exporting countries of such natural non renewable resources should be vigilant to ensure that liberalised trade does not lead to excessive exports and unsustainable exploitation of resources. There would be a need to balance such trade liberalisation in importing countries with carefully considered regulatory and restrictive trade practices.

One of the severest challenges to the harmonisation of the environment with development arises out of short run gains which may arise from the import of environmentally polluting technology. Developing countries, faced with a severe shortage of capital for investment, would be tempted to benefit by short run gains of lower cost polluting technology rather than look to the long run adverse environmental effects of such imports. This is an area in which developing countries, like the countries of South Asia, should be mindful of at this stage of industrial development. The countries of South Asia should not fashion their trade and industrialisation policies on the basis of short run gains, but look to the long run costs and benefits and sustainability of their industrialisation.

Current trade policies of developed countries also pose challenges and opportunities for the developing world. Some of the environmental conditions on production methods imposed by the developed countries would require the exporting countries of South Asia to conform to their requirements. Such impositions are controversial as they provide a large measure of

discretion which could be used as non tariff barriers for South Asian exports. This could be more so if the conditions imposed are discriminatory among nations in practice.

The environmental concerns in western countries also provide new opportunities for South Asia. These include the much higher valued bio friendly products demanded by developed countries' consumers. There is a growing demand for foods grown under natural or bio friendly conditions and these products fetch a much higher shelf price in developed countries. South Asian countries could benefit by producing higher value environmentally friendly agricultural produce for these emerging developed country markets.

Foreign investment too offers both positive and negative possibilities with respect to environment. If firms shift their polluting industries, which are banned in developed countries, to the developing world, then the environmental impact of foreign investment could be damaging to the environment. However, more recently, technological developments have been towards environmentally sound technologies. The growing interest and concern of multi-national corporations to invest in research and development for the production of environmentally sound technology offers the prospect of foreign investment for such companies being accompanied by environmentally sound technology transfers. This is so not merely because of the multi-nationals' concern for the environment but also because it would be economically more feasible to use the same technologies in their far flung operations in the world rather than use different technologies. Nevertheless, countries in South Asia must be vigilant in their own interest to ensure compliance of their own environmental standards or codes.

Given the enormous resource constraints of the developing countries of South Asia, the harmonisation of environment and development could be made a greater reality, if developed countries themselves take some responsibility. This responsibility consists of adopting trade policies, which ensure that non renewable resources of developing countries are not jeopardised. Where developing countries have to bear a higher cost in order to ensure higher environmental standards, developed countries could assist them by subsidies, loans or grants to finance such technology. Such policies of assistance are to be expected, not merely because of the financial weaknesses of developing countries, but also because the action of any country could have a global environmental impact. Financial assistance for pursuing environmentally sound technologies should be provided by developed countries as the much higher levels of per capita consumption of resources in developed countries are responsible for many environmental problems such as the diminution of the ozone layer, global warming and depletion of bio-diversity.

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4

ENVIRONMENTALLY SUSTAINABLE INDUSTRIAL DEVELOPMENT

Ir. Tien N Pham

While there are natural emissions of most major pollutants, industrialisation is still a major threat to the biosphere. Industry has become a major contributor to environmental degradation with its manufacturing, mining, utilities and construction activities.

The global degradation of the environment in relation to industrial development occurs at both the input and the output sides of production activities. On the input side, the consumption of water, energy and mineral resources causes environmental damage and ecological disruption. On the output side, the manufacturing process generates air pollution, water pollution, solid wastes, hazardous wastes and toxic chemicals.

Environmentally Sustainable Industrial Development (ESID) is a new approach to reconcile the demands of population growth, the need for continued industrialisation and protection of the environment. To achieve ESID, industrial development must comply with three criteria: protection of eco-capacity; efficient use of human, material and energy resources and equity in sharing the environmental burdens as well as the outputs of industrialisation.

ENVIRONMENTALLY SUSTAINABLE INDUSTRIAL DEVELOPMENT

Ir. Tien N. Pham

Industry and the Environment

The natural concentration of CO₂ in the atmosphere is controlled by the interactions between the atmosphere, the oceans and the biosphere in what is known as the geochemical carbon cycle. Human activities can disturb this cycle by injecting additional CO₂ into the atmosphere, thereby aggravating the natural greenhouse effect. Over the past 100 years, the global mean temperature has risen by 0.3^o to 0.6^o C. A doubling of atmospheric concentration of CO₂ is expected to increase the global mean temperature in the range of 1.5^o to 4.5^o C. There was a notion that CO₂ was the only greenhouse gas. However, research over the last two decades has found that other gases such as nitrous oxide, methane, chlorofluorocarbons (CFCs) and tropospheric ozone also contribute to greenhouse gases.

CFCs are used as propellants and solvents in aerosol sprays; as fluids in refrigeration and air-conditioning equipment; as foam blowing agents in plastic foam production; and as solvents, mainly in the electronics industry. Emissions of bromine can also lead to significant reduction of the Ozone layer. These are major causes of the "ozone hole", leading to ultraviolet radiation, skin cancers, loss of immunity, yield reduction in crops and fisheries, smog etc.

Emissions of sulfur dioxide (SO₂) and nitrogen oxides (NO_x) create acidity in the natural environment especially seen in freshwater lakes, rivers, forests and soils and the deterioration of metal and building structures. Acid deposition may be absorbed, even in sensitive areas, by the natural buffering capacity of the environment. However, the onset of acid conditions in an environment may occur long after an increase in acid deposition.

All chemicals are toxic to some degree. The health risks from a chemical depend mainly on its toxicity and on the exposure. Although the term "hazardous" has different connotations among countries, it is widely applied to wastes containing metallic compounds, halogenated organic solvents, acids, asbestos, organophosphorus compounds, organic cyanides and phenols. Emissions of toxic chemical substances, heavy metals (lead, cadmium, mercury and arsenic) and aromatic polychlorinated compounds (PCBs, pentachlorophenol, dioxin) threaten aquatic ecosystems and soil in whole regions and seas.

Most hazardous wastes are produced by industry, but it is now recognised that there are hundreds of thousands of facilities that generate hazardous wastes. These include households, medical facilities, garages and auto-repair workshops, petrol stations and small scale industries and businesses.

Air pollution refers to gaseous or particulate contaminants in quantities, characteristics or durations that are injurious to human, plant or animal life or to property. The combustion of fossil fuels, both for power generation and transportation, is the major source of atmospheric pollution.

The commonly known air pollutants are SO₂, NO_x, suspended particulate matter (SPM), hydrocarbons (HC), carbon monoxide (CO) and lead (Pb). Both particulate matter and lead are serious threats to human health in the rapid urbanising areas in developing countries.

Some water pollutants, such as organic wastes from agro-industries and human settlements, are easily decomposed into substances that are normally harmless. However, at high concentrations, they may disturb the ecosystem. Other pollutants, such as metals and persistent organic compounds, can not be degraded; they usually remain absorbed on bottom sediments near the source of discharge. Some organisms have a remarkable ability to accumulate such pollutants, even when they are present in extremely low concentrations.

Both the atmosphere and rivers contribute to marine pollution. The atmospheric pathway accounts for more than 90 per cent of the lead, cadmium, copper, iron, zinc, arsenic nickel, DDT etc. The chief contaminant of fresh water is untreated or inadequately treated waste water from cities and industrial plants. Contaminants from agricultural lands, forests and roads can be significant in rural areas.

Industrial Growth and Pollution

Past development trends have resulted in very limited well-being for developing countries. In 1992, 80 percent of the world population received only about 20 percent of the world's income and produced only a small share of industrial output. The share in the industrial output of developing countries from 1970-1980 accounted for 13.8 per cent of the total global industrial output. Moreover, 10 countries accounted for over 60 per cent of the total MVA of all 116 developing countries, and 18 countries for nearly 80 per cent.

Industrial activity is a major contributor to environmental deterioration. It includes activities such as a manufacturing, mining, utilities and construction. Of these sector manufacturing alone accounts for, on average, one third of total final energy consumption. More specifically, five manufacturing subsectors are known to be the most pollution-intensive activities: iron and steel; nonferrous metals; nonmetallic minerals; chemicals; and pulp and paper. Table 1 summarises the environmental effects of some of the major industrial polluters.

For a long time such energy- and pollution-intensive industries were confined to developed countries. But they are now growing twice as fast in developing countries, due to rapid industrialisation. There has been a gradual relocation of resource-based (and energy-intensive) industries, such as steel, aluminum and petrochemicals, from the industrialised countries to developing countries.

Environmental deterioration associated with industrial pollution occurs at both the input and the output sides of production activities. Industrial production requires the input of a wide variety of natural resources, such as water, energy, minerals, forest products and other raw materials whose rapid depletion may cause environmental damage and ecological disruption. On the output side, the manufacturing process generates a myriad of wastes, including hazardous wastes, toxic chemicals and thermal wastes, that pollute the soil, the air and surface water and groundwater. Also, many manufactured end-products, such as pesticides, detergents, paints, plastics and combustion engines, add to the pollution.

Table 1. Environmental effects of selected industrial sectors

Industrial sector	Raw material use	Air	Water resources		Solid wastes and soil	Risk of accidents	Other (noise, health and safety)
			Quantity	Quality			
Textiles	Wool, synthetic fibers, chemicals for treating	Particulates, odours, SO ₂ , HC	Process water	BOD, suspended solids, salts, sulfates, toxic metals	Sludges from effluent treatment		Noise from machines, inhalations of dust
Leather	Hides, chemicals for treating and tanning		process water	BOD, suspended solids, salts, sulfates, chromium	Chromium sludges		
Iron and steel	Iron ore, limestone, recycled scrap	Major Polluter: SO ₂ , Particulates, NO _x , HC, CO hydrogen, sulfide, lead, and mists	process water	BOD, suspended solids, oil, metals, acids, phenol, sulfides, sulfates, ammonia, cyanides, effluents from wet gas scrubbers	Slag, wastes from finishing operations, sludges from effluent treatment	risk of explosions and fires	Accidents, exposure to toxic substances and dust, noise
Petro-chemical refineries	Inorganic chemicals	Major polluter: NO _x , HC, CO, SO ₂ , particulates, odours	cooling water	BOD, COD, oil phenols, chromium, effluent from gas scrubbers	Sludges from effluent treatment, spent catalysts, tars	risk of explosions and fires	Risk of accidents, noise, visual impact
Chemicals	Inorganic and organic chemicals	Major polluter: organic chemicals (benzene, toluene), odours, CFCs		organic chemicals, heavy metals, suspended solids, COD, cyanide	major polluter: sludges from air and water pollution treatment, chemical process water	risk of explosions, fires and spills	Exposure to toxic substances, potentially hazardous products
Non-ferrous metals e.g. aluminum	Bauxite	Major local polluter: fluoride, CO, SO ₂ , particulates		gas scrubber effluents containing fluorine, solids and hydrocarbons	Sludges from effluent treatment, spent coatings from electrolysis cells (containing carbons and fluorine)		
Micro-electronics	Chemicals (e.g. solvents, acids)	Toxic gases		Contamination of soils and groundwater by toxic chemicals (e.g. chlorinated solvents), accidental spillage of toxic material			Risk of exposure to toxic substances
Bio-technology				Used for effluent treatment	Used for clean up of contaminated land		Fears of hazards from the release of micro-organisms into the environment

Source: The state of environment (OECD, 1991)

In *Industry and Development: Global Report 1990/91*, UNIDO assessed the global degradation of the environment from both the input and output sides of production activities. On the input side, it looked at the consumption of water, energy and mineral resources. Industry uses much less water than agriculture, but it pollutes the water more. Although more than 80 per cent of the water used for cooling and cleaning is returned, the returned water is often contaminated by industrial effluents and thermal pollution. In the countries of the Organisation for Economic Co-operation and Development (OECD), industry used more energy than any other sector in 1970-1987. Its share ranged from 40 per cent in 1970 to 33 per cent in 1987. The industrial share of energy consumption in developing countries varied from country to country, ranging from 63 per cent in China to 20 per cent in West Africa. There seems to be no cause for concern about the exhaustion of minerals within the foreseeable future, although political disruptions can always lead to temporary shortages. More important in connection with mineral resources are the environmental problems posed by their production and industrial use.

On the output side, the *Global Report* analysed air pollution, water pollution, solid wastes, hazardous wastes and toxic chemicals. The manufacturing sector is not the sector that generates most air pollutants. Each major air pollutant has a different major source: electricity generation accounts for the bulk of anthropogenic emissions of SO₂; transport activities, for NO_x and CO; and motor vehicles, for hydrocarbons and lead. Industry however, is a major source of particulate emissions in many countries. Industry is responsible for a fairly large share of waste-water discharges containing traditional pollutants. Estimation of the share is complicated by the fact that in many countries industry discharges its waste into municipal waste-water systems. Fragmentary data indicate that the share of industry in total waste-water discharges is roughly 20 per cent.

An inter-country comparison of solid waste generation is difficult owing to the different definitions for categories of wastes. Industry's share of solid waste generation accounts for 17 percent of the total in the United States, 9 percent in France and 60 percent in Japan; National data on hazardous wastes are scarce and incomplete. Even when available, they are not comparable because of the widely varying definitions and classification schemes for hazardous wastes adopted by different countries. Bearing these limitations in mind, the fragmentary data show that, with some minor exceptions, the largest portion of hazardous wastes is generated by industrial production. For instance, in the United States over 85 percent of the hazardous waste is accounted for by the manufacturing sector. In Thailand, this share is over 95 percent. It is difficult to estimate the quantity of toxic chemical wastes produced in different countries each year, partly because the term 'toxic' is defined differently in different countries. Some recent data from the United States seem, however, to permit the identification and quantification of the types and sources of toxic chemical wastes. The chemical industry accounted for 54 percent of the total releases, followed by the paper products and primary metals subsectors.

The Path To Environmentally Sustainable Industrial Development

Industrial development can be sustained only if it preserves the balance of the nature. Otherwise the gradual eroding of the environment will eventually undermine an economy's ability to grow. Environmentally Sustainable Industrial Development (ESID) is a new approach to industrialisation that will allow us to reconcile the demands of population growth, the desire for continued industrialisation and the need to preserve the environment. The conference on ESID, held at Copenhagen in October 1991, defined ESID as "those patterns of industrialisation that enhance economic and social benefits for present and future generations without impairing basic ecological processes".

To achieve ESID, industrial development must meet three criteria. Firstly, eco-capacity; meaning the capacity of ecosystems to continue to function despite pollution. It refers, on the one hand, to the capacity of an ecosystem to be resilient, that is to maintain its patterns of behaviour in the face of external disturbances. On the other, it refers to the capacity of the system to remain stable, that is to maintain its equilibrium in response to normal fluctuations in the environment. Secondly, efficiency; meaning the most efficient conversion of human, material and energy resources into industrial outputs. Thirdly equity, meaning the equitable distribution of environmental burdens as well as of the outputs of industrialisation across nations, across segments of society and across generations.

The main objective of the United Nations Conference on Environment and Development, 1992 (UNCED) was to propose an alternative path for global development into the next century. UNCED adopted the Rio Declaration on Environment and Development and developed Agenda 21 as the world agenda for environmentally sound and sustainable development in the twenty-first century. Chapter 30 of Agenda 21 summarises the role of business and industry in achieving sustainable development. It emphasises Cleaner Production, i.e. the reduction of pollution intensity refers to the recommendations of the Conference on Ecologically Sustainable Industrial Development which was organised by UNIDO and held in Copenhagen in October 1991.

Guidelines to Industry, Governments and International Organisations

At the UNIDO Conference on Ecologically Sustainable Industrial Development held in Copenhagen, from 14 to 18 October 1991, it was agreed that the reduction of pollution intensity across all media (air, water and land) and within industry, through the application of Cleaner Production Practices was the key to achieving ESID. The conference recommended several initiatives for industry, governments and international cooperation.

Industry initiatives should include the following:

- (a) adopt pollution prevention, the approach that prevents pollution at the source in products and manufacturing processes rather than removing it after it has been created;
- (b) integrate environmental awareness and responsibility at all levels of management, taking into account careful analysis of relative risks, introduction of waste minimisation and environmental compliance auditing, establishment of emergency, risk and safety management systems, as well as training programmes;
- (c) assume a cradle-to-grave approach to product and project design,
- (d) development, transfer and adaptation of environmentally sound technologies know, how and skills to meet the needs of other countries, in particular developing countries, and mobilisation of financial resources and provision of human resources for this purpose.

Governmental action may include the following:

- (a) institutional infrastructure that affect industry and environment with a view to contributing to the transition to ESID through appropriate policies and measures;
- (b) strengthen procedures for reviewing industrial projects with potentially significant environmental effects,

- (c) internalise the cost of environment protection in price calculations. Inclusion of the cost for pollution abatement in entrepreneurial calculations would thus be a useful approach;
- (d) encourage ESID through research, development, acquisition and transfer of techniques and technologies, as well as efficient utilisation of existing relevant technologies in the public and private sectors; and
- (e) promote technical and managerial training and education that incorporate ESID in both informal and formal sectors

International cooperation to encompass the following:

- (a) resources are of vital importance to ESID, as well as to alleviating environmental problems in general;
- (b) transfer the techniques, technologies and processes, and the requisite information, skills and know-how from industrialised to other countries, in particular developing countries, as well as means necessary to develop infrastructure and policies to support them; and
- (c) seek international cooperation in linkages between trade and the environment in manufactured goods.

Conclusion

Protecting the biosphere from industry-related activities is a fundamental criterion for sustainable development. It includes stabilising the biosphere in the face of the threats from greenhouse gases and ozone-depleting substances, maintaining the carrying capacity of natural resource systems (forest, fisheries and agricultural land) and protecting the absorptive (assimilative) capacity of air, water, and soil from emissions and waste discharges.

Environmentally sustainable industrial development is a new approach to industrial development that will allow industry bestow economic and social benefits to the present generation without compromising the ability of future generations to meet their own needs and without impairing basic ecological processes.

Reduction in the pollution intensity of industry through Cleaner Production Practices is the only immediate way for industrial development to meet the ESID criteria. Industry and industrial institutions have to play a central role in the transition to ESID. While governments can assist, regulate and control that transition, it is essential that industry acts in accordance with the principles implied by ESID. The relevant organisations and institutions should promote managerial practices and technologies based on the principles of sustainability.

It currently seems inevitable that both global population numbers and per capita income will increase. The challenge we face is to reconcile the demands of population growth, the desire for continued industrial development and the need to preserve our environment. We must find a new approach to industrial development, both in developed and developing countries, that will allow us to preserve the ability of our environment to sustain us. In short, we must achieve environmentally sustainable industrialisation. The only way to do this is to reduce the "pollution intensity" of industrial activities.

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5

HARMONISING ENVIRONMENT AND DEVELOPMENT

Cecil Amerasinghe

Sustainable development goes beyond environmental protection. It is a fusion of ideas of the proponents of economic development and environmental protection.

South Asian countries have a number of common problems. Water is being polluted by activities of industry, agriculture and commerce and also by indiscriminate domestic waste disposal. Air pollution is prevalent in the larger cities with the main contributors being industry and vehicular traffic. Economically, South Asian Countries are dependent on agriculture. Productivity in agriculture itself is reaching a plateau.

All South Asian countries have opened up their economies, thus exposing themselves to the world of trade outside. The liberalised trade and open economic policies have marginalised certain segments of society and most governments have targeted special programmes for their benefit. Poverty is a common factor and it is taking a heavy toll on the natural resources and the environment.

Economic instruments will have to be used innovatively in addition to 'command and control' measures. Taxes and subsidies could be used as levers to promote environment friendly technologies. It is left to the countries concerned to maintain the right balance between the use of economic instruments and dependence on command and control measures.

HARMONISING ENVIRONMENT AND DEVELOPMENT

Cecil Amerasinghe

Sustainable development is the product of harmonising environmental concerns with developmental imperatives. The world Commission on Environment and Development also known as the Brundtland Commission defined sustainable development as “a process in which the exploitation of resources, the direction of investment and the orientation of technological development and institutional change meet the needs of the present generation without compromising the ability of future generations to meet their own needs”.

Sustainable development is a much wider concept than environmental protection. It is a fusion of ideas of the proponents of economic development and those of environmental protection. Sustainable development has, three far reaching priority goals namely, economic growth, human development and resource management. Unlike environmental protection, sustainable development requires an innovative approach where the root causes of environmental degradation such as poverty, population pressure, resource depletion, over consumption and wasteful production are either eliminated or minimised.

Even though the world community has been paying attention to environmental protection during the last two to three decades, the major thrust was given by the United Nations Conference on Environment and Development of 1992. At this “Earth Summit more than 150 heads of state pledged their support to protect the environment and to make the earth a safe place for people to live in.

The Rio Declaration on Environment and Development has enunciated guiding principles for environmentally sound and sustainable development of our planet. Some of these principles include eradication of poverty, elimination of unsustainable patterns of production and consumption, promotion of appropriate demographic policies and the fostering of an open international economic system so that development today will not undermine the development and environmental needs of the present and future generations. Also, to achieve sustainable development, environment should constitute an integral part of the development process, people are entitled to a healthy and productive life in harmony with nature; nations have the sovereign right to exploit their own resources and nations will co-operate to protect the earth’s eco-systems.

For nearly three decades since the 2nd world war, countries in South Asia have been pursuing a path of economic development without giving due consideration to the adverse impacts of the development process on the environment. With the advent of the “Green Revolution” in the 1960’s many South Asian countries concentrated on higher production and greater productivity. Large extents of land were opened up for agriculture and the entire governmental machinery was geared to meet the food demands of an ever increasing population. The “Green Revolution” was unable to offer a continuing high standard of life to the people and its limitations were recognised within a short period. At the same time during the 1970’s and 1980’s the importance of industry as an engine of growth and a source of employment came to be highlighted.

The introduction of the market economy in the 1980s brought about different patterns of growth in the South Asian region. Many of our countries opened up their economies exposing themselves to the forces of external trade. Although in the short run this affected farmers, fishermen and artisans, they understood the need to adjust themselves to the new situation and to improve production efficiency. There was no doubt that in the process of opening our doors to the larger world a group of people who could not keep pace with these changes were economically marginalised. This requires special programmes to be undertaken by governments to target welfare measures for the most affected people in order to ensure that they do not fall below accepted living standards.

A factor which disturbs the harmony between environment and development is the existing pattern of unsustainable consumption. There has to be the right balance between the production capacity of a given society and its level of consumption patterns within communities as well as the global context. The Earth's resources are not evenly distributed among countries. However this does not give a license to countries with a greater share to use such resources in a manner that would jeopardize the interests of other countries. Sometimes I wonder whether we should not think in terms of "sustainable living styles" rather than in terms of sustainable development.

In the context of the South Asian region there are a few common characteristics relating to environment and development that can be identified. The comparatively high population growth rate is not compatible with economic growth. Although the manufacturing sector is overtaking the agricultural sector, the pace of growth is not fast enough to absorb the surplus labour force.

In our countries, several steps have been taken in the direction of poverty alleviation. Yet, the greatest threat to the environment is ever increasing poverty. Rapid population growth pushes the poor into marginal lands where they are forced into adopting unsound cultivation practices. Owing to the scarcity of land, they have no option but to cultivate steep slopes or occupy disaster prone areas.

Land degradation and natural resource depletion appear to be common phenomena. Only a few countries have been able to take meaningful steps to arrest these problems. Depletion of forest cover is a matter of grave concern to all South Asian Countries. In addition to the demands made by the increasing population on forests, they are being illicitly cleared for settlements. Commercial logging which is largely illicit has been going on unabated.

Forests serve the important propose of absorbing the carbondioxide emitted by industries and by vehicular traffic. It also retains soil moisture so that with minimum rainfall, the streams, rivers and reservoirs could be recharged. Large scale deforestation leads to the erosion of the top soil which has disastrous consequences on the productivity of the land. The last two decades have witnessed trends towards desertification in many parts of the world including South Asia.

Water pollution caused by industry, agriculture, commerce and the disposal of domestic waste is having an adverse impact on the waterways and marine eco-systems. Industries which emphasise profitability do not make investments in treating waste which find their way into waterways. The chemical pollution of waterways in many South Asian countries has led to health hazards both for humans and animals. Municipal waste and household waste find their way into rivers and reservoirs. The large scale use of agro chemicals both for agriculture and horticulture has resulted in seepage of residues into the ground water table and aquifers.

Not many studies have been undertaken to estimate the extent of underground water contamination in the region.

Air pollution is confined to the larger cities of the region. However, it is reaching problem proportions with increasing vehicular traffic as well as with the location of industries in urban centres. Studies conducted in Colombo have indicated that the principal contributor to air pollution in the city is vehicular traffic.

In the South Asian region, the growth of mega cities is putting pressure on the already over loaded urban infrastructure. Problems of domestic and municipal waste disposal, water pollution and sanitation are caused by the expansion of unauthorised settlements such as schemes and shanties. Lack of potable water of acceptable quality is a matter of concern for both rural and urban inhabitants. Only a few countries in the region reach WHO standards for drinking water. Consequently diseases that are traceable to unsafe drinking water and poor sanitation such as diarrhoea and hookworm infestation are rampant in the urban areas.

Wetlands, marshes and mangroves are being reclaimed for development purposes. Large extents of mangroves are also lost to aquaculture especially prawn farming. Although electricity and gas are being used in urban centres a large section of the population still depends on firewood as a domestic energy source. This leads to depletion of forests. The need to develop alternate energy sources is being increasingly felt.

Depletion of biodiversity is another issue of sustainability that the region needs to address. The large scale clearing of forests for settlements and indiscriminate trading in plants and animal products have also contributed to the loss of terrestrial biodiversity. The discharge of industrial effluents and toxic waste in to rivers and water bodies and domestic waste of hotels and municipalities to the beaches have contributed to the decline of marine and coastal biodiversity. Dependence on coral or livelihood by coastal communities is the main reason for depletion of coral beds and reefs. Most countries are signatories to the Biodiversity Convention and it would be necessary to evolve systems for the preservation of biodiversity with community participation and provision made for the sustainable utilisation of flora and fauna.

It is imperative that we develop sustainable agricultural practices in order to ensure continued productivity of the land. Regional land use plans need to be developed at national, sub-national and grassroot levels. Agricultural research and extension should provide for cropping systems which are suitable for different land classes. Disruptive agricultural practices such as slash and burn as well as cultivation of erodible hill slopes need to be discouraged. Countries can take advantage of the research already undertaken both at the international and national research stations. The conservation farming techniques developed in India and Sri Lanka as well as the sloping land techniques developed in Sri Lanka and the Philippines may be of interest to member countries as proven agricultural practices that prevent soil erosion on steep lands.

It would be of interest to study the approaches and experiences of the countries of the region in harmonising environment and development. It is an accepted fact that some element of command and control is needed to bring about desired changes in any society. In USA where many incentives are offered to industry to adopt environmental friendly technologies, the environment protection laws are also enforced strictly.

In India there is a Central Pollution Control Board under the Ministry of Environment and Forestry and many of the environmental protection functions have been devolved to the state pollution boards. In Sri Lanka, a limited number of environmental protection functions have been delegated to the local authorities.

There is therefore the need for a greater devolution of powers. The importance of involving the local authorities who are traditionally responsible for disposal of solid waste, distribution of water and for sanitation services cannot be over emphasised. Admittedly the level of skills available with the local authorities are woefully inadequate to meet these demands. Hence the enhancement of the capacity of the sub national bodies is one of the most urgent requirements of the region.

South Asian countries need to make an assessment of the relative advantages as well as effectiveness of command and control measures as against the use of economic instruments. Economic instruments can be used in a very innovative manner to promote environment friendly practices. Unfortunately in most countries taxes are looked upon as a means of earning revenue. The latent potential in the tax systems which regulate the behaviour of the development agents as well as the community in general has not been taken into consideration adequately. For instance tax rebates can be offered for environment friendly technologies and direct incentives could be given to what are termed the "Green Industries". Apart from cleaning up the environment we would also be preparing our industrialists who are producing their commodities for the world market to conform to global quality requirements. It is now recognised that companies that have gained membership of International Standards Organisations such as ISO 900 have an edge over their competitors. Similarly ISO 14000 that would come into force soon will influence the future trade patterns of South Asian countries.

There is a noticeable polarisation of views of environment practitioners and development practitioners. On the one hand we cannot permit our limited resources to be depleted and environment polluted blatantly, which in turn will impact on the long term development potentialities. At the same time we cannot be oblivious to the miseries of present generations caused by widespread prevalence of poverty, malnutrition and employment and think only of the interest of future generations. This is the dilemma a developing country is faced with - to develop or to conserve.

It must be noted that economic development or the lack of it has a more serious impact on the environment than that of segmented activities of environmentalists. Since environmental protection is a new dimension, environmental strategies should exert a strong influence on development. This can be achieved only if environmentalists consider themselves as a part of the development planning process. It is also becoming clear that the responsibility of protecting the environment should not be left solely in the hands of the environment ministries. Macro economic and fiscal planning agencies can play an important role in harmonising environment and development by re-examining development priorities.

Many institutional mechanisms have been tried out in the region for the purpose of harmonising environment and development. They include among others the development of National Conservation Strategies of Nepal, Pakistan and Sri Lanka and National Environmental Strategies and National Environment Action Plans of India and Sri Lanka.

Cabinet ministries for environment have been established in almost all the South Asian countries. Institutional mechanisms to build a closer dialogue between the planning and environmental ministries have already commenced in a number of South Asian countries

including India, Bangladesh, Pakistan, Nepal and Sri Lanka. The action taken by Sri Lanka Government to incorporate environmental considerations into the 5 year Public Investment Programme (PIP) 1996 - 2000 appears to be a very constructive and innovative approach. All major public investment programmes have to be generated through the Department of National Planning and they now include environmental criteria in selection of projects. There is a need to extend the integration of environmental considerations into the planning process at the intermediate and grassroot levels.

Another institutional mechanism developed in Sri Lanka to bring the polarised groups to a common platform may be of interest to the other countries. The Chambers of Trade and Industry have formed an institution known as "Lanka International Forum for Environmental Protection" (LIFE). The private sector, public sector and NGOs have representation in this forum. The objective is to find a middle ground where different groups often take extreme stands. Undoubtedly a great deal of understanding of each other's problems and an on-going dialogue is needed to pursue the path of sustainable development.

The introduction of resource accounting systems as well as analytical economic instruments like extended cost benefit analysis can enhance the real benefits of development projects. The loss of environmental assets are taken for granted as no economic value is assigned to them. This gives a distorted picture to the decision makers who are sometimes misdirected to take decisions that are harmful to the environment.

Case studies confirm the necessity of obtaining the support of high ranking political and government officials for strategy development and implementation. Pakistan and Nepal are excellent examples of this support as evidenced by the National Conservation Strategies of these countries being recognised by successive governments. Nepal's Conservation Strategy was endorsed by the King, the Prime Minister and the Task Force of senior public officials. In Pakistan, formal links are being forged between the National Conservation Strategy and the Planning Commission.

An effective institutional instrument being used by most countries in the region is the Environmental Impact Assessment (EIA) regulations. EIA is a new concept to the South Asian region, even though this tool has been in use in the west for over 25 years. Initially, the private sector tends to view EIA with a certain element of suspicion fearing that it would be an obstruction to their development and would eventually affect their profitability and competitiveness. As both the public and private sectors are better exposed to the EIA methodology, there develops a greater appreciation of this process as an instrument to mitigate environmental hazards. There are certain inherent limitations in the EIA process in that environmental concerns are looked at virtually at the end of the pipe line. Applications are made to the environmental authorities for clearance after the preparation of feasibility studies and even after initial designs are completed. If and when environmental concerns are detected in the proposed project, the project proponents find it difficult to make the adjustments at that late stage. This had been a cause for conflict and misunderstanding by the environmentalists and developers.

Comprehensive training in the EIA process, including detailed EIA guidelines for micro sectors such as tourism, mining, textile mills, chemical industries, tanneries, etc. could greatly assist the project design. The EIA process itself should be simplified and provide ample opportunity for the stakeholders including the community to comment on the project proposal. An understanding of the environment requirements at the early stage of the project preparation would obviate the need for adjustments at the final stages thereby eliminating

delays and costly re-design. South Asian countries should develop expertise in EIA so that when specialist advice is needed all can draw from a pool of resources within the region. Sri Lanka is in the process of developing a center of excellence for EIA and steps are being taken to offer specialised training courses at the Masters level in the Universities.

In Sri Lanka we have taken steps to decentralise the EIA process by appointing 18 public sector agencies as Project Approving Agencies (PAA) for environmental clearance relating to projects in their respective areas. Any detailed technical advice needed by the PAA is provided by the Central Environmental Authority (CEA). Under the EIA regulations an aggrieved party can appeal to the Secretary to the Ministry of Environment whose decision is final. Under the proposed environmental law now under consideration, such appeals will be heard by a Tribunal.

I wish to touch briefly on the subject of sustainability and technology. There are incredible advances made in the field of technology. Advances made in the area of communication is bringing the people of the world closer together. Yet there is an unbridgeable gap between the levels of technology available to the developed and developing countries. Although we often hear of transfer of technology at international fora, the real transfer is so costly that countries like ours can ill afford access to technology.

The challenge before us therefore is to develop technologies that we can afford. We still have a high level of expertise within the South Asian region, although the brain drain has deprived us of some of our finest experts. SACEP as an organisation can make a positive contribution by serving as a catalyst to share the expertise among the member countries. As the current Chairman of the SAARC Technical Committee on Environment, I have made a similar recommendation to that organisation. The modalities employed by Technical Cooperation among Developing Countries (TCDC) where the beneficiary country has to offer only host country facilities to experts appear to be an ideal for our purpose.

II

POLICY CONSIDERATIONS

Economic Policy Framework for Sustainable Development

Women in Environment and Development

Peoples Participation

Integrating Environment into Development Planning

6

ECONOMIC POLICY FRAMEWORK FOR SUSTAINABLE DEVELOPMENT

Dr. Mohan Munasinghe

Sustainable development has economic social and environmental components. Given the key role played by economics in development decision making, it is necessary to set out a practical framework for integrating the different elements for sustainability based on environmental economics.

Concepts and techniques for valuation of environmental impacts of projects and policies have been presented to enable such environmental considerations to be explicitly considered in the conventional cost benefit calculus used in economic decision making. The process of internalising these environmental externalities may be facilitated by extending the techniques of conventional economic theory, with particular reliance on willingness-to-pay as a measure of value.

When economic valuation of environmental impacts is difficult, reliance may have to be placed on multicriteria methods. Economywise policies, both sectoral and macroeconomics, often have significant environmental effects. The solution is not necessarily to modify the original broader policies which have conventional economic or poverty-related goals but rather to design more specific and complementary environmental measures that would address the particular policy, market or institutional imperfection and thereby help mitigate negative effects or enhance positive impacts of the original policies on the environment.

The Action Impact Matrix (AIM) based approach is helpful in identifying, prioritising, and addressing issues arising from links between economic decisions and the environment. At the international level, environmental economics help to analyse issues relating to transnational pollution, as well as global climate change and ozone layer protection.

ECONOMIC POLICY FRAMEWORK FOR SUSTAINABLE DEVELOPMENT:

Dr. Mohan Munasinghe

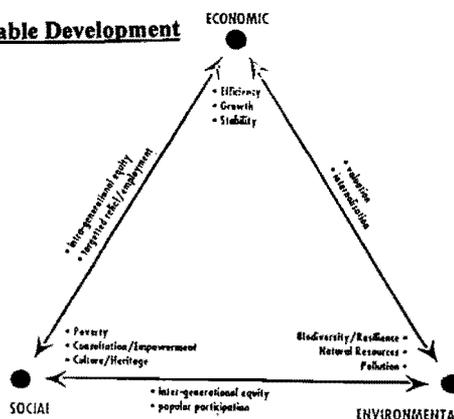
Sustainable Development and Sustainability

The environmental assets that we seek to protect provide three main types of services to human society, and the consequences of their degradation must be incorporated into the decision making process. First, it has been known for centuries that the natural resource base provides essential raw materials and inputs (both renewable like forests and depletable like minerals) which support human activities. Second, the environment serves as a sink to absorb and recycle (often at little or no cost to society) the waste products of economic activity. Finally, there has been increasing recognition, particularly in the last two decades, that the environment provides many other generalized services ranging from simple amenities to irreplaceable life support functions (e.g., stabilization of the global climate or filtering out of harmful ultraviolet rays by the stratospheric ozone layer).

The concept of sustainable development which emerged in the 1980s draws heavily on the experience of several decades of development efforts. Historically, the development of the industrialized world focused on production. Not surprisingly, therefore, the model followed by the developing nations in the 1950s and the 1960s was output and growth dominated, based mainly on the concepts of economic efficiency. By the early 1970s the large and growing numbers of poor in the developing world, and the inadequacy of "trickle-down" benefits to these groups, led to greater efforts to directly improve income distribution. The development paradigm shifted towards equitable growth, where social (distributional) objectives, especially poverty alleviation, were recognized as distinct from and as important as economic efficiency.

Protection of the environment has now become the third major objective of development. By the early 1980s, a large body of evidence had accumulated that environmental degradation was a major barrier to development. The concept of sustainable development has, therefore, evolved to encompass three major points of view: economic, social and ecological, as shown in Figure 1 (Munasinghe 1992).

Figure 1 Elements of Sustainable Development



Source: Munasinghe (1993a)

The *economic* approach to sustainability is based on the Hicks-Lindahl concept of the maximum flow of income that could be generated while at least maintaining the stock of assets (or capital) which yield these benefits (Solow 1986, Maler 1990). There is an underlying concept of optimality and economic efficiency applied to the use of scarce resources. Problems of interpretation arise in identifying the kinds of capital to be maintained (e.g., manufactured, natural, and human capital) and their substitutability, as well as in valuing these assets, particularly ecological resources. The issues of uncertainty, irreversibility and catastrophic collapse pose additional difficulties (Pearce and Turner 1990).

The *social* concept of sustainability is people-oriented, and seeks to maintain the stability of social and cultural systems, including the reduction of destructive conflicts (Munasinghe and McNeely 1994). Intragenerational equity (especially elimination of poverty), is an important aspect of this approach (Dasgupta 1993). Preservation of cultural diversity across the globe, and the better use of knowledge concerning sustainable practices embedded in less dominant cultures, are desirable (Hanna and Munasinghe, 1995a, 1995b). Modern society would need to encourage and incorporate pluralism and grass-roots participation into a more effective decision making framework for socially sustainable development.

The *ecological* view of sustainable development focuses on the stability of biological and physical systems (Munasinghe and Shearer 1995). Of particular importance is the viability of subsystems that are critical to the global stability of the overall ecosystem (Perrings 1991). Protection of biological diversity is a key aspect. Furthermore, "natural" systems may be interpreted broadly to also include man-made environments like cities. The emphasis is on preserving the resilience and dynamic ability of such systems to adapt to change, rather than conservation of some "ideal" static state.

Reconciling these various concepts and operationalising them as a means to achieve sustainable development is a formidable task, since all three elements of sustainable development must be given balanced consideration. The interfaces among the three approaches are also important. Thus, the economic and social elements interact to give rise to issues such as intragenerational equity (income distribution) and targeted relief for the poor. The economic-environmental interface has yielded new ideas on valuation and internalisation of environmental impacts. Finally, the social-environmental linkage has led to renewed interest in areas like intergenerational equity (rights of future generations) and popular participation.

Sustainable development implies a set of measures or actions adopted to achieve certain desirable objectives, defined in terms of improvements to human well-being. Indeed, not all activities that improve human well-being can be considered sustainable. Those that meet the criteria of sustainable development, are measures that can be *sustained* over time. In order to understand sustainable development, it is important to formulate a definition of 'sustainability' in terms of a physical state, rather than a set of activities. The concept of sustainability as applied to ecological and social systems, has both spatial and temporal dimensions (see Box 1). This definition clarifies key characteristics of sustainable states -- based on the persistence, viability and resilience of ecological and social systems over their "normal" life span.

The concept of sustainable development must be addressed within the context of the three dimensions as described above, and all three must be given balanced consideration. However, in seeking an implementable framework that integrates the three approaches in a practical way, it is useful to recognize that most development decisions continue to be based on the economic efficiency criteria. To this end, environmental economics plays a key role in

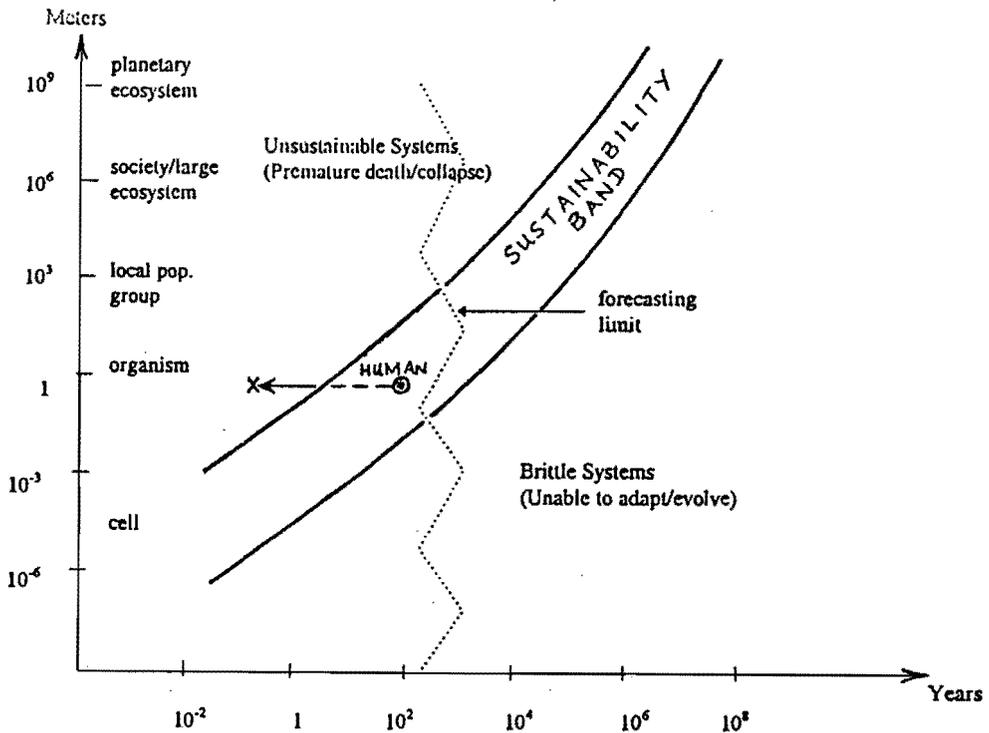
Economic, Policy Framework for Sustainable Development

in integrating environmental considerations with economic decisionmaking at various levels of analysis.

The Role of Environmental Economics

Environmental economics helps us incorporate environmental concerns into the structure of economic decisionmaking, as shown in Figure 2. The right-hand side of the diagram indicates the hierarchical nature of modern society. The global and transnational level consists of sovereign nation states. In the next level are individual countries, each having a multisectoral macroeconomy. Various economic sectors (like industry and agriculture) exist in each country. Finally, each sector consists of different subsectors and projects.

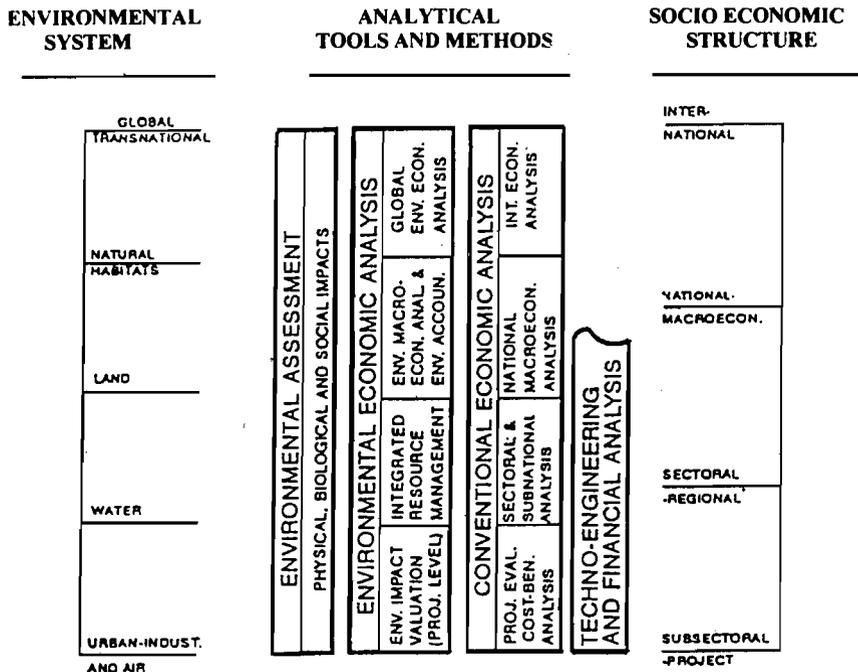
Box 1 Spatial and Temporal Aspects of Sustainability



An operationally useful concept of sustainability must refer to the persistence, viability and resilience of organic or biological systems, over their "normal" life span. In other words, the lifetime of purely physical entities (e.g., a proton or the Milky Way) are not especially relevant to a discussion of sustainable development. In this ecological context, sustainability is linked with both spatial and temporal scales, as shown in the figure. The X axis indicates lifetime in years and the Y axis shows linear size (both in logarithmic scale). The central dot represents an individual human being -- having a longevity and size of the order of 100 years and 1 meter, respectively. The diagonal band shows the expected or "normal" range of lifespans for a nested hierarchy of living systems starting with single cells and culminating in the planetary ecosystem. The bandwidth accommodates the variability in organisms as well as longevity.

Environmental changes that reduce lifespans below the normal range imply that external conditions have made the systems under consideration, unsustainable. In short, the regime above and to the left of the normal range denotes premature death or collapse. At the same time, it is unrealistic to expect any system to last forever. Indeed, each sub-system of a larger super-system (such as single cells within a multi-cellular organism) generally has a shorter life span than the super-system itself. If subsystem lifespans increase too much, the encompassing super-system is likely to lose its plasticity and become "brittle" -- as indicated by the region below and to the right of the normal range. In other words, it is the timely death and replacement of subsystems that facilitates successful adaptation, resilience and evolution of larger systems (Holling, 1992).

We may summarise the foregoing by arguing that sustainable development requires biological systems to be able to enjoy a normal life span and function normally, within the range indicated in the figure. Thus, leftward movements would be especially undesirable. For example, the horizontal arrow might represent a case of infant death -- indicating an unacceptable deterioration in human health and living conditions. In this context, extended longevity involving a greater than normal life-span would not be a matter for particular concern. On the practical side, forecasting up to a time scale of even several hundred years is rather imprecise. Thus, it is important to improve the accuracy of scientific models and data, in order to make very long-term predictions of sustainability (or its absence) more convincing -- especially in the context of persuading decisionmakers to spend large sums of money to reduce unsustainability. One way of dealing with uncertainty, especially if the potential risk is large, relies on a precautionary approach -- i.e., avoiding unsustainable behavior while studying the issue more carefully.



Source: Munasinghe (1993a)

Figure 2. Linking Environmental Systems with the Socio-Economic Structure Using Environmental Economic Tools

Unfortunately, the environmental analysis cannot be carried out readily using the above socioeconomic structuring. The left side of the figure shows one convenient environmental breakdown in which the issues are: (1) global and transnational (e.g., climate change, ozone layer depletion); (2) natural habitat (e.g., forests and other ecosystems); (3) land (e.g., agricultural zone); (4) water resource (e.g., river basin, aquifer, watershed); and (5) urban-industrial (e.g., metropolitan area, airshed) - related. In each case, a holistic environmental analysis would seek to study a physical or ecological system in its entirety. Complications arise when such natural systems cut across the structure of human society. For example, a complex forest ecosystem (like the Amazon) or a physical resource system (like a large river) could span several countries, and also interact with many economic sectors within each country.

The causes of environmental degradation arise from human activity (ignoring natural disasters and other events of non-human origin), and therefore, we begin on the right side of the figure. The physical effects of socioeconomic decisions on the environment must then be traced through to the left side. The techniques of environmental assessment (EA) have been developed to facilitate this difficult analysis. For example, destruction of a primary moist tropical forest may be caused by hydroelectric dams (energy sector policy), roads (transport policy) slash and burn farming (agriculture sector policy), mining of minerals (industrial sector policy), land clearing encouraged by land-tax incentives (fiscal policy), and so on. Disentangling and prioritizing these multiple causes (right side) and their impacts (left side) will involve a complex analysis.

Meanwhile, the usual decision making process on the right side relies on techno-engineering, financial and economic analyses of projects and policies. In particular, conventional economic analysis has been well developed in the past, and uses techniques such as project evaluation/cost-benefit analysis (CBA), sectoral/regional studies, multisectoral macroeconomic analysis, and international economic analysis (finance, trade, etc.) to assist the process of decision making at the various hierarchic levels.

The figure also shows how environmental economics plays its crucial bridging role, by mapping the EA results onto the framework of conventional economic analysis. A variety of environmental economic techniques including valuation of environmental impacts (at the local/project level), integrated resource management (at the sector/regional level), environmental macroeconomic analysis and environmental accounting (at the economywide level) facilitate this process of incorporating environmental issues into traditional decisionmaking. Since there is considerable overlap among the analytical techniques described above, this conceptual categorization should not be interpreted too rigidly.

Clearly, the formulation and implementation of such policies is itself a difficult task. In the deforestation example described earlier, protecting this single ecosystem is likely to raise problems of coordinating policies in a large number of disparate and (usually) non-cooperating ministries and line institutions (i.e., energy, transport, agriculture, industry, finance, forestry, etc.) in several countries. As described above, the field of environmental economics, broadly defined, essentially encompasses an integrated conceptual approach in which the net benefits of economic activities are maximized, subject to maintaining the stock of productive assets over time, and providing a social safety net to meet the basic needs of the poor. This approach implies that renewable resources, especially if they are scarce, should be utilised at rates less than or equal to the natural rate of regeneration. The efficiency with which non-renewable resources are used ought to be optimized based on the substitutability between these resources and technological progress. Waste should be generated at rates less than or equal to the assimilative capacity of the environment, and

efforts should be made to protect intra- and intergenerational equity. Finally, the implementation of sustainable development will require a pluralistic and consultative social framework that, among other things, protects cultural diversity and facilitates the exchange of information between dominant and hitherto disregarded social groups, in order to identify less material and pollution intensive paths for human progress.

Three Steps in Applying Environmental Economics to Conventional Decision Making

The role of environmental economics is to establish a systematic procedure to improve design and articulation of: (a) sectoral and macroeconomic policies; (b) the investment projects; and (c) complementary environmental measures.

The *first step* towards incorporating environmental concerns into conventional economic decisionmaking is to determine the environmental and social impacts of a project or policy. Economically valuing environmental and social impacts is the *second step* in taking these issues into account. Once the foregoing steps are completed, the *final step* involves redesigning projects and policies to reduce adverse environmental and social impacts, thereby shifting the development process towards a more sustainable path.

Determining environmental and social impacts of policies and projects requires multi-disciplinary expertise. For example, epidemiological studies are used to determine the impact of policies and projects on human health, while sociological studies and analyses provide information on the relevant social impacts. Similarly ecological impacts of development activities are established by means of ecological analyses. The credibility and effectiveness of the subsequent steps depends on the successful completion of the first step. Hence it is crucial that the environmental and social impacts of policies are both thorough and well documented. Very often uncertainty and lack of adequate information tend to hamper the estimation of impacts of projects and policies.

Valuing Environmental and Social Impacts

Economic valuation -- the second step in the implementation process outlined earlier -- poses significant problems. There has been some modest progress in recent years, in both the theory and application of valuation methods. The conceptual basis for valuation techniques is discussed next.

The basic purpose of valuation is to determine the *total economic value* (TEV) of a resource. As indicated in Figure 3, TEV consists of two broad categories: use value (UV) and non-use value (NUV). *Use values* may be broken down further into: (1) direct use value (DUV); (2) indirect use value (IUV); and (3) potential use value or option value (OV). Direct use value is the immediate contribution an environmental asset makes to production or consumption (e.g., food or recreation). Indirect use value includes the benefits derived from functional services that the environment provides to support production and consumption (e.g., recycling nutrients or breaking down wastes). Option value is the willingness to pay now for the future benefit to be derived from an existing asset. *Non-use values* are based generally on altruistic, non-utilitarian motives (Schechter and Freeman 1992), and occur although the valuer may have no intention of using a resource -- one important category called existence value arises from the satisfaction of merely knowing that the asset exists (e.g., a rare and remote species).

For the practitioner, what is important is not necessarily the precise conceptual breakdown of economic value, but rather the various empirical techniques that permit us to estimate a monetary value for environmental assets and impacts. However, there is uncertainty in the results derived from some of these techniques even in developed market economies, and therefore, their use in developing countries should be tempered by caution and sound judgment (Munasinghe 1993).

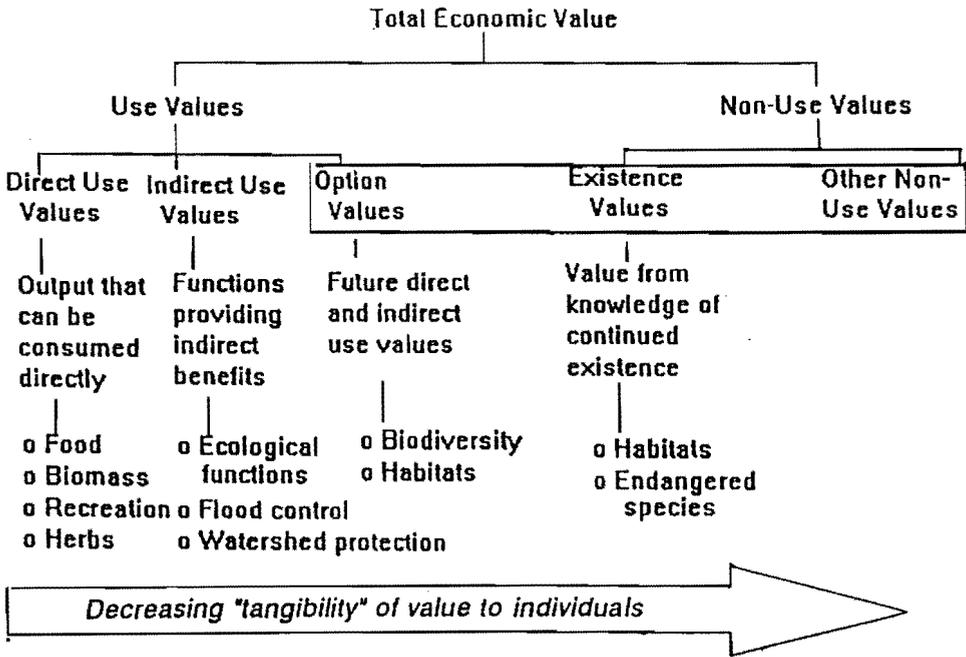


Figure 3. Types of Economic Value Attributed to Environmental Assets (Examples are from a Tropical Forest).

A variety of valuation techniques are available. The basic concept of economic valuation underlying all these techniques is the willingness to pay (WTP) of individuals for an environmental service or resource (Braden and Kolstad 1991). Willingness to pay itself is based on the area under the demand curve, as illustrated below by a simplified case.

In Figure 4 the curve $D(S_0)$ indicates the demand for an environmental resource (e.g., the number of visits made per month, to a freshwater source like a river). X_0 is the original demand level at the price p (e.g., the cost of making a trip, including the value of time spent for traveling). The total WTP or value of the services provided by the environmental resource is measured by the area OHEA which consists of two main components: (1) the area OBEA or (pX_0) , which represents the total cost; and (2) the area BEH, which is called the consumer surplus or net benefit (i.e., the net value over and above actual expenses). The point H represents the "choke" price, at which demand falls to zero.

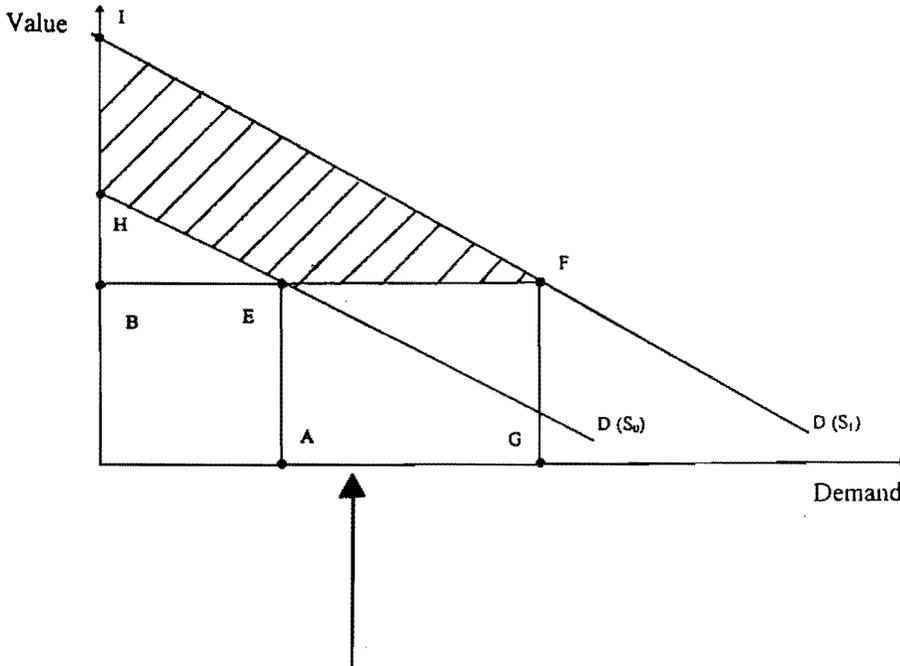


Figure 4: Benefit Increase Due to the Improvement in Quality of an Environmental Asset.

Next, we extend this example to examine what could happen if the quality of the environmental service is improved (e.g., by clean-up of the freshwater source). The normal response would be an increase in demand, represented in Figure 4 by a shift in the demand curve from $D(S_0)$ to $D(S_1)$. The new level of demand is X_1 (assuming the same price p), yielding the corresponding total WTP equal to area $OGFI$, and the new net benefit measured by area BFI . Thus, the quality improvement will result in an incremental increase in the value of the environmental resource -- given by the shaded area $EFIH$.

The theoretically correct demand function to use in estimating value, is the compensated or Hicksian one which indicates how demand varies with price while keeping the user's utility level constant. Equivalently, the change in value of an environmental asset could be defined in terms of the difference between the values of two expenditure (or cost) functions. The latter are the minimum amounts required to achieve a given level of utility -- for a household (or output -- for a firm) before and after varying the quality of, price of, and/or access to, the environmental resource in question. All other aspects are kept constant.

Problems of measurement may arise because the commonly estimated demand function is the Marshallian one -- which indicates how demand varies with the price of the environmental good, while keeping the user's income level constant. In practice, it has been shown that the Marshallian and Hicksian estimates of WTP are in good agreement for a variety of conditions (Willig 1976). Furthermore, in a few cases once the Marshallian demand function has been estimated, the Hicksian function may be derived in turn (Willig 1976, Kolstad and Braden 1991).

The payments people are willing to accept (WTA) in the way of compensation for environmental damage, is another measure of economic value that is related to WTP. WTA and WTP could diverge. (Cropper and Oates 1992). In practice either or both measures are

used for valuation, and therefore, references to WTP in the subsequent discussion 'may be broadly interpreted to include WTA also, unless otherwise stated.

Valuation methods may be categorized according to which type of market they rely on, and by considering how they make use of actual or potential behavior (see Box 2). The most useful methods are based on how a change in environmental quality affects directly observable actions, valued in conventional markets. Some special problems with respect to economic valuation are related to discount rate, risk and uncertainty (see for example, Munasinghe 1993a).

Tracing Impacts and Determining

If the economic valuation exercise is successful, these results could be incorporated directly into cost-benefit analysis (CBA). CBA seeks to assess project costs and benefits using a common yardstick. Benefits are defined in relation to how a project improves human welfare. Costs of scarce resources used up by the project are measured by their opportunity costs -- the benefit foregone by not using these inputs in the best alternative application. One basic criterion for accepting a project compares the flow of costs and benefits over time to ensure that the net present value (NPV) of benefits is positive.

Efficiency-related problems arise in measuring costs and benefits because some project inputs and outputs have incorrect market prices. A general remedy is to use shadow prices, usually based on economic opportunity costs (Dasgupta et. al. 1972, Little and Mirrlees 1974, Squire and Van der Tak 1975, Munasinghe 1979). In simpler cases, existing market prices may be adjusted directly (e.g., by eliminating distorting taxes and duties or subsidies) or pre-calculated conversion factors could be used to estimate shadow prices for relevant goods and services. A more difficult example that is more specific to environmental assets involves a typical class of market failures called externalities -- they are defined as beneficial (or harmful) effects imposed on others, for which the originator of these effects cannot charge (or be charged). Unfortunately, many externalities are not only difficult to quantify in physical terms, but even harder to convert into monetary equivalents. Another example, equally difficult to value, involves open access resources -- typically those goods and services that are accessible to everyone without payment, such as a lake or public highway. They tend to be overexploited since user charges are negligible. If the value of a damaging externality can be estimated based on its shadow price, then appropriate charges may be imposed on the source. When such valuation and pricing are difficult, often the approach taken is to: (a) impose regulations and standards that set physical limits on perceived external damages; or (b) better define property rights -- thereby encouraging improved natural resource management. Techniques such as multicriteria analysis also are helpful to decision makers, when economic valuation is difficult (see Box 3).

Box 2. Techniques for Valuing Environmental Impacts.

TYPE OF BEHAVIOUR	TYPE OF MARKET		
	Conventional market	Implicit market	Constructed market
Based on actual Behaviour	Effect on Production	Travel Cost	Artificial market
	Effect on Health	Wage Differences	
	Defensive or Preventive Costs	Property Values Proxy Marketed Goods	
Based on intended behaviour	Replacement Cost		Contingent Valuation
	Shadow Project		

Effect on Production. An investment decision often has environmental impacts, which in turn affect the quantity, quality or production costs of a range of productive outputs that may be valued readily in economic terms.

Effect on Health. This approach is based on health impacts caused by pollution and environmental degradation. One practical measure related to the effect on production is the value of human output lost due to ill health or premature death. The loss of potential net earnings (called the human capital technique) is one proxy for foregone output, to which the costs of health care or prevention may be added.

Defensive or Preventive Costs. Often, costs may be incurred to mitigate the damage caused by an adverse environmental impact. For example, if the drinking water is polluted, extra purification may be needed. Then, such additional defensive or preventive expenditures (ex-post) could be taken as a minimum estimate of the benefits of mitigation.

Replacement Cost and Shadow Project. If an environmental resource that has been impaired is likely to be replaced in the future by another asset that provides equivalent services, then the costs of replacement may be used as a proxy for the environmental damage – assuming that the benefits from the original resource are at least as valuable as the replacement expenses. A shadow project is usually designed specifically to offset the environmental damage caused by another project. For example, if the original project was a dam that inundated some forest land, then the shadow project might involve the replanting of an equivalent area of forest, elsewhere.

Travel Cost. This method seeks to determine the demand for a recreational site (e.g., number of visits per year to a park), as a function of variables like price, visitor income, and socio-economic characteristics. The price is usually the sum of entry fees to the site, costs of travel, and opportunity cost of time spent. The consumer surplus associated with the demand curve provides an estimate of the value of the recreational site in question.

Property Value. In areas where relatively competitive markets exist for land, it is possible to decompose real estate prices into components attributable to different characteristics like house and lot size, air and water quality. The marginal WTP for improved local environmental quality is reflected in the increased price of housing in cleaner neighborhoods. This method has limited application in developing countries, since it requires a competitive housing market, as well as sophisticated data and tools of statistical analysis.

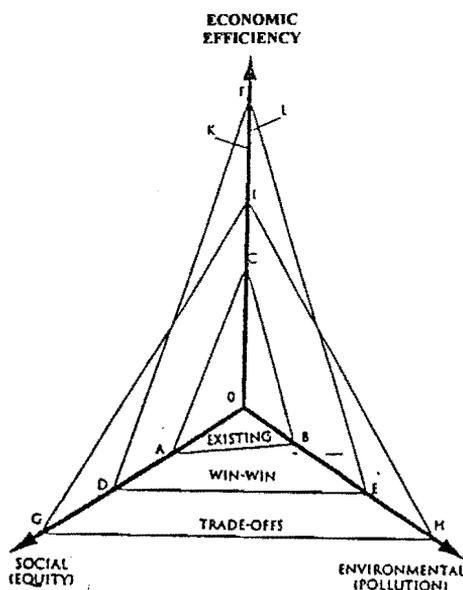
all factors other than environment (e.g., age, skill level, job responsibility, etc.) that might influence wages.

Proxy Marketed Goods. This method is useful when an environmental good or service has no readily determined market value, but a close substitute exists which does have a competitively determined price. In such a case, the market price of the substitute may be used as a proxy for the value of the environmental resource.

Artificial Market. Such markets are constructed for experimental purposes, to determine consumer WTP for a good or service. For example, a home water purification kit might be marketed at various price levels, or access to a game reserve may be offered on the basis of different admission fees, thereby facilitating the estimation of values.

Contingent Valuation. This method puts direct questions to individuals to determine how much they might be willing-to-pay (WTP) for an environmental resource, or how much compensation they would be willing-to-accept (WTA) if they were deprived of the same resource. The contingent valuation method (CVM) is more effective when the respondents are familiar with the environmental good or service (e.g., water quality) and have adequate information on which to base their preferences. Recent studies indicate that CVM, cautiously and rigorously applied, could provide rough estimates of value that would be helpful in economic decisionmaking, especially when other valuation methods were unavailable.

Box 3 Multicriterial Analysis for Strategic Decisions



Multicriteria analysis helps policymakers make strategic decisions when progress toward multiple objectives cannot be measured in terms of a single criterion (i.e., monetary values). Take the case of drinking water -- an essential element of sustainable development -- illustrated in this chart. While the economic value of water is measurable, its contribution to social and environmental goals is not easily valued monetarily. Outward movements along the axes trace improvements in three indicators: economic efficiency (net monetary benefits), social equity (service to the poor), and environmental pollution (water quality).

How are policy options assessed? First, triangle ABC describes the existing water supply where economic efficiency is moderate, social equity is low, and overall water quality is worst. Next, triangle DEF indicates a "win-win" future option in which all three indices

How are policy options assessed? First, triangle ABC describes the existing water supply where economic efficiency is moderate, social equity is low, and overall water quality is worst. Next, triangle DEF indicates a "win-win" future option in which all three indices improve, as could occur with a new water supply scheme that provided cleaner water, especially to the poor. The economic gains would include cheaper water and increased productivity from reductions in waterborne diseases; social gains would occur from helping the disadvantaged; and wastewater treatment would reduce impure water discharges and overall water pollution.

After realising such "win-win" gains, other available options would require trade-offs. In triangle GIH, further environmental and social gains are attainable only at the expense of sharply increasing costs. In sharp contrast to the move from ABC to DEF, which is unambiguously desirable, a policymaker may not make a further shift from DEF to GIH without knowing the relative weights that society places on the three indices. Such preferences are often difficult to determine explicitly, but it is possible to narrow the options. Suppose a small economic cost, FL, yields the full social gain DG, while a large economic cost, LI, is required to realize the environmental benefit EH. Here, the social gain may better justify the economic sacrifice. Further, if budgetary constraints limit costs to less than FK, then sufficient funds exist only to pay for the social benefits, and the environmental improvements will have to be deferred.

Asymmetries in the incidence of project costs and benefits also have equity implications. The issues are particularly acute if the principal beneficiaries are relatively wealthy, while costs (frequently related to environmental degradation) have to be borne by poorer groups. In theory, if total benefits exceeded total costs, the gainers could compensate the losers and still remain better off. In practice, such schemes are often difficult to implement. For example, in a number of hydroelectric schemes, local residents whose dwellings were inundated by the dams received quite inadequate resettlement benefits, even though specific measures were included in the original project design (Guggenheim 1994). A more difficult case might involve a polluting industry discharging toxic chemicals into a river, which in turn results in a diffuse and hard-to-measure external health hazard, downstream (Carlin et al. 1992).

Sectoral or Subnational Level Analysis

Actions that affect an entire sector or region of a country often have more significant and pervasive environmental and social impacts than individual projects -- examples include policies concerning the pricing of water or transport, investment programs involving a series of energy projects, and administrative measures like improving land tenure. The basic rule for economically efficient pricing of a scarce resource (or service) like energy, water or transport, is that price should equal the marginal opportunity cost of supply (Munasinghe 1990-b). In many countries, such resources are subsidized -- an example of a policy distortion. Raising resource prices closer to efficient levels and strengthening market forces are essential prerequisites for reducing their wasteful use, thereby realizing both economic savings and environmental gains. At the same time, efficient investment planning at the sector level implies determining the supply facilities that meet the demand at the lowest cost. A typical example is the optimal long-run development plan for a power or water supply system, involving a series of projects (Munasinghe 1992).

Environmental-economic analysis of such sectoral measures has helped to improve efficient resource use. For example, the use of a resource may have external impacts -- like automobile exhausts causing respiratory problems. In this case, pollution taxes should be imposed on energy users, corresponding to the marginal environmental or health damage that occurs. Such

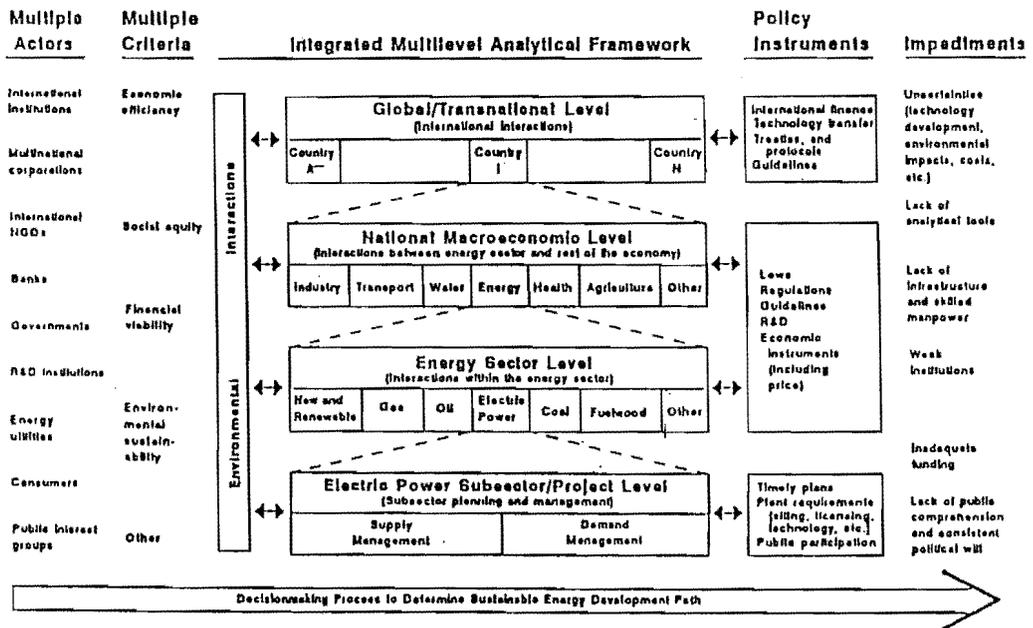
Economic, Policy Framework for Sustainable Development

Some sectoral policies such as energy price reforms have such widespread effects that they are better analyzed in the same context as other economywide policies (see below).

The widespread nature of policies in a given sector emphasizes the need to explicitly take account of their impact on other sectors of the economy (i.e., treat them as economy-wide policies). This requires an integrated, multisectoral analytic framework. Such an integrated decisionmaking approach is described here. It is presented within the context of the energy sector and emphasizes the hierarchical conceptual framework for analysis of sustainable energy development. But the framework can be easily adapted to other sectors as well.

The core of the framework is the integrated multilevel analysis shown in the middle column of Figure 5 (drawing on the example of the energy sector). The framework can accommodate issues ranging from the global level down to the local or project level. At the global level it is recognized that there are energy-environmental issues. Individual countries constitute elements of an international matrix. Economic and environmental conditions imposed at this level constitute exogenous inputs or constraints on national level decision makers.

Figure 5. Conceptual Framework for Sustainable Energy Development



Source: Munasinghe 1991.

The next level of hierarchy focuses on the multi-sectoral national economy, of which the energy sector is one element. The framework suggests that planning within the energy sector requires analysis of the links between the energy sector and the rest of the economy. At the intermediate level the framework focuses on the energy sector as a separate entity composed of sub-sectors such as electricity, petroleum products and so on. This permits detailed analysis, with special emphasis on interactions among different energy sub-sectors. The most desegregate and lowest hierarchical level pertains to energy analysis within each of the energy sub-sectors. At this

such as electricity, petroleum products and so on. This permits detailed analysis, with special emphasis on interactions among different energy sub-sectors. The most desegregate and lowest hierarchical level pertains to energy analysis within each of the energy sub-sectors. At this level most of the detailed energy resource evaluation, planning and implementation of projects is carried out by line institutions (both public and private).

In practice, the various levels of analysis merge and overlap considerably, requiring that (inter-) sectoral linkages should be carefully examined. Energy-environmental interactions (represented by the vertical bar) tend to cut across all levels and need to be incorporated into the analysis as far as possible. Such interactions also provide important paths for incorporating environmental considerations into national energy policies.

Economywide or National Level Analysis

Economywide policies traditionally have not been concerned with environmental goals, but may often influence the environment significantly. A wide range of policy reform programs have been undertaken to address macroeconomic problems (such as those affecting international trade, government budgets, private investment, wages, and income distribution) and broad sectoral issues (such as those relating to agricultural productivity, industrial protection, and energy use). The economywide measures for attaining these goals include: altering the rates of exchange or interest, reducing government budgets, promoting market liberalization, fostering international openness, enhancing the role of the private sector, and strengthening government and market institutions, often coupled with pricing and other reforms in key sectors such as industry, agriculture and energy.

Such measures rely mainly on market-based policy instruments that influence the structure of incentives governing diverse economic activities, which in turn, affect resource use and the environment. Typical incentives include not only prices of commodities and natural resources, but also the system of rights or entitlements governing access to resources. Most of these policy changes are not designed explicitly to meet environmental objectives, and consequently, their environmental implications are not always apparent and often are difficult to trace. For example, foreign exchange rates and the degree of openness of the economy will obviously influence the level of extraction of exportable minerals, but sustainable mining concerns are not the driving motives for trade and foreign exchange policies.

Policy-Environmental Links

A comprehensive recent study identified several linkages between economic policy-making and the environment (Munasinghe and Cruz 1994).

- First, many economic reforms initiated to promote more efficient resource allocation and use are also environmentally beneficial. However, residual imperfections often give rise to environmental harm.
- Second, stabilization measures meant to restore macroeconomic stability are necessary for sustainable development, but short-term contractionary aspects of such programs also may have adverse environmental implications.
- Finally, economywide policies have longer term implications on economic growth and income distribution, that may also lead to environmental changes.

These broad findings are described and illustrated in Munasinghe and Cruz (1994), first, by specific World Bank country studies and, second, through other selected studies.

Decision Making Implications

The findings discussed above have implications for decision making. *Proper recognition of the generally positive environmental consequences of economywide policy reforms could help to build additional support for such programs. At the same time, broader recognition of the underlying economic and policy causes of environmental problems can enhance support for environmental initiatives -- both in terms of environmental policies as well as projects.* While the relationships between economywide policies and the environment are complex and involve many economic and non-economic variables, the main concerns may often be limited to a small subset of priority environmental concerns. These are often identifiable by region and certainly by country. The environmental analysis and implementation efforts related to specific programs can therefore be sufficiently focused to be effective, if the following steps are taken.

- **Problem Identification:** Decision-makers could promote more systematic efforts to *monitor environmental trends and anticipate emerging problems* when policy reform proposals are being prepared. The range of currently available environmental information should be analyzed to help identify the highest priority pre-existing or emerging environmental problems, and their sensitivity to policy measures.
- **Analysis:** Serious potential environmental impacts of proposed economywide reforms identified in the problem identification stage could then be subjected to *careful environmental analysis* -- to the extent that data and resources permit.
- **Remedies:** Where potential adverse impacts of economywide reforms can be identified, *targeted complementary environmental policies or investments* should be implemented as soon as feasible -- to mitigate predicted environmental damage, and enhance beneficial effects. Where linkages are *difficult to trace ex-ante*, *greater* reliance will need to be placed on *preparing contingency plans* to be invoked ex-post.
- **Monitoring and Follow-up:** *A follow-up system for monitoring the impacts of economic reform programs on environmentally sensitive areas* should be designed, and resources made available to address environmental problems that may arise during implementation.
- **Economic-Environmental Coordination:** Beyond analyzing specific reforms or programs, there should be an effort to "institutionalize" a synergistic approach in planning and management. Economic planning exercises (e.g., economic development plans) should more systematically discuss environmental issues. Similarly, environmental strategy documents should strengthen their analyses of economic linkages.

Indicators of Well-being

To better include environmental concerns in macroeconomic analyses, standard income accounting techniques must be re-examined. Gross domestic product (GDP), the commonly used growth measure, relies on transactions in markets, and is the basis on which many aspects of macroeconomic policy are determined. However, its shortcomings include neglect of income distributional concerns and non-market activities. Furthermore, from the environmental viewpoint, there are weaknesses in the current national accounting framework because

depreciation of natural resource stocks (like deforestation) is ignored, and harmful outputs like pollution are overlooked, while beneficial inputs related to environmental needs are implicitly (Lutz and Munasinghe 1991, Atkinson et al. 1996).

To overcome these deficiencies, it is necessary to develop a system of national accounts (SNA) which will yield an Environmentally-adjusted Net Domestic Product (EDP) and an Environmentally-adjusted Net Income (EDI). The World Bank has worked closely with the United Nations for the past decade, to better incorporate environmental concerns into the present round of revisions of the SNA framework that encourages the compilation of relevant data on environmental and natural resources -- through a new set of satellite accounts (United Nations 1993). These satellite accounts constitute an important step towards the eventual goal of computing the EDP and EDI. In fact, the full incorporation of environmental effects into the SNA will take many years to accomplish, even in the OECD countries. Therefore, less comprehensive (and mainly physical) indicators of sustainability that measure air, forest, soil and water degradation may be used in the interim (Munasinghe and Shearer 1995, Atkinson et al. 1996).

International Level Analysis

Transnational impacts (e.g., acid rain) and global issues (e.g., ozone layer depletion, global warming, biodiversity loss, and pollution of international waters) give rise to difficult issues of external impacts, cost and benefit sharing and free riding (King and Munasinghe 1995, Munasinghe 1995). These pervasive and long-term problems have led to new ideas on uncertainty, irreversibility, and time discounting (Munasinghe 1993a). For example, even when impacts are uncertain, sustainability suggests that limits should be imposed on resource degradation, particularly if future consequences could be irreversible and catastrophic. This precautionary approach underlies the emerging consensus on limiting greenhouse gas emissions to avoid possible global warming. Efforts are also under way to improve mitigation mechanisms to mobilise and allocate resources efficiently and equitably (e.g., the Global Environment Facility).

Action Impact Matrix (AIM): Strengthening the Articulation and Coordination of Policies and Projects

To enhance the joint contribution of economic and environmental analyses and policy to sustainable development goals, the foregoing discussion suggests that these activities be explicitly linked and articulated. Implementation of such an approach would be facilitated by constructing an Action Impact Matrix (AIM) -- a simple example is shown in Table 1, although an actual AIM would be very much larger and more detailed (Munasinghe, 1993b). Such a matrix helps to promote an integrated view, meshing economic decisions with priority environmental and social impacts. The first column of Table 1 lists examples of the main development interventions (both policies and projects), while the first row indicates some of the main sustainable development issues. Thus the elements or cells in the matrix help to: (a) explicitly identify the key linkages; (b) focus attention on valuation and other methods of analyzing the most important impacts; and (c) suggest action priorities. At the same time, the organization of the overall matrix facilitates the tracing of impacts, as well as the coherent articulation of the links between a range of development actions -- i.e., policies and projects.

A stepwise process, starting with readily available data, has been used effectively to develop the AIM in several country studies. First, data from NEAPs, EAs, etc. may be organised into an environmental issues table that prioritises these problems, provides quantitative or qualitative indicators of damage, and helps identify underlying economic causes. Second, the main

economywide policies (current and intended) could be set out in a second table, together with a brief review of the basic economic issues that they address and potential environmental linkages. The information from these two tables are then combined to develop a preliminary action impact matrix. One of the early objectives of the AIM-based process would be to help *in problem identification* -- by preparing a preliminary matrix that identifies broad relationships, without necessarily being able to specify with any accuracy the magnitudes of the impacts or their relative priorities.

Table 1 – Action Impact Matrix (AIM)

Activity/Policy	Main Objective	Matrix of Other Impacts on Key Sustainable Development Issues			
		Land Degradation	Air Pollution	Resettlement	Others
1. Macroeconomic and Sectoral Policies	Macroeconomic and Sectoral Improvements				
* <i>Exchange Rate</i>	Improve Trade Balance and Economic Growth	Positive Impacts Due to removal Distortions Negative Impacts Mainly Due to Pre-existing Constraints			
* <i>Exchange Pricing</i>	Improve Economic and Energy Use Efficiency	(-H) (deforest open-access areas)			
* <i>Others</i>			(+M) (improve energy efficiency)		
2. Complementary Measures	Specific or Local Social and Environmental Improvements	Enhance Positive Impacts and Mitigate negative Impacts (above) of Broader Macroeconomic and Sectoral Policies			
* <i>Market Based</i>	Reverse Negative Impacts of Market Failures and policy Distortions		(+M) (pollution tax)		
* <i>Non Market Based</i>		(+H) (inundation)	(+M) (displace fossil fuel use)	(-M) (displace people)	
3. Investment Projects	Improve Efficiency of Investments	Investment Decisions Made More Consistently with Broader Policy and Institutional Framework			
* <i>Project 1 (Hydro Dam)</i>	* Use of Project Evaluation (Cost-Benefit Analysis, Environmental Assessments, Multi-Criteria Analysis, etc.)	(-H) (inundation)	(+M) (displace fossil fuel use)	(-M) (displace people)	
* <i>Project 2 (Re-afforest)</i>					
* <i>Project N</i>					

* A few examples of typical policies and projects as well as key environmental and social issues are shown. Some illustrative but qualitative impact assessments are also indicated: thus + and – signify beneficial and harmful impacts, while H and M indicate high and moderate severity.

* The AIM process focuses on the highest priority environmental issues and related social concerns.

Source: Munasinghe (1993 b)

For example, in Table 1, a currency devaluation may make timber exports more profitable and lead to deforestation of open access forest. The appropriate remedy might be to strengthen property rights or restrict access to the forest areas. A second example might involve increasing energy prices toward marginal costs to improve energy efficiency and decrease pollution. Adding pollution taxes to marginal energy costs will further reduce pollution. Increasing public sector accountability will reinforce favorable responses to these price incentives, by reducing the ability of inefficient firms to pass on cost increases to consumers or to transfer their losses to the government. In the same vein, a major hydroelectric project is shown in Table 1 as having two adverse impacts -- inundation of forested areas and villages; as well as one positive impact -- the replacement of thermal power generation (thereby reducing air pollution). A re-forestation project coupled with adequate resettlement efforts may help address the negative impacts. The matrix-based approach therefore encourages the systematic articulation and coordination of policies and projects to achieve sustainable development goals. It would be possible to develop such an initial matrix for many countries -- based on readily available data.

This process may be developed further to assist in *analysis* and *remediation*. For example, more detailed analyses may be carried out for the sub-set of main economywide policies and environmental impact linkages identified in the cells of the preliminary matrix. This in turn would lead to a more refined final matrix, that would help to quantify impacts and formulate additional measures to enhance positive linkages and mitigate negative ones. The more detailed analyses that could help to determine the final matrix would depend on planning goals and available data and resources. They may range from the application of simpler sectoral economic analysis methods (appropriately modified in scope to incorporate environmental impacts), to a fairly comprehensive systems or multisector modeling effort. The former approach is used in many of the case studies described in Munasinghe and Cruz (1994), while the latter approach is illustrated in a recent study of Costa Rica (Persson and Munasinghe 1995), where a computable general equilibrium model was constructed that includes strictly economic, as well as environmental variables. At the moment, data and analytical shortcomings are likely to preclude reliance upon general equilibrium or comprehensive systems modeling approaches. The Costa Rica study and other early efforts constitute a step in this direction -- their major contribution being to identify more precisely the information and data required for operational policy purposes, and the strengths and limitations of a general equilibrium approach.

So far, the more successful attempts to value environmental impacts have been based on their effects on conventional economic output that are priced in the marketplace (supplemented sometimes with shadow pricing corrections). This approach may be linked up more easily with commonly used market measures of well-being like gross national product (GNP). However, some environmentally and socially crucial impacts (eg., loss of biodiversity or human health hazards) may be as important in certain cases, and they may require extension or adaptation of conventional economic techniques. One step would be to improve environmental valuation by using a wider range of methods that use both market and non-market information to indirectly estimate the economic value of environmental assets (eg., travel cost or contingent valuation methods). Such techniques have been used quite widely in project level applications in the industrial countries. There is a growing body of case studies on the environmental valuation of project impacts in developing countries. However, considerable work is required to extend this experience to cover economywide impacts.

Other (non-economic) indicators of environmental and social well-being also would be helpful in decisionmaking, especially in cases where economic valuation was difficult. Techniques such as multicriteria analysis (MCA) may be used to trade off among different economic, social and environmental indicators, as a supplement to conventional cost-benefit analysis (CBA) -- in making development decisions more sustainable. This approach parallels the recommendations

in the new handbook for the System of National Accounts (SNA), including the proposal to supplement the conventional SNA with a set of satellite accounts that reflect environmental corrections like depletion of natural resources and pollution damage. The essential point is that even when environmental valuation is not possible, techniques exist that will help to better prioritize environmental and social impacts -- thereby improving development actions. (Munasinghe 1993 a).

Conclusion

Sustainable development has economic, social and environmental components. Given the key role played by economics in development decision making, this paper has set out a practical framework for integrating the different elements of sustainability, based on environmental economics. The use of this approach has been described at various hierarchical levels of decision making -- project/local, sectoral/subnational, economywide/national, and global/transnational.

Traditionally, the economic analysis of projects and policies (including the techniques of shadow pricing), has helped countries make more efficient use of scarce resources. "External effects," especially those arising from adverse environmental consequences, often have been neglected in the past. The paper has focused on concepts and techniques for valuation of environmental impacts of projects and policies that enable such environmental considerations to be explicitly considered in the conventional cost-benefit calculus used in economic decisionmaking. The process of internalizing these environmental externalities may be facilitated by extending the techniques of neoclassical economic theory, with particular reliance on willingness-to-pay as a measure of value. Problems caused by discounting, risk and uncertainty were discussed. When economic valuation of environmental impacts is difficult, reliance may have to be placed on broader methods like multicriteria analysis.

Economywide policies (both sectoral and macroeconomic) often have significant environmental effects. Broad policy reforms which usually promote efficiency or reduce poverty, also should be generally beneficial for the environment. However, some of these reforms may have negative environmental effects, depending on pre-existing (and often localized) imperfections -- including policy distortions, market failures, and institutional constraints. The solution is not necessarily to modify the original broader policies (which have conventional economic or poverty related goals), but rather to design more specific and complementary environmental measures that would address the more specific policy, market or institutional imperfection and thereby help mitigate negative effects or enhance positive impacts of the original policies on the environment. Such environmentally focused remedial actions would include both market-based approaches (like Pigouvian taxes on environmental externalities, or allocation of limited pollution rights coupled with marketable permits), as well as non-market methods (such as command-and-control techniques, or better definition of property rights). Both economic planners who devise economywide policies and environmental analysts who seek to address environmental issues need to cooperate closely in this process.

Overall, economic techniques exist -- and for most countries, so does natural resource information -- to improve the way environmental issues are addressed at the project, sector and macro levels. Although data problems remain, recent studies illustrate the feasibility of beginning to make rough assessments, not simply of the environmental impact of projects, but also of economic policies -- and in particular -- economywide policies, thereby hastening the integration of environment into the mainstream of economic decisionmaking. An Action Impact Matrix-based approach is outlined that may be applied at varying levels of sophistication to improve the coordination and articulation of policies and projects -- thereby

addressing more effectively the economic, social and environmental goals of sustainable development.

The environmental economics concepts and techniques presented in this paper must be applied more frequently to practical problems in developing countries. Such work can indicate orders of magnitude of impacts, eliminate gross environmental errors, and help identify the critical environmental indicators to which decisions should be sensitive. Valuation techniques for determining use values may be applied successfully in appropriate cases, especially at the project level. However, examples involving the estimation of non-use values are virtually non-existent in the developing world, and still scarce but becoming more common in the industrialized nations. The use of multiobjective decision methods also needs to be explored more systematically.

Further in-depth work is required in tracing the environmental implications of economywide policies, that will seek to relate comprehensive packages of economywide policy reforms to a range of priority environmental concerns in different countries (see Box 4 for details of an ongoing study). Some areas of current interest such as trade reform and privatization policies should receive early attention. At the same time, there ought to be more emphasis on developing more practical models and analytical tools that can be applied in a variety of situations.

The role of global mechanisms to institute changes in policy and practices should be more fully considered. International conventions and frameworks (such as the FCCC) should be utilised as influencing bodies with the capacity to instigate standards and establish guiding principles. International development bodies should work in tandem with country strategy.

Distributional, political economy, and institutional issues also need to be addressed in future work. The nature of environmental problems is heavily dependent on the allocation of political and institutional power, and policy reforms may have substantial implications for redistributing income and wealth. Thus, there are obvious obstacles to overcoming what might be very powerful vested interests when environmental reforms are recommended, and implementation problems such as asymmetries in the incidence of environmental costs and benefits, timing of reforms, and the role of environmental conditionalities, will have to be studied.

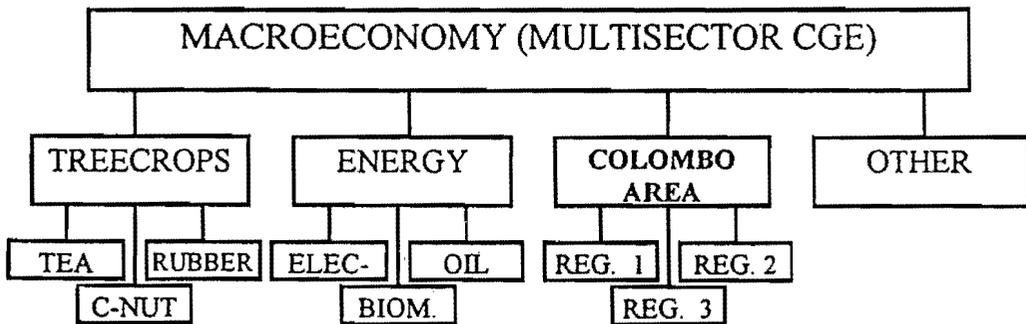
Finally, the need for a more systematic way of monitoring the impacts of policies and projects suggests that better environmental and social indicators should be developed. Current work has focused on methods of incorporating environmental aspects in national income accounts. However, severe data constraints limit the applicability of such a comprehensive approach in many developing countries. "Short-cut" methods therefore need to be developed. For example, easily applicable rules-of-thumb (calibrated by well-chosen national studies) could be used to devise baseline estimates of national wealth in the form of natural resources, human capital, and produced assets. Environmental indicators of land use, soil, water and air quality could supplement economic measures, in the same way as social indicators (such as literacy and health status).

An ongoing study in Sri Lanka focuses on establishing the macro-economic environmental linkages (Munasinghe et al. 1995). Sri Lanka has traditionally dealt with environmental problems through a regulatory cum planning approach, supported by extensive environmental legislation. However, because of growing awareness that there are economic causes and outcomes associated with environmental degradation, policymakers are now recognizing the importance of complementing macroeconomic and sectoral policy reforms with environmental measures, in addressing sustainable development problems.

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The analysis is conducted in several interactive stages. First, key macroeconomic and sectoral issues as well as major environmental problems of concern are identified through partial equilibrium models, using both quantitative and qualitative techniques. Then this information is used to develop an action impact matrix (AIM) in which major economic policy measures are listed by row, and the major environmental and social impacts are listed in corresponding columns (see also Table 1 of main text). The matrix is a useful way to illustrate the linkages between economic measures and their environmental and social impacts. In the third stage, the outcome of key policy experiments are analyzed within a general equilibrium modeling framework. Intuitive results obtained in the partial equilibrium analysis are tested in the general equilibrium model -- which incorporates the macroeconomy as well as several key (environmentally sensitive) sectors. The results from this analysis are fed back to 'fine tune' the AIM, and test further policy options. Finally, recommendations for action are generated.

Initially, three high priority topics were selected, so as to better understand the mechanisms involved and exemplify approaches that can be used for different types of problems: (a) an important and pervasive economic sector -- energy -- to determine the economic as well as environmental consequences of policies that affect this sector; (b) a well defined and economically vital region -- the Colombo area -- to help analyze both the economic and environmental impacts of pricing, technical and regional policies; and (c) a sector that interacts sensitively with environmental resources -- the treecrop sector -- where environmental effects in the form of soil degradation and water quality feed back into the production function..



Box 4. Modeling Macroeconomic-Environmental Linkages and Analysing Policy Options

As shown in the figure, each of these elements are represented by a detailed module (including submodels) and are all linked together through a multisector computable general equilibrium (CGE) model. Already, the modeling analysis has revealed interesting preliminary results, especially regarding energy and urban pollution.

alternative power subsector “futures” are determined. These are based on rational environment-economic tradeoffs. Earlier (partial equilibrium) studies had shown that efficient energy pricing has a more pervasive and significant impact on economic efficiency and environmental attributes than purely technological solutions. The present (general equilibrium) study tested three policy scenarios based on: (a) average energy price increase of 30% by 2005 (*base case*); (b) average energy price increase of 50% to achieve long-run marginal costs, or LRMC, by 2005 (*policy M1*); and (c) real price of energy held constant, thereby reflecting “business as usual” (*policy M2*). The modeling results confirm that higher energy prices do indeed give rise to significant economic and environmental benefits.

However, there is an unexpected outcome, in that an increase in the real price of electricity (policy case M1) does not reduce electricity demand – because factors of production shift from more to less electricity-intensive sectors in the economy, the income effect outweighs the price effect, and the demand for electricity is slightly higher in the policy case M1 than in the base case. Thus given the higher demand for electricity in case M1, system investments and costs increase, as well as environmental damage indicators (e.g., GHG emissions). The environmental impacts could be better evaluated if one were to consider emissions of GHGs per unit of GDP as opposed to the total emissions of GHG. At the same time, what is relevant as a measure of economic efficiency is either the system cost per unit of useful energy delivered and/or cost of supplying electric service per unit of GDP. Thus, a comparison is made of the average incremental cost (AIC), a proxy for LRMC (instead of the present value of system costs), versus annual GHG emissions per unit of GDP in a representative year (2014). The results confirm that although the absolute magnitude of environmental impacts increase marginally when the energy price is raised, the emissions per unit of GDP decrease significantly.

In modeling the Colombo area, a high level of disaggregation was necessary. Therefore the Colombo urban/industrial submodel has an explicit spatial focus, which allows for incorporation of issues such as migration, congestion, industrial location, urban development, municipal waste and sanitation. Application of the Decision Support System (DSS) submodel, helps to identify spatially and industrially disaggregate production data that can then be used in a physical model of air and water pollution. Starting with emissions, tracing air and water dispersion paths, and determining ambient pollution levels in relation to population distribution, it is possible to identify toxic dosages and potential responses in terms of ill health. Next the economic costs of meeting a range of environmental standards, using various control technologies and policies, are estimated.

The results indicate that the Colombo Metropolitan Area (CMA) is marked by a high level of risk, essentially in the form of surface and ground water pollution. Most significant is the indiscriminate disposal of industrial wastewater with a minimum amount of treatment. Waste discharged from highly concentrated domestic areas (including slums) also contribute to this increasingly serious problem. With municipal waste disposal facilities fully loaded, water quality has deteriorated rapidly due to the lack of a declared ambient water quality standard, as well as inadequate monitoring and enforcement of effluent charges. Spatially disaggregate analysis within the DSS submodel helps to determine localised environmental measures that will mitigate further increases in water pollution due to urban growth. To the extent that greater pollution is induced by the growth promoting overall macroeconomic strategy, the new environmental measures would play a key complementary role.

Specific recommendations for pollution control in the short run involve investments to improve municipal sanitary services, including sewage and solid waste disposal. In the long run, key steps include participatory strategies such as a comprehensive public health campaign in order to

encourage effective and sustainable measures to improve public hygiene and disposal practices. Complementary policy options also have to be used -- such as mobilising private sector funds for investments in municipal wastewater treatment and solid waste disposal, as well as the use of economic instruments, such as pollution charges, permit systems, and financial incentives. The latter could involve the imposition of pollution fees and fines for large industries and government-industry financial co-operation schemes for small- and medium scale plants. Concentration-based discharge standards should be replaced or supplemented with volume-based discharge limits consistent with ambient quality requirements for specific water bodies. Furthermore, industries themselves must be encouraged to build their own cost-effective and cost-efficient treatment systems. Finally, there is an urgent need to strengthen the capacity for monitoring and enforcement of regulations.

Source: *Munasinghe et al. (1995)*

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7

WOMEN IN ENVIRONMENT & DEVELOPMENT

Dr. Lorna Dewaraja

In rural Asia women are central to food production. In Sri Lanka, from colonial times, women had specific tasks to perform in paddy cultivation. Even in cash crop cultivation women's labour is crucial. Yet according to UN statistics women own only one percent of the world's land. In Sri Lanka, according to customary law, women could own property, a right which they lost with colonial legislation.

In many developing countries, women are the water suppliers and water managers. With the destruction of forests, women have had to walk longer distances to fetch water. Women have to find water for domestic use, and home gardens and they know how best to manage it. Yet their knowledge and experience is not fully utilised.

Rural women depend on the forests for food, fuel and fodder, medicinal herbs and honey in addition to raw materials for income generation such as reeds, rushes, cane and fibre. Lack of fuel is disastrous to family health since cooked meals and boiled water become luxuries.

Due to landlessness and joblessness many rural families have migrated to urban areas and live in shanty towns. It is true that the eco-crisis has affected men, women and children alike. However, in our part of the world women are the most adversely affected.

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Conventional views of development overlook the limitations of the natural resources that support all human activities. It assumes that economic development if continued for a period of time will eventually bring material and social benefits to all people. It was expected that the benefits of development would first reach the higher ranks of society and then trickle down to the lower ranks. It was nearly 4 decades ago that the UN General Assembly designated the year 1960 as the Development Decade to hasten economic development in Third World countries. Today, after thirty years or more of massive injections of capital, equipment and technology, millions of people in the Third World countries have no access to adequate food supplies, clean water, decent housing, clothing, health and education services. On the other hand over exploitation of natural resources for short term benefit has resulted in environmental degradation and depletion of natural resources thereby impoverishing the quality of life of the poor.

Eco-Feminism

Sri Lanka in common with the rest of Asia has seventy five per cent of the female population living in the rural areas and engaged in agricultural activities. In addition to their farm work, their daily task of processing and preparation of food, gathering firewood, fetching water and tending animals, bring them close to nature and thereby make environmental concerns of prime importance to women. The association of women with nature has given rise to a new term "eco feminism", coined by a French feminist writer in 1970, Francoise d' Eaubonne, who points out the interconnection between feminist and ecological concerns. Eco feminists believe that women and nature are both victims of patriarchal power structures. The term also serves to highlight that the cause of environmental conservation and protection is one that will appeal to women because it is in the nature of women to nurture, protect, provide and most important of all, bring forth life. Nature is feminine and referred to as "she" and the Earth as Mother. All development activities whether in the urban or rural areas affect the environment and any environmental degradation has an adverse impact on women.

Women and Food Production

Women are and have always been central to food production. Robert Knox a British ship wrecked sailor who lived in the Kandyan Kingdom of Sri Lanka for 19 years (1660-1679) as a prisoner noticed that the women provided all the food that was necessary for the household other than rice and salt. Since the Kandyan Kingdom was in the interior of the island the salt was brought by merchants who came from the coast. In the case of rice the women contributed their labour in weeding, transplanting and harvesting the grain and also carrying it to the threshing floor. From this point till it reaches the table to be eaten, the women were responsible for the entire process. Robert Knox also mentioned that the women were very thrifty and could prepare a tasty meal from the produce of the garden. Women's contribution to the nutrition of the family and her dependence on the environment is seen in a lullaby sung in Sri Lanka to put the babies to sleep. It means your mother will come soon with her hands full of berries picked from the woods, with herbs tied round her waist and her head laden with firewood.

This picture is applicable to the whole of rural Asia even today. A study conducted in 1988-89, in Laos found that all village women in the area in question did some form of forest gathering; some relied entirely on forest products to support their families during droughts. It is clear that any degradation of the environment affects women in many ways specially the poor women who have the primary responsibility of providing food for the family. Besides subsistence agriculture women are engaged in the production of cash crops on their own account and also as hired labourers.

Despite their being the world's agriculturists and produce more than half the world's food, according to UN statistics, women own no more than one per cent of the world's land and even if they have access to it their tenure is uncertain and costly. In pre-colonial Sri Lanka women had the right to own land and could sell or bequeath it to any one they pleased without let or hindrance from their husbands. During centuries of colonial rule certain changes introduced in the guise of modernisation and economic development adversely affected the position of women. Customary law, for example, recognised women's legal status and property rights independent of father or husband, but these concepts were alien to English Common Law, which integrated the legal identity of a woman with that of her husband. In the course of colonial rule, British policy and legislation undermined women's relatively independent position.

Land Tenure

As in many parts of the world in Sri Lanka too the colonial past still profoundly affects land tenure. Europeans grabbed valuable land and its resources all over the world. An alien law sanctioned the land grab and removed from the colonised the right to their own land. With a view to expropriating the land of the Kandyan peasants of Sri Lanka the British rulers in 1840 introduced the Crown Lands Ordinance also known as the Waste Lands Ordinance. Thereby all lands which the British rulers considered "waste lands", such as forests, chenas (which are forest lands used for 'slash and burn' agriculture) uncultivated and unoccupied land were presumed to be the property of the Crown until the contrary was proved. According to the traditional concepts of ecology there were no "waste lands". The forests, chenas, marshes were all an integral part of the village ecology. Those were the made idam or wet lands where rice was grown; the goda idam or dry land where the women mainly grew vegetables, coconut and arecanut palms and the val or forests which though unoccupied or uncultivated were an essential part of the ecosystem from which the women collected firewood, fruits, edible and medicinal herbs and honey. The forests were used as pasture for the cattle and sometimes forest patches were cleared for "slash and burn" agriculture in times when the rice harvest failed. The marshy lands provided the rushes and reeds from which the women wove baskets and mats for household use. When the Waste Lands Ordinance was implemented the peasants were helpless in the face of the inroads made by the Crown. They were deprived with no compensation of what they thought was their inalienable right to the use of the land creating a landless, and impoverished peasantry deprived of a means of sustenance.

The lands thus grabbed were subsequently sold to British Planters at 5 shillings an acre paving the way for the massive foreign owned plantation industry based on the growing of cash crops, such as coffee and tea. The change from food crops to cash crops preceded by large deforestation adversely affected the position of women. When food crops were grown the women, brought the harvest home and the family nutrition was ensured. When cash crops were grown the men took the produce to the market place and got the cash thus depriving the women of the food as well as the cash, resulting in the economic dependence of women and malnutrition in the family. The clearing of mountain slopes for the large scale planting of cash

crops such as coffee and tea which began in the last century had led to the gradual loss of top soil specially through bad land use. Studies have shown that soil erosion has increased over the century. Some of the first assessments of soil erosion carried out in 1930 in the catchment of the Mahaweli estimated the loss of soil at 115 tons per hectare per year. In 1984 an estimate of the sediment yield of the Mahaweli in the years 1952-82 indicate an average of 15 million tons. Clearing of forests and mountain slopes for the large scale planting of tea, rubber and tobacco, which involves periodic clearing and replanting is the cause for the heavy soil erosion.

Traditional cultivation of rice and home gardens and even the slash and burn agriculture show careful soil conservation and also allow the land to lie fallow and recover before the next crop is shown. Those old fashioned methods were abandoned in the name of development causing frequent floods, and landslides.

Women and Agriculture

Large scale monocrop cultivation not only caused deforestation and taxed soil fertility but has also been detrimental to the interests of women. Cheap labour was imported from South India to work on the estates of Sri Lanka and this system still continues. The men prepare the land, plant and prune the tea bushes while the women always pluck the tea leaves from the bushes that grow on the hill slopes. Before coming to work at 8.00 a.m. the women have to cook the midday meal for the family, feed the children and send them to school, that is they have done half days work before starting work on the estate. They work longer hours than the men but until recently were paid less. In some instances the woman's daily wage was collected by her husband. Sri Lankan estate women have been lobbying to obtain joint husband-wife ownership to plots of land and dwellings allocated by estate owners. Evidence from the rest of Asia and Africa has shown that securing women's access and tenure to land and resources is crucial to improving their productivity and economic well being.

Even when women remain in subsistence agriculture their position is ignored by development economists. Agricultural extension work is rarely targeted towards women. Women are specially vulnerable to the injudicious use of pesticides spraying of fields and local storage of unsafe chemicals. In Sri Lanka there are frequent reports of accidental deaths and also suicides due to the indiscreet storage of dangerous chemicals. In Central America more and more women are found with poisoned milk from pesticides. These dire consequences on women and children are overlooked by planners and statisticians whose only focus is on the yield per acre.

It is clear that women, as the world's major food producers are directly dependent on the environment; they are conscious of their dependence and they know a great deal about it. Their practices adapt to the environment and are sustainable without long term damage to the land. In Sri Lanka it is noticed that women used household refuse and made compost pits, collected dried leaves, coconut husks and burnt resiniferous wood to eradicate pests. But these traditional environment friendly methods such as rotation of crops, and recycling of organic nutrients were abandoned because they were considered backward and not scientific enough for modern agriculture, although they served to enhance the self-reliance of the woman farmer.

In many parts of rural Asia women carrying pots of water on their heads is a picturesque sight. But how many realise the fact that their task is becoming more and more laborious everyday with shrinking forests and depleting water supply. Women have to find water for

family use, for domestic animals and home gardens. When supply is limited women are hit the hardest having to manage with less and less. Throughout the centuries women have developed practices regarding the collection and preservation of water, and the source of water, the village well or tank is their informal meeting place where they both wash clothes and exchange views. Yet their knowledge in this area is ignored in rural development programmes even with regard to water supply. Since it does not concern them directly men tend to overlook the proximity of the water source even when selecting a family home. If the time and energy spent on water collection is saved women could use it profitably for the welfare of the children so that the quality of life of the whole family could be improved. Women need water for economic use as well. In the dry zone villages of Sri Lanka the women complain that the lack of water precludes them from home gardening, animal husbandry and many other income generating activities.

Irrigation, deforestation and over-grazing has changed fertile land into deserts. In many Asian countries inefficient irrigation methods have resulted in a great deal of water being wasted. It is mainly the women who suffer from the consequences as in the Indian State of Rajasthan now on the brink of desertification; wells and rivers are dry, due to the cash cropping of sugar cane.

Deforestation

Since independence in 1948 Sri Lanka has lost 50% of her natural forests. According to the National Forest Inventory of Sri Lanka of 1983 the total extent of natural forest cover was 1.75 million hectares or 27% of the total land area. A provisional map prepared by the Forest Department indicated that the closed canopy natural forests covered only 1.33 million hectares or 20% of the total area of the island. During the past decade Sri Lanka has been losing about 54,000 hectares of natural forests every year. At the present rate of deforestation and population growth by the turn of the century forests in Sri Lanka will decline to .05 hectares per person which is the lowest ratio in Asia. The most dismal factor as far as Sri Lanka is concerned is that the lowland rain forests, the most biologically diverse category, is occupying less than 10% of the total land area. It is most alarming to note that 2/3 of the population of Sri Lanka live in the wet zone area where biodiversity is at its best. The biodiversity in this country is great and is said to be greater per square kilometre than any other country in Asia. This valuable global resource is being threatened.

Apart from the decline in biological diversity deforestation has dramatically altered rainfall patterns in Sri Lanka resulting in floods, siltation and droughts. Deforestation is one of the world's most pressing problems. Major factors contributing to this are; the illicit felling of trees which goes on unabated in Sri Lanka, conversion to agricultural land; planned migration, housing projects and resettlement, large scale construction projects such as tourist hotels and commercial buildings added to the ever increasing demand for firewood, timber for building purposes and fodder. Statistics show that deforestation is accelerating worldwide at an alarming rate due to unplanned and environmentally hostile development but little is known of the daily pressures that deforestation places on women. Forests play a crucial role in the lives of poor women. In ancient Sri Lanka there were the "tahansi kele" or prohibited forests where felling of trees was illegal and women could collect fuel, fodder, honey, herbs, berries, medicines, building materials and cane, rushes and reeds for weaving mats and baskets.

The environmental degradation caused by deforestation is detrimental to the interests of poor women. Women's work within and outside the home depends on energy specially firewood. Women rarely cut down entire trees, they often collect twigs, smaller branches and often dead wood; so destruction is limited. Unlike men who see the commercial potential of timber women see trees and forests as multi-functional. Less fuel means less cooking and the family might consume uncooked or dangerously undercooked meals. Firewood which was once freely available has now to be purchased. Poor quality firewood makes cooking more of a drudgery while the smoke emanating from the lack of firewood may damage the housewives eyes and respiratory tract. Faced with the problem of increasingly severe environmental stress in their communities, a growing number of women in the Third World are initiating projects or playing leadership roles in programmes introduced by outside agencies, aimed at improving environmental conditions and thus the quality of life.

The Chipko Movement in India shows how women have fought bravely to preserve their forests and introduce successful tree planting programmes. Women have realised the value of the forests in the sustenance of life. Forests are essential for a regular and clean water supply. The Chipko Movement articulates in song the value of the forests to provide man's multiple needs.

*What forests bring us
Soil water and clean air
Soil water and clean air
The basis of our life*

In 1974 the women of the Chamoli district in Uttar Pradesh were faced with the threat of their forests being destroyed for commercial purposes. When the contractors arrived to cut the trees, the women who were alone in their homes organised themselves, and marching into the forest encircled the trees. Chipko means to hug. The women informed the wood cutters that they would just have to cut off their heads. The contractors who were intimidated by the joint protest withdrew. In the forests of Rajasthan too the systematic felling of trees had caused major ecological instability resulting in soil erosion and catastrophic flooding. The women rose to action resisting state and private agencies who were causing the destruction. They fasted, guarded the forests and wrapped themselves round the trees to be felled. Their silent protests were so effective that Indira Gandhi issued a 15 year ban on the commercial felling of trees in Uttar Pradesh. The Chipko movement which arose in a particular area has gained momentum and now spans the whole Himalayan region covering as much as 5000 km. across in India, Nepal and Bhutan. There had been instances in India where the women protested against destroying forests for potato farming and mining even though their husbands and sons were given employment in the new development projects. In the face of strong opposition from the men folk, the women continued their protest refusing to walk extra miles a day in search of fuel and fodder. The Chipko Movement has now branched into taking positive steps to rehabilitate the environment by tree planting campaigns.

In Andhra Pradesh in India where much rainfed cropland is exhausted, women organised themselves at village level to revive the land with traditional farming techniques. They received no support from Banks but the Deccan Development Society provided them with loans. The project involved 400 women in 20 villages. Within 3 years, over 280 hectares of cropland was returned to production and more land was added every year. Both international agencies and the Indian government have endorsed the programme as a good example of sustainable development.

In Sri Lanka one has only to see the tragedy of Wellassa where massive deforestation preceded the establishment of the Pelawatte Sugar Company, a major development venture. The valley was filled with medicinal trees, Aralu, Bulu and Nelli, grown very likely by the Kandyan kings. It was rich in flora and teeming with wild life. Three waterways giving life to the dry South East originated in the Wellassa valley. Kumbukkan Oya, Kuda Oya and Menik Ganga. On the banks of the Kumbukkan Oya roamed the wild elephant the pride of Lanka. Today, the rivers run dry. The elephant herd is dispersed all in the name of development.

Since most of the world's remaining primary forests are in the Third World and tropical forests are specially valuable for biodiversity conservation it is clear that a solution to the deforestation crisis lies with us. Sri Lanka's rate of deforestation is the second highest in Asia exceeded only by Nepal.

Community management of local forests has emerged as the most promising alternative to imposing a state administered centrally managed system. Communities living in or near natural forests would protect them if clearly authorised by the government and if the latter provides them with economic returns on their time. Women should not be considered as beneficiaries or hired labourers but integrated into the planning and management process. At present women are not visible at the top level administration or at the level of implementation. Their traditional knowledge and their land rights should be accommodated.

The depletion of the forest cover due to unplanned economic activities aimed at short term gains and its adverse impact on rural women cannot be overemphasised. It is said that they have to carry 35 kilos of fuelwood for over 10 kilometres leading to spine damage, headaches, backaches and knee problems. In many countries girls start this work at an early age. In some parts of Africa and South Asia they spend the whole day doing this kind of work at the expense of their education.

In Sri Lanka the vast majority of the households use fuelwood for cooking and home based small industries. Activities in which women are involved are pottery, brick making, extraction of coconut oil. Due to the lack of fuel these income generating activities are neglected.

Women, Urbanisation and Industrialisation

Whether it is in the village or city, poor women work and live close to the environment. Industrialisation gathered momentum in Sri Lanka during the last 15 years, and 80% of the industries are in the Western Province. Though urbanisation is less of a problem in Sri Lanka than in the rest of Asia, still a drift towards the urban centres, specially Colombo is apparent. Landless people from the villages drift to the cities, build shanties on the fringes of the towns. These people who have no toilet facilities or garbage disposal cause damage to the city's health, housing and sanitation standards and pollute the city's water supply.

The creation of the Free Trade Zone and the other local industries which sprang up in the area have caused many problems to the residents in the area, specially when factories spring up in residential areas. Even in the suburbs of Colombo small scale industries have arisen with no proper plan to dispose of their effluents. There is the danger that the industrial effluents will seep into the sources of drinking water. For instance dyes used in the textile factories, discharges from tanneries and soap factories can pollute paddy fields, marshes and wells. In all these instances the women suffer the most because they spend more time at home and they are responsible for the health of the family and the sanitation in the home.

Women form 90% of the labour force in Sri Lanka's garment factories. Due to substandard working conditions these women are the victims of noise and heat pollution. The latter is due to overcrowding in the factory and lack of proper ventilation. Employees could complain to the management or make representations to the Department of Labour. However, it is rarely that remedial action is taken. There is also a high incidence of female labour in the pesticide packaging industry and pesticide inhalation is particularly harmful to pregnant women. Since the pesticide workers are recruited on a contractual basis, the Labour Department is unable to monitor their health status because only permanent employees come within its purview.

Air fouled with automobile exhausts and industrial emissions, belching buses and lorries sending carbon dioxide and lead products into the air - this is the price that city dwellers in Asia are paying to satisfy their urge for a higher standard of living. In addition many particles are thrown into the air by cement factories, quarries, and saw mills causing respiratory problems. The screeching of vehicles, the screaming of machines and the endless whirring of power loom textile mills, the blasting of quarries can cause severe mental and physical exhaustion. A recent study has highlighted cases where women had been severely affected by air, water and noise pollution from neighbouring industries, damaging the health and habitats of their families. Very often the women concerned do not have the resources to go to courts. It often happens that the offender is a wealthy entrepreneur who has influence with the police and politicians of the area, and could therefore silence the victim, or even resort to thuggery.

An example from Japan shows the adverse impact of industrialisation on women and how collective action by women brought positive results even when they were confronted by powerful companies. The Kitakyushu Industrial Zone was one of the four largest Industrial Zones in Japan which supported the country's economic growth. The focus was on steel production with coal from the neighbouring fields providing energy. The centre of activity was the Tobata city. Soon the citizens were enriched but the environment declined. The dust, soot and chemicals that were emitted by the factories polluted the air and threatened the health of the citizens - children were suffering from eye & lung diseases specially asthma. Soot stained the living rooms of the people. At this point women who are responsible for the health of the families raised their voices in opposition. They organised themselves into Women's Groups and with the help of the City Councillors compelled the company owners to install dust collectors at a cost of 100 million yen. IN 1963 the Samroku Women's Society formed study groups to research into the impact of industrial pollution on children's health. They consulted ENT specialists, dermatologists and gynaecologists and their slogan was "We want our blue skies back." Their husbands who were the employees of the Companies reprimanded them; nevertheless they carried on questioning the social responsibility of the companies. Their success shows that no company could ignore women who collectively and seriously sought to protect citizens rights.

Discussing the impact of the environment on women's health Dr Bonnie Lee Kettel shows how the health of women and the bio-physical environment are linked and also this fact has been unrecognised. Women are the primary users and managers of the environment and they manage the health care of the household and families. Many diseases that kill women are environmental in origin. One in every nine women suffer from breast cancer in North America. Evidence has been found that women who live in areas with chemical waste dumps are six and a half times more likely to have breast cancer in their life times than women who live in communities that do not have chemical waste dumps. Obviously one of the factors that lead to the high incidence of breast cancer is environmental. Kettel has used the concept of "lifespace." Although men and women occupy the same household their "life spaces" are different. This has an implication for environmental health. Women are often assigned the

messy jobs. Even the cleansing agents used to keep the home clean are health hazards. A good example of women working in extremely unhealthy environments is found in the southern sea coast of Sri Lanka where women work knee deep in stagnant putrid water, processing coconut fibre inhaling the unbearable stench of rotting husks.

Women in Environment and Development

While there are many other factors which worsen the impact, population growth certainly contributes to environmental degradation. In Sri Lanka it is clear that there is a direct correlation between population growth and deforestation which as we have seen leads to depletion of the water, lack of fuel wood, soil erosion, siltation of rivers, floods, etc. Crucial to population control are women. Evidence from many countries shows that in poorer families the women have babies earlier and also produce more children. Women's poverty, lack of education and limited economic opportunities and resources, all contribute to high fertility rates. In poor families children provide labour for basic survival and household income as well as insurance against old age. Sri Lanka is a good example to show that as female literacy rates go up fertility rates go down; child and maternal mortality rates too go down. Education of women broadens the opportunities of income earning thus providing options other than child bearing and care.

Educated, income earning women have more decision making authority within the household and could be more assertive about family planning. With the phenomenal strides in female education the average age of marriage in Sri Lanka has gone up to 25 years which should result in women having fewer and healthier babies. Maternal education appears to have a greater effect on child health and survival than does paternal education. Fewer pregnancies reduce the risk of death from maternity related causes and long term physical stress. Just as women are central to population control, women's health is a critical component of sustainable development. Only healthy mothers could produce and breast feed healthy babies yet more women than men suffer from malnutrition specially in Africa & Asia. In India and Bangladesh females from birth get less and poorer quality food than males, thus endangering the health of the future generation.

The "ecocrisis" has gripped the attention of the world community and aroused the attention of every living being today. Research, legislation conferences, seminars, publications are taking place all over the world; but this is not just one more problem which can be solved by scientific research. It must dawn upon us in the most disturbing manner that in the conquest of nature, the unbridled technological advances and industrial growth; not to speak of nuclear proliferation man has placed himself in danger of losing his own humanity. Various measures have been taken by national and international authorities to prevent further environmental degradation. Despite limited success, these measures remain mere cosmetic devices, whereas the problem is far more fundamental.

Modern industrialised societies assume that happiness and well being lie in the satisfaction of our material needs and sensual desires and nature must be conquered and exploited to satisfy those desires. What is needed most today is a change of values. The ecocrisis is not a solely technological problem. Have we realised that alternative energy technologies, better management of resources, population stability are all effective emergency measures and may suffice as short term solutions?

So long as man retains his insatiable greed for pleasure and acquisition of wealth and continues to exploit nature to realise his aim no permanent solution to the ecocrisis can be found. Buddhism with its philosophic insight into the inter-dependence of all conditioned things, its major dictum that happiness is found through the control of desire and not through the proliferation of desires, the injunction, "santhutthi paraman dhanam -contentment is the highest gain;" its reverential attitude towards all forms of life which in the case of monks include plant life as well; its condemnation of wastefulness and miserliness could form the basis for a sound environmental ethic.

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8

PEOPLES PARTICIPATION

Lal Hewapathirana

Mahatma Gandhi admonished humanity that man must learn to fulfill his need, but not his greed. That in brief is the moral of sustainable development and peoples participation in it.

The Buddhist principle of Dependent Origination teaches us that everything depends on everything else, and nothing is independent. When man becomes irresponsible and selfish, looking for excessive comforts and luxury, beyond his basic needs and what is reasonable, he puts himself, his family, his community, and even his country out of equilibrium.

A vast majority of what man has thus acquired, is more materialistic than spiritual and far from real development. Development of a person, a family, a community or a nation should not be measured in terms of pure socio-economic aggregates.

There are many factors that bring total development to human beings, like the moral factor, the cultural factor, the spiritual factor, the social factor, the political factor and the economic factor. The potentialities of all these factors must be carefully harnessed and synthesised for sustainable development, instead of the social and economic development alone.

PEOPLES PARTICIPATION

Lal Hewapathirana

Why do we have to discuss Peoples Participation in Sustainable Development today? Is it because people do participate, or do not participate in Sustainable Development?. Or is it because people have participated in the unsustainable development processes long enough, and therefore, at least now we have to focus more attention on sustainable development with peoples participation?.

Whichever the answer is, the fact that emerges crystal clear is that peoples participation in sustainable development has become the issue of the day, because man has failed to control himself. In his thirst for unlimited comfort and luxury, man has become greedy in extreme terms. Mahatma Gandhi, one of the greatest sons of South Asia said, "Man must learn to fulfill his need, but not his greed". In his quest to beat the other men, often his neighbour, by hurdling over one obstacle he stumbled upon two other obstacles. The result is that he himself, and his family and his community quickly become the victims of his own deeds.

This phenomenon has been lucidly explained by Lord Buddha, South Asia's most enlightened human being, in his teachings on Dependent Origination, which clarifies that there is nothing that is not dependent on something else. Nothing can arise on its own accord independently. For instance, the candle gives light because the wick burns. The wick burns for long hours because of the wax. That is how Dependent Origination works. All the known sciences are connected to and concerned with this process of thought.

The question of sustainability has arisen today, because unsustainability grows all around us. Man has forgotten the principle of Dependent Origination, and has become such an irresponsible being, destroying one by one, the gifts of nature, for his own benefit with no consideration for his kith and kin. This is the sum and substance of unsustainability.

On the other hand, what really is sustainable, in a world where nothing is permanent, according to Buddhist philosophy. The flowers that blossom today will wither away tomorrow. Impermanence is the law of the universe and nothing and none can escape this. By and large, isn't that the very reason why another plant must be grown to blossom flowers for the next day. That is indeed the order of sustainability, which man must realise and pursue.

As regards development, the world and its leadership and its people have gone through centuries long experiences, testing and trailing with philosophies and concepts on what development should be. And today we have ended up with issues, like wars, drugs, resource depletion, incurable diseases, destructive weapons and so on. Have we then really achieved development? Has the world at large achieved development? Have the developed and affluent nations been able to stop those disasters in the name of development? Let us first get the philosophy and the concepts of development right. It is only then that the true participation of the people will become a reality. Such development must be all-people oriented and all- people centered - but certainly not a few people or some people centred.

Today, the problem is that some people or a few people are working towards self development at the expense of many people, who are distancing themselves from the actual process and the resultant benefits of development. Why is this happening throughout the

world? Because the theory and the practice of development by the people today are more economy or “wealth” centered than “health” centered in terms of mental, physical and environmental concerns.

Lord Buddha, in his discourses has referred to Health as Wealth. “Arogya Parama Labha” Health is a multi faceted complimentary factor largely contributing towards true development. Although health is interpreted as freedom from disease, it largely helps in acquiring stability in many other faculties or elements of development in human life. They are as follows:

- a. Moral Faculty - Values and ethics upheld, and principles practiced by a human being.
- b. Cultural Faculty - Traditions, customs, beliefs, aesthetics, arts etc. which help to maintain the cohesiveness of a human community.
- c. Spiritual Faculty - Mental equilibrium, wisdom and ability to make correct decisions through right thoughts, contentment and sharing the joy of others
- d. Social Faculty - Ability to gain access to ones community, being free from fears (like thefts, ragging, threats etc.) Participating in community, social, cultural and other activities acceptable to the society.
- e. Political Faculty - Enjoying fundamental and equal human right, freedom of expression and selecting the government of ones choice.
- f. Economic Faculty - Income to meet the basic human needs initially and then gradually progressing to enjoy reasonable comforts of life not forfeiting the other faculties stated earlier.

If development is the process of improving the quality of life of the people and maximising their capacities and opportunities to awaken and enlighten themselves to realities of life, then its sustainability must be ensured. Suprisingly, not many governments or other organizations seem to have analysed development in a wider context taking into consideration the key human dimensions.

In terms of the above analysis, development cannot be comprehensively assessed by means of only the socio-economic indicators of a community, or the development criteria pronounced at a conference. Seeds and roots of development are with, within and among the ordinary people and their communities. Sustainable development is therefore a matter entirely within the purview of society as a whole.

The point in fact is that world has always discussed development in terms of that last Faculty alone - the Economic Faculty. It is an area with heavy competition - uncompromisingly endless competition; merely for one human being to beat the other in the accumulation of wealth. And this process goes on everyday everywhere in the village, city, country, region and the world. The result is that we are compelled to see, hear and talk about competitive industrialization, uninterrupted production, technical and technological innovations, breach

of peace, international conflicts and even refugees. They resultantly produce some of the most acute problems for the natural cycle of the universe, some of which we identify as deforestation, loss of biodiversity, depletion of ozone layer, global warming, pollution, etc.

We address these issues today with simpler terms like protection of the environment and conservation of earth's resources. We do so purely in the context of sustainable development having considered only the economic aspects of a person, community or a nation often forgetting the relationship of the other factors to the factor of economics. Their inter-relationships could substantially bring down the degree of so called economic fulfillment of a person, family or a nation. The economic factors should not be isolated, but integrated with the other factors. If the world refuses to recognise the elements of human dimensions, we shall have no alternative, but to define sustainable development merely in commercial terms with words built around materialism centred greed of the people. That apparently is what appears to have taken place, as illustrated by one of the current popular definitions of sustainable development namely; "The management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations." And we -the people - are asked to participate in sustainable development efforts, "to ensure the attainment and continued satisfaction of human needs for present and future generations."

How should we - the people - participate in this activity? And what is our role in it? In 1908, when the British motivated the people of India to participate in development, one of the most learned men in India, Rabindranath Tagore said "We have for over a century been dragged by the prosperous west behind its chariot, choked by the dust, deafened by the noise, humbled by our own helplessness, and overwhelmed by the speed. If we ever ventured to ask "progress towards what? and progress for whom?", it was considered to be peculiarly and ridiculously oriental to entertain such doubts about the absoluteness of progress." What Tagore wrote is as much true and relevant today as then. People in poorer countries are called upon to participate in sustainable development on some mythical assumptions, such as technological transfers and capital transfers as it could bring about development. These assumptions do not recognise that equity is a necessary condition of development, and that if the rich get richer and the poor become more in numbers and even less in wealth, that development will not be sustainable over time. It will also not be sustainable if there is discrimination against women, children, political opponents or the coloured people. And if development substitutes machines and chemicals for human labour, and thus tends to destroy the natural environment, development will not be sustainable either.

What are the people being asked to do through participation? To start up tree planting campaigns by the school children, to protest against firewood collection by poor women ignoring the felling of trees by the rich businessmen to prevent the destruction of rain forests by multinational companies to picket against Chernobyl or Bhopal, to parade in support of Chipco and Green peace Movements, to fast unto death to prevent dumping of waste, chemicals and oils in seas? These are samples of the programmes advocated by various environmental organisations that promote peoples participation in sustainable development.

But is this really the kind of programme that would bring about meaningful sustainable development for the people? As we have now understood, human development is not mere economic aggregates; neither labour productivity and technological progress, nor industrialisation nor shift of population to urban areas. Not even other socio-economic indicators such as poverty, income distribution, nutrition, infant mortality, life expectancy

etc. alone mean human development. These factors in a way contribute towards human development in terms of passively supplied goods, services and materials.

Human development however will be complete, and sustainability will become a meaningful reality only if attention is focused on more qualitative concepts like the development of human potential and capabilities. This is called empowerment of individuals and social groups. People's participation must be directed towards developing themselves, and other members of their communities, in order to understand better their own socio-economic and political trends and processes. People must be trained in skills and equipped with capabilities to analyse and embrace the moralities of life such as cultures, traditions, values etc. as well as in the restoration of human dignity, self respect and equality of opportunity, if sustainability of their development is to be ensured. These are factors that will cause social emancipation and enhancement of moral and intellectual capabilities and secure for people the optimum development and sustainable growth.

Sustainable Development is always construed as protection and conservation of the Environment - purely because development of the people has been assessed in material terms than in spiritual terms - a theory forced on us by the West. But countries in South Asia are endowed with religion based philosophies, cultures, traditions, values, principles, and customs which are heavily integrated with the day to day lifestyles of the people. They often carry much mutual respect, honour and even veneration at individual, family and community levels. Therefore, in the life of a South Asian citizen, sustainable development should not be considered in the context of the natural environment and economic prosperity alone, but as an integral part of total human development. To him or her, sustainable development has to be much more cohesive, corporate and complete. His or her participation and the participation of his or her family or the community towards sustainability therefore will be to achieve and sustain a process of total development, spiritually materialistically and environmentally.

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9

INTEGRATING ENVIRONMENT INTO DEVELOPMENT PLANNING

K. M. Ehsanul Haq

For any development to be sustainable environmental considerations must be integrated into the planning process. This is particularly vital for a country like Bangladesh because of her enormous population and thin resource-base.

Although Bangladesh is relatively a new-comer in this field it has made an impressive start. There is a National Environment Policy, a Ministry of Environment and Forests, and a Department of Environment. The importance of environmental legislation has been recognised. It is mandatory for all major development projects to carry out Environment Impact Assessment. Among other advances made are adoption of a National Environmental Policy and formulation of a National Conservation Strategy.

Since environment affects all of us equally, any planning process must be based on consensus. The National Environmental Management Action Plan (NEMAP) is the outcome of this process where the inputs came from the grass-roots to the highest level. NEMAP, together with several other studies look at all the ecosystems of the country identifying the major areas of concern and the key issues while coming up with suggestions for remedial action. This is just the beginning of a long and arduous journey.

INTEGRATING ENVIRONMENT INTO DEVELOPMENT PLANNING

K. M. Eshanul Haq

It is now universally recognised that for development to be sustainable environmental considerations must be integrated into the planning process. This is particularly vital for a country like Bangladesh with a teeming population and a thin resource-base. Its meager resources are either over exploited or used sub-optimally.

The need for integrating environmental considerations into the development planning process was beginning to be felt in Bangladesh during the seventies - largely as a result of the global concern over the degradation of environment. It was reinforced by donor pressure, particularly by the Nordic countries and later, gradually by multilateral agencies, such as the World Bank and the Asian Development Bank. By the late eighties the expression "Sustainable Development" had been firmly entrenched in our development literature.

Economic emancipation of the ever growing population of Bangladesh is the principal objective of any planning activity. Poverty alleviation has been identified as the principal objective and human resource development, through enhanced investment in education, has been prioritised as a means of optimising the use of human resources. Integrating environment in to all development activities as a means of achieving environmentally sound development has therefore emerged as the greatest challenge for Bangladesh.

Environmental Planning

Any planning effort must be for the people. In the final analysis people are the users of environmental resources. People's participation in the development planning process is therefore essential from a democratic as well as economic point of view. Since environment affects us all equally, any planning process must be based on consensus. The National Environment Management Action Plan (NEMAP) is the outcome of this process. I consider NEMAP to be unique for it is the first successful attempt at a participatory planning process where the inputs came from the grass-roots level to the highest level of decision-makers. The Government of Bangladesh (GOB) through its Ministry of Environment and Forest (MOEF) decided to undertake the NEMAP, with the support of UNDP involving a peoples consultative process where people would have an opportunity to define their environment, identify the issues and concerns, prioritise problems and give solutions in three forms:

- a) What shall we, as individuals and families, do to solve a particular problem ?
- b) In what ways can the local community, local government agencies and local level NGOs and community groups contribute towards the solution of a particular problem?
- c) What actions shall the central government agencies take to solve a problem?

In the NEMAP process the governmental agencies, the NGOs, and other members of the civil society such as doctors, lawyers, journalists, academics, grass-roots activists, researchers, parliamentarians, the business community and the media representatives worked closely together, gave their inputs through structured consultation process and workshops, written and verbal inputs. Along with the consultation jointly organised by the government and NGOs, a massive media campaign was organised to solicit peoples inputs from all levels of individuals, community groups, NGOs, civil society organisations and the wide ranging governmental agencies.

The environment question is addressed in two other important documents - the National Conservation Strategy and the Forestry Master Plan. These documents, together with NEMAP look at the entire ecosystem of the country identifying the major areas of concern and the key issues of environmental management with suggestions for remedial measures.

The Fourth Five-year Plan (1990-1995) described the government's environmental objectives as follows :

- a) to control pollution and degradation related to soil, water and air ;
- b) promote environment friendly activities in the development process ;
- c) preserve, protect and develop the natural resource base ;
- d) strengthen the capabilities of public and private sectors to manage environmental concerns as a basic requisite for sustainable development ; and
- e) create people's awareness for participation in environmental promotion activities.

To further these objectives the government has undertaken a wide range of initiatives including :

- a) Creation in 1989 of the Department of Environment within a new Ministry of Environment and Forest.
- b) Approval in 1992 of a National Environment Policy and Action Plan.
- c) Initiation of work on National Environment Management Action Plan (NEMAP), National Conservation Strategy and Forestry Master Plan.
- d) Declaration that Environmental Impact Assessment should be carried out by all major development projects.
- e) Enacting the Bangladesh Environment Protection Act 1995.

Policy Aspects

The National Environment Policy sets the policy framework for environmental action in combination with a set of local sectoral guidelines. It emphasises inter alia :

- Maintenance of ecological balance;
- Protection of the country from natural disasters;
- Identification and control of all types of activities related to pollution and degradation of environment;
- Environmentally sound development in all sectors;
- Sustainable long-term and environmentally congenial utilization of natural resources; and
- Active association with all environment related international initiatives.

Sustainable development is a formidable task and a tremendous challenge for the development planners of the country. The main stumbling blocks are; poverty and malnutrition, population growth, natural hazards, and scarcity of water resources. The state of the environment in Bangladesh is rather daunting as can be seen from the factors discussed below.

Population & Natural Hazards

Population growth is perhaps the most serious problem inhibiting the sustainable use of resources. Bangladesh has a population of 120 million confined within 144,000 Km², making its population density one of the highest in the world. Recurrent floods cause widespread damage to human lives, crops, livestock, housing and infrastructure. The north west of the country is vulnerable to drought and the north-east to flash floods. Besides, river bank erosion dislodges large areas and devastates thousands of acres of farmland every year.

Agriculture

Agriculture intensification and the increase in irrigated area have led to a number of environmental problems i.e., loss of biodiversity through the conversion of forest land into agricultural land, depletion of soil nutrients and organic matter due to intensive cropping, loss of wetland habitats through abstraction and drainage resulting in depletion of aquatic fauna and flora and reduction of water availability to the rural poor, desertification in the north-western region, increased use of agro-chemicals raising the pollution of surface and ground water.

Water Resources

The geographical location of Bangladesh makes water management the key issue in its environmental plans. Concerns in this sector relate mainly to flood damage, river bank erosion, degradation of water bodies, increased water pollution, non-availability of water for irrigation and drainage congestion. Water resources need to be exploited most optimally to achieve a bare minimum sustainability to feed the growing population. But development in this sector has to be made environmentally sound and sustainable. Water development projects might have adverse effects on fisheries, wetlands, agricultural land, water transport and quality of water supplies. Inadequate planning of Flood Control, Drainage and Irrigation (FCDI) projects and failure to consider their wider impacts have in some cases, led to environmental degradation, poor drainage of wetland, flooding, water logging, and salinisation.

Industry

Issues and concerns in industrial sectors relate to a general absence of pollution abatement in terms of waste awareness among industrialists and entrepreneurs, lack of technology to ensure efficient use of resources and waste minimisation and absence of any guideline for the location of industrial units.

Energy

Large scale deforestation to satisfy rural energy requirements poses a serious threat.

Land Resources

Availability of land is a major constraint in Bangladesh as virtually all land is utilized for crop production, forestry, fishing and urban development. Cumbersome land registration system and absence of a comprehensive land use policy give rise to frequent land use conflicts and uncoordinated action amongst the ministries and agencies concerned with land management.

Health and Sanitation

The generally inadequate state of human health in Bangladesh is the result of inextricable linkage between over population, poor nutritional status, unsustainable potable water and poor sanitary provisions. The key concerns are inadequate provision of safe drinking water, using open spaces for defecation and urination, lack of mother and child health care facilities, unhealthy condition of workplaces and drug abuse.

Housing and Urbanisation

The key issues in this sector are - unplanned and unregulated urban growth, high density of population often with poor provision of sanitation causing high incidence of disease, and inadequate facilities for disposal of waste and sewage treatment and management.

Coupled with these unfortunate and more or less natural phenomena, there are other problems which are man-made. One such problem is water pollution which may be categorized into three groups :

- (a) Faecal pollution is widespread and has a strong negative impact on human health;
- (b) Industrial pollution is localised. Untreated industrial waste is dumped into rivers causing pollution of both the terrestrial and aquatic environments.
- (c) Agro-chemical pollution through use of pesticides, is likely to enter the food chain.

Commercial felling of timber for fuel and other uses together with encroachments for agricultural and settlement purposes have substantially reduced the area covered by forests. Total reserve forest area has been reduced by 50 per cent over the last 20 years.

Bangladesh is rich in biodiversity. The wetlands and flood plains and particularly the mangrove forests of Sundarbans are the storehouse of biodiversity but they are under increasing threat. Bangladesh has signed the UN Biodiversity Convention but very few steps have been taken so far to protect biodiversity.

Institutional Aspects

Environmental matters cover a wide range of subjects which extend beyond the jurisdiction of the Ministry of Environment and Forest. There is a need to develop an appropriate mechanism to resolve inter-ministerial disputes and cross-sectoral environmental issues. At present certain facilities exist where cross-sectoral matters can be discussed and resolved. At the national level, there is the National Environmental Council headed by the Prime Minister which is expected to function through an Executive Ministerial Committee headed by the Minister of MOEF and Divisional Environmental Committees headed by the Divisional

Integrating Environment Into Development Planning

Commissioners. At the local level no effective institution or mechanism exists that can deal with inter sectoral issues related to environment. There exists at present an Environmental Committee at the divisional level but this is mostly non-functional. Efforts are being taken to activate these committees and such committees are being contemplated at the smallest local administrative units.

The Ministry of Environment and Forest has been given a wide mandate as a matter of policy which will increase with the implementation of NEMAP, Forestry Master Plan and National Conservation Strategy. Both the Ministry and its technical arm, the Department of Environment (DOE), at present, lack adequate manpower, expertise and other resources to fulfil their mandate and responsibilities.

Poverty Alleviation

Poverty itself is the greatest pollutant. It is therefore absolutely imperative that we combat poverty. Environmental degradation can easily be linked to poverty as they are caught in a vicious chain. What is required to break this chain is public awareness. Thanks to NEMAP and other such initiatives both by the government and the NGOs, there is a very high level of public awareness of environmental concern in Bangladesh. Poverty alleviation, being the main thrust of the government's development planning, it is hoped that it will also address the problems related to environment. We are just at the beginning of a long and arduous journey which lies ahead. There is no time to lose as we have a lot to accomplish.

In our efforts to harmonise environment and development we should adopt a pragmatic rather than an idealistic attitude. We should not be carried away by the rhetoric of eco-politicians, or get bogged down in the mire of development. Our target should be development which is sustainable, or else we shall be the victims of our own creation.

III

MANAGEMENT OF ECOSYSTEMS AND BIODIVERSITY

Management of Biodiversity

Coastal and Marine Ecosystems

Management of Mountain Ecosystems

Participatory Forest Resource Management

Agroforestry

Conservation Oriented Agriculture

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MANAGEMENT OF BIODIVERSITY

Dr. Sarath W. Kotagama

The management of biodiversity includes the full range of activities, from preservation of species, their genetic traits, habitats and landscapes, to the restoration of ecosystems, harvesting of organisms and the distribution of benefits.

In the management of biodiversity, the level of awareness and understanding of the public, the leadership of both public and private agencies, a balance between the use of modern technologies and local indigenous knowledge, the country's level of economic development, national policies and institutional structures, and international commitments are important considerations. It must also be recognised that biodiversity management requires a multi disciplinary and multi-sectoral approach.

The methods and tools of biodiversity management can be grouped under in-situ and ex-situ restoration and rehabilitation, land-use policy and institutional aspects. Biodiversity management can become successful provided strategic planning, managing at bioregional or ecosystem scale, and adaptive management techniques are employed.

The aspects that need to be covered in the management of biodiversity are very wide. Yet, it would be incomplete if some insight is not provided to protection and restoration of ecosystems, species, populations and genetic diversity; and socio-economic and legal measures for conservation and sustainable use.

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The Management of Biodiversity has to be considered in the light of the current understanding of biodiversity, the internationalization of the subject, the greater emphasis placed on the uses of biodiversity, and the sensitive issues of “sovereign resource” and “common resource”. The goal of biodiversity management should be to achieve a balance between conserving biodiversity and development. This in terms of the present understanding is to attempt the balance between “conservation and sustainable use”. The term “conservation” is used here to mean “protection”, and “sustainable use” to mean “use and the sharing of benefits” as implied by the Convention on Biological Diversity. This is of course very different from the normal understanding of “conservation” which includes “protection, sustainable use and benefit sharing”, as adopted in the World Conservation Strategy (IUCN/WWF/UNEP 1980).

Biodiversity management should seek to maintain biodiversity for its associated material, social, cultural, spiritual and ecosystem values, attributes and functions. The management of biodiversity therefore will include the full range of activities, from preservation of species, their genetic traits, the array of habitats and landscapes, to the restoration of ecosystems and the harvesting of organisms both plant & animal, and the distribution of benefits.

Accordingly, biodiversity management could be defined as the mode and manner of planning and implementation of programmes for protection and sustainable use of biodiversity and biological resources, while ensuring adequate sharing of benefits therefrom; develop the human, financial, infrastructural and institutional capacity to address these objectives; and establish the institutional arrangements necessary to foster the required co-operation and action by private and public sector interests.

For this to be successful two basic needs have to be satisfied. They are namely; the policy makers and managers need an adequate understanding of the social, political, economic and cultural context within which biodiversity management is pursued, and the need to select appropriate tools and methods that show promise in achieving the desired biodiversity management objective.

Essential Prerequisites for Biodiversity Management

The biological diversity which concerns us is the product of evolution, and much of it a result of natural selection, and less so of the “artificially selected” products of recent human interventions. We therefore have little control over them. Yet their survival and their use is in our hands. The management of the biological diversity is very much dependent upon the conditions of the cultural, historical, social, ecological and economic realities of the country in which the diversity is present.

The selection of methods and tools for biodiversity management depends very much on the level of public awareness and understanding, in the leadership of both public and private agencies, and in the efficacy of the policies of the state sector. This will determine whether one commences the management with an intensive education and awareness programme or

with direct actions of regulation and control of the issues pertaining to biodiversity. In the latter approach education becomes a supplement to the principal activities while in the former education and awareness become the principal and preceding activities prior to the real implementation of the management activities.

A balance between the use of modern technologies and local indigenous knowledge brings about an effective management approach. Much of the existing concerns have to do with the present and future needs of the people which has led to the unsustainable exploitation of biological diversity. Indigenous knowledge which is often based on years of experience, often to meet a much more limited demand can yet be used to some extent within modern resource use practices. These however, require a better understanding of both the resource exploitation and demand.

The country's level of economic development is also an important factor that has to be considered in adopting management options. The determination of priorities will without doubt be guided by the levels of poverty and affluence. Where poverty is a central concern, competition for land and resources may be particularly high, leading to conflict. Should a forest be cleared for food production or is it to be retained in the wild state for ecotourism, biodiversity prospecting and other uses?

National policies, and institutional devices also have an effect on management. Often national policies, promote intentionally or unintentionally the conversion of important habitats, unsustainable use of biological resources, pollution and environmental degradation. The policy of trade is often at conflict with conservation, and with the new "open economic" trends sustainable use is becoming more important than ever before. Countries are called upon to meet many international agreements, that are sometimes in conflict with the Convention on Biological Diversity which is the principal guiding document for biodiversity conservation and sustainable use. It therefore becomes clear that planning and implementation of biodiversity management begins in an atmosphere of national and international conflict.

Above all, the present needs for biodiversity management require an interdisciplinary and multi-sectoral approach. The interdisciplinary skills required fall into almost every discipline known today, ranging from modern technologies such as biotechnology and genetic engineering to the traditional disciplines of zoology, botany and social studies. Its multi sectoral nature is evident from the wide array of sectors that impact ecosystem degradation such as transportation, industry, energy and minerals, to name a few.

Methods and Tools

The methods and tools for biodiversity management look after the conservation of ecosystems, species and genetic strains; the sustainable use of resources and the equitable distribution of benefits of conservation and sustainable use. These methods and tools can be grouped into five categories namely; insitu and exsitu restoration and rehabilitation, land use and policy and institutional. Insitu is the most widely used method for the conservation of habitats, ecosystems, species and genetic strains. Through the setting aside of areas for protection at various levels i.e. Strict Nature Reserves, National Parks etc, many countries have attempted to conserve the biodiversity, which was in the past considered as wildlife or natural systems. The evolution of the concept of protected area management has resulted in an array of processes which have diverse levels of resource utilisation. Aspects of sustainable use by residents within and adjacent to such areas have become a major component of the conservation and sustainable use of the biological diversity. The methods and tools used in

these reserves vary considerably and no attempt will be made to list them here. With the present outlook of biodiversity the in-situ category now includes conservation and sustainable use of biodiversity outside protected areas too. Thus programmes to protect genetic strains in residential areas, or of agricultural crops, also become part of the in-situ category.

The exsitu methods include maintaining of biodiversity outside their natural systems and involve the relocation of plants, animals and microbial species and genetic varieties. They are maintained in botanic and zoological gardens, mycological collections, museums, seed banks, and tissue culture collections. These relocations are done for the purpose of breeding, storage, cloning or rescue in cases where either habitats no longer can sustain them, or where materials can be used for research and development of new products. The plants and animals located outside their natural environment automatically deprive their ability of becoming involved in the natural evolutionary process. A combination of in-situ and ex-situ methods can to a large extent overcome this limitation.

Ecological restoration is the reconstruction of natural or semi-natural ecosystems on degraded lands including the reintroduction of species. Ecological restoration involves the repair of ecosystem processes, such as nutrient cycles. This doesn't necessarily involve the recreation of a natural ecosystem with its full complement of species. The land use category is concerned with the tools used in forestry, wildlife, and agricultural management and tourism incorporating aspects of protection and sustainable use, and criteria and guidelines for the management of biodiversity.

Policy and institutional category covers many legal and policy aspects that provide incentives and mechanisms to ensure good land-use practices such as zoning and tenure settlement. It also establishes private and public sector links for better biodiversity management.

The application of these methods to single species is currently considered to be a very costly exercise and as such the present emphasis is on ecosystem, habitat or area management. By this method not one species, but many could be managed with almost the same effort. However the emphasis on each system is different. The tools and methods and the problems will differ. So will the proposed activities for management. Generally these activities may include; establishment of Protected Areas to protect and regulate the use of ecologically valuable and sensitive habitats; form seed banks, culture collections to maintaining viable samples of germplasm; promoting conservation practices in forestry, fisheries, and wildlife; promoting, restoration of degraded areas using technologies available with botanic and zoological gardens and agriculture; and land-use planning more extensively in the development planning process and ensure that policies, laws and the administrative structures are readily available. The most important aspect at the end of the day is to have a well planned, integrated approach for the management of the resource. Failure to do this has been the major cause for bad experiences in the past.

Management of Biodiversity

There are three critical aspects in the management of biodiversity. They are; strategic planning, bio-regional and ecosystem management and the use of adaptive management techniques. Planning is a basic need under any management option. This has been clearly emphasized in the Biodiversity Convention wherein countries are called upon to have strategies, action plans or programmes developed to ensure the conservation and sustainable use of biodiversity. The strategic planning process must identify vital links between biodiversity, environmental health, and the natural resource base that sustains livelihoods

and provides new options for social and economic development. The process is not merely adding activities on to traditional national planning, but a total integration of these activities. Many countries have already commenced the preparation of these documents and adequate literature on guidelines and approaches is now available through UNEP, WWF, IUCN etc. The most important aspect in the preparation of these strategies or action plans is the integrated process, which involves many sectors and the public.

The understanding of biodiversity and its manifestation in a given area clearly recognizes the regional or bioregional nature of biodiversity. To manage biodiversity within such regions therefore becomes the most practical approach. The approach also permits the integration of areas outside the traditional boundaries of protected areas. It permits linking up with private landowners, local government, communities and other organized social institutions in the area. Many of these programmes often dubbed as community participatory approaches are being developed or implemented in different parts of the world. These programmes include; an ecological component, economic component and a socio cultural component which ensures peoples participation.

At the hub of this approach is the availability of a mechanism and institution to negotiate with the local population supported by a research and academic institution. Its success rests on effective negotiation and participatory implementation. Thus the greatest challenge in this method is the attainment of the right balance between local people and authority and between central and decentralised institutions. The obstacles are many. And among them are: the lack of mandate for public agencies to take the lead to institute such programmes, the lack of capacity to move into larger areas from the traditional PAs, the lack of mechanisms to adjust to needs of social integration programmes, the lack of political will and absence of suitable long-term funding mechanisms to compensate those that have sacrificed for the cause. The management objectives and the process is so strong that this approach is widely used for sound management of biodiversity, with an extensive array of models in the world.

The main constraint in the management of biodiversity is the lack of adequate information about the resource. Under the circumstances actions proposed are subject to a fairly high level of uncertainty. the recognition of this aspect leads to the realisation that goal setting and trying to achieve them may not be always possible. This alone promotes the dynamic aspect of adaptive management, where change is accepted as a basic reality and one seeks to plan around and through change. The principal elements in the approach are to make ; management interventions on an experimental basis and the outcomes used to reduce uncertainty; sufficient monitoring prior, during and after; and make adjustments based on feed back and change. This approach is very much like the "DO - SEE - DO" cycle of management, where actions are made efficient, through the process of doing and monitoring and doing it better or changed to ensure better management.

Priority Setting

The next most important aspect is priority setting for management. It starts with the question of what, where and when to manage. All of these aspects are very complex. They are basically centered round relative factors and states on the ground. The different approaches for determining priorities are based on genetics, species, ecosystems and integrative approaches. Each of the approaches have their advantages and disadvantages. Of them the more accepted approach is the ecosystem approach, which allows for combining elements of the various different approaches.

A very significant aspect that needs consideration in the management of biodiversity is that much of what needs managing according to the present interpretation of biodiversity is in the already utilised land areas. Only 5% of the temperate and tropical land areas is uninhabited in the world. These areas harbour much less of the known and unknown biodiversity, compared to the protected uninhabited areas. The task therefore becomes more difficult as this means that management of biodiversity really means managing the activities of the human species.

The management of biodiversity is more the management of human activities and their impacts. Measures for sustainable use of biodiversity as part of natural resource management in fields such as agriculture, forestry, fisheries, wild flora and fauna prospecting, tourism, urbanization and infrastructure become major parts of the exercise. The methodologies to be covered under these aspects are wide, and varied and involve restoration, socio-economic strategies for sustainable use, benefit sharing and legal measures.

The choice of specific methods and techniques of biodiversity management is location specific. They need to be indigenous and heavily aligned to the socio-economic and cultural aspects of the country concerned.

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INTEGRATED COASTAL MANAGEMENT

Dr. Jayampathy Samarakoon and Hans van Zon

Integrated economic development in the coastal realm is termed Integrated Coastal Management (ICM). ICM has as its goal; the improvement of the quality of life of communities which depend on coastal resources while maintaining the biological diversity and productivity of coastal ecosystems

The Muthurajawela Marsh-Negombo Lagoon (MM-NL) estuarine system (2,232 ha) is situated in the highly urbanised Colombo Metropolitan area. It is subject to diverse resource use conflicts stemming from population pressure, unintegrated land uses and pollution. Nevertheless, its present annual economic worth is more than US \$ 20 million and supports a fisher population of 3,000.

An ecosystem-based ICM, Master Plan was prepared for the MM-NL system in 1991 based upon an ecological survey. The Master Plan is an integrated landuse zoning strategy which consists of, as proportions of the estuarine land/water area, Conservation Zone (90%), a Mixed-Urban Zone (4%), and a Buffer Zone (6%). The surrounding area (4,000 ha) has been zoned for settlement development. A detailed Conservation Management Plan was subsequently prepared for the Conservation Zone.

The ICM process for MM-NL system harmonises economic development with conservation of the structure and functioning of the ecosystem while ensuring equity. The conclusion based upon the Sri Lanka experience is that it is possible to harmonise environment and development by adopting an ecosystem-based ICM approach to planning and plan implementation.

INTEGRATED COASTAL MANAGEMENT

Dr. Jayampathy Samarakoon and Hans van Zon

In May 1996, practitioners of Integrated Coastal management (ICM) from all parts of the world met in Xiamen, China to reflect on 20 years of experience and to extract lessons for wider application. The workshop report affirms that ICM provides a framework and practical tools to assist policy makers, planners and resource managers to meet the challenges of sustainable development in coastal areas. Coastal areas are a mosaic of rich and diverse ecosystems and resources that are strategically important to the economic well being and development of all nations. ICM when applied in a timely and comprehensive manner provides a vehicle for sound investment and sustainable use of coastal areas and natural resources. (Xiamen Workshop Report, 1996). At this workshop, the Sri Lankan case study based upon ICM for Muthurajawela Marshes and Negombo Lagoon, was presented, and it attracted attention both for its practicality and soundness.

The Muthurajawela Marshes and Negombo Lagoon Estuarine System

The Muthurajawela Marsh-Negombo Lagoon (MM-NL) coastal wetland, 6,232 ha in extent, is situated along the western coast of Sri Lanka, just north of Colombo. The lagoon (3,164 ha) is connected by a single narrow opening with the sea, the channel section situated in the Negombo town. The marsh (3,068 ha) extends southward from the lagoon (Figure 1). The main inflowing river Dandugam Oya drains a catchment of 727 km² and discharges at the junction of the lagoon and the marsh. The entire wetland is separated from the sea by a sand barrier situated on beach rock formed during relative sea level changes. This marsh-lagoon wetland complex must, for continuity for its ecosystem structure and functions, interact adequately both with the terrestrial watershed and the sea.

This ecosystem is situated in the Western Province which is the political, administrative and commercial nucleus of Sri Lanka. The Districts of Gampaha (in which the ecosystem is situated), Colombo and Kalutara constitute the metropolitan area. Muthurajawela marsh and Negombo Lagoon are situated in Gampaha District. Within the Gampaha District, the Divisional Secretaries' Divisions (DSDs) of Kelaniya, Wattala, Ja-ela, Kandana and Negombo have the greatest influence and impact on the marsh-lagoon system. The Divisional Secretary is a recent institutional mechanism established in 1989 for the devolution of administrative power.

State land allocation which has a direct bearing on the management of the system is the responsibility of the Divisional Secretaries. Land allocation of the unitary NM-NL ecosystem is fragmented and distributed among four Divisional Secretaries. The northernmost section of Negombo Lagoon, the channel segment, falls also within the boundary of the Negombo Municipality. As a result, decisions regarding land allocation becomes the responsibility of both the Divisional Secretary, Negombo and the Mayor, Negombo Municipality, a further fragmentation. Proper management of the channel segment of this estuarine complex, which is situated within the Negombo Municipality, is absolutely critical to the hydraulics of the entire ecosystem.

The population growth rate in these divisions is high, 2.4% per year and the projected land requirement for housing the expected to exceed 4,000 ha within the next 10 years. One of the major resource use problems is illegal encroachment by poor, landless families into the Muthurajawela Marsh and the intertidal areas of Negombo Lagoon. Evidently, in the absence of land identification, settlement planning and management, the existing encroacher problem must necessarily become more serious. At the same time the labour force projection for the region is 500,000 by the year 2001. The needed number of jobs to satisfy demand is expected to come primarily from industrial development.

Absorption of the excess population directly dependent upon the lagoon fishery into industry is unlikely because of their low level of education and absence of necessary skills. Clearly, therefore, the estuarine ecosystem must, at the minimum, continue to support the existing number of jobs, if not more.

Policy Considerations

Liberalisation of the national economic policy occurred in 1978. An immediate consequence was escalation of land prices in the Colombo metropolitan area, including the stretch in which the MM-NL system is situated. Concurrently, government agencies with a mandate for "land creation" such as the Sri Lanka Land reclamation and Development Corporation (SLLRDC) perceived filling of Muthurajawela Marsh as an economic opportunity. SKKRDC was established in 1966, following a cabinet decision in 1965 to halt further investment in developing paddy cultivation at Muthurajawela, the polderise and to fill the marsh for relocation of the slum population from Colombo to enable planned modernisation of the city (Irrigation Department, 1966). The plan was not implemented at that time because of inadequacy of funds as well as the inability to recover the cost of filling. In 1985 when the SLLRDC again proposed filling the marsh, since an encroacher population of about one thousand families already occupied the marsh, a conflict immediately ensured. In response to lobbying by interest groups the President of Sri Lanka ordered that a Master Plan for the Muthurajawela marsh and Negombo Lagoon be prepared based upon an ecological survey.

Three national policies, industrialisation, shelter and fishery have a direct adverse impact on the structure and functioning of the marsh-estuarine system. Under the industrialisation policy and industrial estate was established at Ekala, situated upstream, along Dandugam Oya (*Figure 1*). All the untreated effluent from industries located there was discharged into Dandugam Oya which delivered this load into Negombo Lagoon. The planners responsible for implementing policy did not regard pollution impacts in Negombo Lagoon as an external cost. By 1989, the pollution impacts on the fish stocks in Negombo Lagoon had acquired serious proportions.

Since, 1978, the national policy on shelter was given high prominence. The planning for implementation of the policy did not proceed through careful land identification. Instead, wherever state land was available housing programmes were initiated. Under this programme, extremely sensitive areas within Negombo Lagoon were filled for house construction. The adverse impact on water exchange has been severe, thereby aggravating pollution impacts. Here again the environmental cost is being borne by the lagoon fisherfolk.

The fishery development policy in Sri Lanka has emphasised modernisation and mechanisation of marine craft. An ancillary activity has been the provision of infrastructure facilities for the expanding marine fishing fleet. Some highly productive estuaries such as Negombo lagoon have become significant anchorages. Negombo Lagoon provides anchorage for 15% of the marine fishing craft in Sri Lanka. However, mechanisms for anchorage

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management have not been developed by the responsible agencies. The oil pollution caused by the marine fishing craft has severely depleted the valuable grey mullet fish stock in Negombo Lagoon.

Despite serious environmental problems the Muthurajawela March-Negombo Lagoon estuarine system continues to support the primary income of about 3000 fisher families. This is about 4% of the total number of families in Sri Lanka which depend on fishing at sea for an income. The total estimated value of fishery production and multiple services provided by this coastal wetland system exceeds US\$ 20 million annually (Table 1).

Table 1: Estimated Annual economic value of multiple uses of the Conservation zone (tentative)

Direct Use	Value (US\$ million)
Lagoon fisher	3.0
Coastal shrimp fishery	0.5
Coastal small pelagic fishery	1.5
Sink value for 45 industries in the Ekala Industrial Zone	6.0
Sink value for domestic and municipal waste form Negombo town & Air Force Base, Katunayake	3.0
Recreational value for tourists	0.1
Amenity value	2.0
Anchorage for marine fishing craft	6.0
Lank for housing in the Muthurajawela marsh	0.3
Intertidal sand shoals as land for housing in the channel segment of Negombo lagoon	1.1
Total	23.5

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General consensus not exists that the foremost problem in the coastal realm is the loss and degradation of coastal ecosystem (habitats). A recent statement of the goal of ICM is "*The goal of ICM is to improve the quality of life of human communities who depend on coastal resources while maintaining the biological diversity and productivity of coastal ecosystems*" (GESAMP 1996, in press). Even where national policies and plans exist for coastal management, the desired changes toward wise use of coastal resources will have to occur at the local level where economically significant coastal ecosystems are situated. This implies that, integration of environment and development in the coastal area must adopt and approach that seeks to incorporate development within the structure and functioning of ecosystems such as estuaries. This was the-planning approach for Muthurajawela Marsh and Negombo Lagoon.

For effective ICM it is necessary to obtain commitment from the widest range of stakeholders while ensuring that the planning area retains a distinctive coastal focus. Otherwise, non-coastal landuse issues may take priority over those that are coastal. The planning boundary for Muthurajawela marsh and Negombo Lagoon was established to include in addition to the and estuary, the surrounding land area of about 4000 ha without diminishing the coastal focus.

A foremost lesson learned form actual ICM programmes is that governments and the public agree on allocation of public funds to only address *tangible problems*. Therefore, for and ICM programme to be effective it is necessary to identify the problems that would be addressed such that solutions are possible. After much deliberation the steering committee

identified the resource use conflicts and the problems that the ICM process had to address for the MM-NL system (Table 2)

Table 2: Problems, resource use conflicts and issues addressed in the Master Plan

Problem	Conflict	Issue
Abdication of state control	Use of state land for planned urban expansion Versus regularisation of encroachment	Acquisition of control of state land in a socially equitable manner
Loss of biodiversity and natural values	Development Versus ecology	Formulation of a land use zoning strategy which will be an adequate compromise
Alternative housing	Sandfilling for capital intensive development Versus continuing use of marsh for housing expansion	Formulation of an adequate relocation/community development package for encroachers
Externalities	Extensive development of the marsh Versus destructive side-effects on lagoon fishery	A zoning strategy and management plan for the lagoon fishery
Coastal stability	Sand pumping from an already eroding coastline Versus erosion protection	Use of appropriate technology and identification of mitigating measures
Wetland as a flood buffer	Loss of retention areas Versus increased flood threat	Enhancement of flood buffer and drainage capacity of the wetland

“Sustainable” is now a catch word. There are diverse interpretations, some obtuse while others match common sense. In Sri Lanka the common experience has been that investment in development in many instances failed to produce the intended results. For the ICM process for the MM-NL system, three facets of sustainability were captured in the following definition (Samarakoon and Van Zon, 1991):

Sustainability of yield: at present the ecosystem provides a wide range of products and services to which a financial value could be give. The supply of these products and services must remain undiminished.

Sustainability of function: the marsh and the estuary together constitute an ecosystem of which the linkages and processes cannot be financially interpreted (e.g. seawater-freshwater mixing, biodiversity), but the continuity of which are essential for present and future yields. They must remain unchanged or become enhanced.

Sustainability of investment: any development activity selected for implementation should necessarily mean that finances allocated to it will result in the anticipated benefits (cost recovery); the development activity must not merely transform existing conditions, which could lead to abandonment of the project and/or adverse side effects (externalities) on yield and functioning of the ecosystem which would compel non-beneficiaries to bear a cost.

The planners recognised that the Master Plan had to acquire legitimacy if it was to be implemented. Therefore, fullest consideration was given to the characteristics that impart legitimacy to a development (environmental management) plan (Faludi, 1987):

- Identifying and taking advantage of development opportunities.

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- Preventing side effects of development that would hurt the interests of others who are not beneficiaries of that development activity (externalities).
- Ensuring equity by providing the fullest consideration to the disadvantaged groups in a manner such that the development activity provides a flow of benefits to them.

Essentially, the goal of the Master Plan was harmonisation of development with ecology while ensuring equity. The most recent United Nations Development Report (1996) clearly shows that the widening gap between the haves and the have-nots in the developing countries is the outcome of the failure adequately address the equity issue.

Integration

Integration is the key word in ICM, Integration has to occur at the institutional level as well as on the basis of ecosystem structure and functioning. Institutions are a combination of human and material resources organised for the achievement of specific objectives. An important characteristic of institutions is the fact that the achievement of objectives depends more on the human component than on the material component. Government agencies are one category of institutions. Similarly, organised groups of resource users also constitute an institution. Institutional integration therefore have both horizontal and vertical dimensions.

“Horizontal integration” is the key to successful ICM. Here all government sectors are brought into a single lateral framework for management in order to reduce bureaucratic fragmentation, duplication and misunderstanding. Thereby the ICM process is moulded into a cooperative venture incorporating all government agencies, community representatives, researchers and non-governmental organisations. Horizontal integration for planning and plan implementation for ICM for MM-NL system was acquired by convening a “steering committee” in which all stakeholders were represented.

“Vertical integration” means involving all levels of government including village government. Muthurajawela Marsh and Negombo Lagoon straddle several governance areas. The local government body for Negombo is a Municipality. Other parts of the system lie in local governance areas know as Pradeshiya Sabas. Wherever, planning and implementation decisions are taken the relevant local government authority is brought into a sub-committee. For instance boundary demarcation for Negombo Lagoon has commenced. The Mayor, Negombo Municipality is a member of the sub-committee convened by the Divisional Secretary, Negombo to coordinate the activity.

An ecosystem-based ICM is essentially an integrated land use strategy. During conceptualisation of the master planning process, unanimous agreement was acquired from the steering committee on the need for a system approach for arriving at planning decisions for the lagoon-marsh complex. However, strong reservations were expressed on the practicality of attempting to understand the system and its planning implications, in a neutral approach, within the given time frame of 18 months. Consequently, instead of getting mired in endless, system interconnections, the essential characteristics were addressed (Holling, 1978). These were found to be four essential characteristics that the coastal ecosystem shares with all other systems, artificial and natural, including the human body system, being linkages, structural complexity, resilience and dynamic stability. These characteristics as well as other relevant information for the ecosystem were captured in a series of thematic maps, chief among them were coastal stability, hydrology, vegetation, fisheries, avifauna, human

activities, water quality and diseases. These thematic maps were used to make decisions on land allocation.

Integration of environment and development in practice incorporates the harmonisation of land and water allocation for diverse uses. This may be achieved through the use of thematic maps. This was precisely what was done for preparation of an integrated land use zoning plan for the MM-NL system. The thematic maps were overlaid and appropriate land allocation decisions were made. Here a caveat is necessary. Map overlaying and decision making may be done using simple techniques; maps prepared on transparent sheets, manually overlaid and scanned by a group of planners who would then discuss and arrive at allocation decisions. The application of the Geographical Information System (GIS) to the ICM process for the MM-NL system was considered, but was rejected because within the period of 18 months given for the exercise its use was impractical. GIS would have benefits, however, in management monitoring activities.

Formulation of the Master Plan

The process leading to Master Plan preparation included collection of information, synthesis and consensus building. The studies constituting the ecological survey were carried out by specialists. They had to carry out their studies within a strict time frame and supply information in keeping with the terms-of-reference which was directly related to the problems to be addressed in the Master Plan. One of the main requirements was the supply of mapped information on the minimum scale required for strategic zoning (1:10,000 scale).

Socio-economic information was collected using questionnaires completed by the Grama Niladhari and verified randomly by the specialist in charge of the task (Mahanama, 1991). The Grama Niladhari is the lowest ranking government officer in the state administrative service assigned to a cluster of villages consisting of about 300 households. He is personally familiar with individual households, income status, occupation, land tenure and land use in the area assigned to him.

The development options survey was carried out by distributing a grid map of the planning area to the widest range of potential investors with a request and instructions for a response. Potential investors who responded positively were sent a large scale grid map on which their land requirements were mapped in greater detail for specified uses.

The information from the ecological, socio-economic and development options survey were synthesised in the Environmental Profile for Muthurajawela and Negombo Lagoon (Samarakoon and Van Zon, 1991) to enable the master planning team to carry out strategic zoning. The environmental profile was divided into three sections;

Part A: described the present situation of the natural and physical resources in area.

Part B: described the ongoing changes in the area, both natural and man-induced, their trends and future projections if existing trends persist unaltered.

Part C: described the available development options for the area, potential impacts as well as anticipated condition and fate of the resources of the area if adverse impacts are ignored. This third part presented the basic considerations to be included in the Master Plan for strategic zoning with the focus on sustainability as defined in Section 3.3.

The foundation of the Master Plan was strategic land allocation (zoning), which addressed the issues of development, ecology and equity. It relates to a planning area of 10,694 ha consisting of the Muthurajawela Marsh (3,068 ha) in Negombo Lagoon (3,164 ha), being on

continuous wetland, and the surroundings (4,462 ha). In response to the six problems, and in keeping with the requirements of legitimacy and sustainability, the Master Plan recommended the establishment of four main zones (*figure 2*):

Conservation Zone (91% of the continuous wetland, or 60% of the total planning area). The most significant function of this zone was expected to be preservation of the structure and functioning of the ecosystem to enable sustainable management to ensure protection of lagoon fisher jobs and to support multiple uses that would not deplete biodiversity.

Buffer Zone (6.4% of the continuous wetland). The Significant function of this zone was expected to be flood buffer, and prevention of expansion of residential and industrial activity into the Conservation Zone. Generally state land which is unused attracts encroachment. Buffer Zone management would therefore include cost effective activities that are economically strong enough to prevent further urbanisation such as recreational development, and which could enhance biodiversity, E.g. golf course, marsh botanic garden, herbal garden and some community recreational use.

Mixed Urban Zone (2.5% of the continuous wetland). The significant function of this zone would be facilitation of integrated economic growth and employment generation.

Residential Zone, low to high density (on the east and west of the continuous wetland, 41.7% of the total planning area). Settlement planning and residential development were expected to occur for this zone in a manner that would provide for relocation of the encroacher population in the marsh to locations with healthier living conditions and better access to infrastructure.

Master Plan Implementation

The Master Plan constituted guidelines for a landuse policy, therefore it was flexible. However, implementation required political authorisation. In October 1991, the cabinet of ministers approved the master Plan and directed its implementation without deviation from the recommendations. Thus a politically authorised integrated landuse policy was born for Muthurajawela marshes and the Negombo Lagoon. However, the Conservation Zone of the master Plan (90%), where major resource use conflicts existed, required detailed planning. This was achieved during the programming and feasibility analysis phase. The Conservation Management Plan for the conservation Zone was completed in 1994. In October 1995, following the change in the government, the master Plan now accompanied by the Conservation Management Plan was again submitted for cabinet approval. The Cabinet of Ministers once again approved its continued implementation. Thereby, the integrated landuse policy framework for the ecosystem was reaffirmed. *A most important lesson learned from this experience is that whatever the affiliation of a political party in power, a plan will be approved, if it incorporates the characteristics that impart legitimacy to it.*

The period 1991-1994 was designated for programming and feasibility analysis to enable the Master Plan to be tested and for it to acquire sensitivity to prevailing socio-political and socio-economic imperatives. In this process, the designed flexibility of the master Plan acquired practicality that made implementation definitive. The plan was also crafted in a manner that would enable the separate components of the plan to be implemented independently under the responsible agency, but with coordination, supervision and monitoring by the institution integrating mechanism, Muthurajawela Master Plan Steering Committee (MMPSC) which had community and NGO representation.

Programming and feasibility analysis included four main types of activities for which further planning was required, but on different levels of complexity. The four types of activity were, from the less to the more complex: (i) preparation of an environmental impact assessment for the sandfill in the Mixed Urban Zone, followed by landuse and business plan for the new land, (ii) developing relocation and community development packages for the encroacher communities living in the Muthurajawela Marsh, (iii) screening of investment proposals for the Buffer Zone and preparation of a landuse plan, and (iv) preparation of a Conservation Management Plan for the Conservation Zone.

Sandfilling of the 162 ha assigned to Mixed Urban Development was the activity that could take off with least problems since the required steps were clear. It involved preparation of a feasibility analysis for the External Resources Department for mobilisation of the necessary funds, followed by signing of a bilateral agreement, and preparation of a project specific environmental impact assessment. However, since 220 encroacher families were already resident at the sandfill site, they first had to be relocated.

The filling of the Mixed Urban Zone required 4.8 million cubic meters for fill material. In accordance with the National Environmental Act, No. 47 of 1980 and environmental impact assessment is required for filling a wetland exceeding 4 ha in extend. The project proponent, SLLRDC, prepared the environmental impact assessment report for which conditional approval was given by the Central Environmental Authority (CEA), the project approving authority.

Filling of the Mixed Urban Zone was done by pumping sea sand collected by a trailing arm suction hopper dredger. Sand dredging and pumping were done in a manner that could not have any adverse impacts on the coastline which is already eroding. The adverse environmental impacts from any other form of filling (lateritic earth or river sand) were expected to outweigh the benefit of urban land creation.

A land use plan for the sandfill has since been prepared by the SLLRDC. In order to acquire optimal benefit from the Mixed Urban Zone Development, a business plan was also prepared. One of the major socio-economic benefits form Mixed Urban Zone development will be labour absorption in construction work in the short term and employment generation in the longer term from industries that would be established. The first investor, Shell Gas Terminal Lanka (investment US\$ 60 million), has already been allocated land in the Mixed Urban Zone. The recently completed EIA report has already received public comment.

A relocation and community development package was formulated in consultation with the target families (300 families). The package included relocation to a site as near as possible to the existing settlement, land preparation, provision of infrastructure (road access, pipe-borne water, electricity, sewage disposal), compensation proportionate to the land that had been developed at the encroachment site (e.g./ coconut cultivation), financial assistance for construction of permanent houses on a self-help basis, a deed of ownership and establishment of autonomous Community Development Councils (CDCs) with support from the National Housing Development Authority. The responsibility for the relocation programme, except, land preparation and infrastructure, was given to the Social and Economic Development Center (SEDEC), a highly respected Roman Catholic NGO. The relocation package ensured a drastic improvement in housing and health conditions for the previous encroacher community, while at the same time the equity issue was addressed such that the SLLRDC allocated a part of the anticipated, increased development value of the Mixed Urban Zone to paying the paying the cost of relocation (UNCHS, 1991).

Integrated Coastal Management

The experience with relocation and community development to facilitate the sandfill in the Mixed Urban Zone was to serve as the foundation for formulating a programme for all encroacher communities in Muthurajawela Marsh. However, the sudden demise of the President of Sri Lanka, who initiated the Master Planning process, opened a floodgate for interference by the politicians whose constituencies included the encroachers. This interference entrained violent encounters as well as intimidation. The eventual consequence was that a segment of the population wanted on-site regularisation, while a few communities living in the north of the marsh still request relocation to an area which is above flood level.

The strategic zoning of the Master Plan is adequately flexible to accommodate the request for on-site regularisation of the encroacher communities. The Muthurajawela Marsh segment of the Conservation has now been redemarcated in a manner that accommodates the land requirement for on-site regularisation. Simultaneously a project is now being developed to provide permanent houses on serviced land for 80 families living in the northern marsh.

Interest in developing the Buffer Zone has been shown by diverse investors. Since this zone was expected to serve three use functions, cost effective recreational development, flood buffer and community services, perceptions differed of how development should occur. Developers desired total control of the Buffer Zone for purposes of integrated management to protect their investments, whereas the local communities were apprehensive of its consequences. Therefore, the local communities desired to acquire use rights which could not be influenced by more politically powerful groups/individuals. In order to ensure that the Buffer Zone management meets the Master Plan objectives, a landuse plan for it was prepared by the Wetland Conservation Project (WCP) with technical assistance from Euroconsult. It has already been tested with the local communities. Implementation will proceed as investment funds become available.

The Conservation Zone is a high intensity multiple use area consisting of a marsh segment and the lagoon. The marsh provides land for housing, serves as a flood buffer and has a wide range of animals and plants. The Negombo Lagoon provides a much wider range of goods and services to the lagoon fisherfolk who extremely poor and disorganised as well as to affluent individuals and groups who have direct access to and influence on political authorities. The existing policy for fisheries development in Sri Lanka focuses primarily on the mechanised marine fishery while concern for the poor traditional fishermen is stated whereas little or no action is taken to improve their living conditions. The brackish water (estuary and lagoon) fishermen have in this process borne the cost of marine fishery development, where these bodies of water have been developed as anchorages. Negombo Lagoon is a major anchorage which serves about 400 boats with a displacement in excess of 5 metric tons and about 1000 smaller mechanised boats. Among other adverse impacts, fish and crustacean stocks harvested by lagoon fishermen have been adversely affected by oil pollution caused by waste oil discharges directly into the estuary.

Conservation Management Planning and Implementation

The three essential elements of the Conservation management Planning process were community empowerment, problem oriented technical studies and integration by way of dialogue at the MMPSC.

The foremost requirement of preparation of an implementable Conservation Management Plan for the Conservation Zone was recognised as obtaining community participation. Community participation in the planning process was recognised as essential. It was formalised by submitting a workplan, which included community workshops as one of the

elements of Conservation management Plan preparation, to all relevant actors who had power to alter the approach, viz; the National Wetland Steering Committee, the Muthurajawela Master Plan Steering Committee and the Netherlands Government. The membership of the Master Plan Steering Committee included all relevant government agencies, the Roman Catholic Church, NGOs a CBO and later political representatives.

Community empowerment continues to be the most formidable task in ICM in Sri Lanka because of the prevailing attitude of political leaders and bureaucrats. Some lessons may be extracted from the experience gained in this area during Conservation Management Plan preparation for the conservation zone of the Master Plan.

The foremost requirement of the encroacher population in the marsh segment of the Conservation Zone was an acceptable relocation package. The residents in the marsh segment were partially organised along clear democratic principles, the leadership was committed to social uplift, they had acquired experience in lobbying, and the activities of the leadership were transparent. Even during the short period available for Master Plan preparation, it was possible to include some detailed management measures addressing the needs of these poor communities.

This estuarine lagoon is a high value resource base with an annual economic worth exceeding US\$ 20 million (Table 1). About 3,000 fishermen from 26 villages surrounding the lagoon depend upon its fisher productivity for livelihood. The annual value of fish and crustaceans harvested from it is US\$ 3 million. Because of the low level of literacy and education, access to alternative occupations is highly limited or unavailable for the lagoon fisherfolk. The priority need therefore was to organise the lagoon fishing community and instill the need for sustainable management of the of the lagoon resources as protection of their own livelihood.

At the outset, it was evident that the lagoon fishermen from the different villages had diverse perceptions as well as common views regarding the health and functioning of the lagoon. The challenge was to get the lagoon fishermen from 26 villages to agree on a common analytical framework for sustainable management of the resources of Negombo Lagoon, required both for their own future as well as for biodiversity conservation. Only a common and shared analytical framework could result in the essential consensus on management measures. An ecosystem approach, based upon the four essential system characteristics, served as the foundation for development of such a common framework. Therefore, the workshops were intensively used to educate the communities in understanding (the need for) management of natural systems. The concept of carrying capacity was kept out of the workshop discussions, since the lagoon fishermen would look with suspicion upon any measures that would reduce access to the lagoon resources, especially in the absence of compensation or acceptable alternative occupations. Emphasis was placed on the message that fishermen are a part of the ecosystem they exploit; at the beginning most the fisherfolk regarded the Negombo Lagoon as something separate from their lives.

The lagoon fisherfolk, now organised as the Negombo lagoon United Fishermen's organisation (NLUFO), have already met the new Minister for Fisheries and presented him with a copy of the Conservation management Plan prepared by the WCP of the CEA. At the same time in a memorandum submitted to the Minister of Fisheries, the NLUFO has requested the DFAR's fishery management plan to be given to them for testing with its membership. The new minister has already given his commitment to ensure management of Negombo lagoon as an ecosystem. During the empowerment process, the lagoon fisherfolk understood that as an organised group (with a block vote), access could be obtained to the political authorities without being deflected by bureaucrats. As a group they are now in a

position to resist imposed change with which they do not agree. Again, the experience here is that public and community participation provide the necessary momentum to plan implementation. As pointed out previously, plan implementation is a political process, while plan preparation has both political and technical ingredients.

Preparation of the Conservation Management Plan commenced in January 1993. The entire work plan for the process leading to plan preparation was submitted to the MMPSC to elicit discussion that would enable definition of scope and recognition of linkages to be forged. Until mid-1993 dialogue and harmonisation of activities relevant to conservation management planning for the Conservation Zone proceeded smoothly. However, from May 1993, following the assassination of the President of Sri Lanka, political interference at the MMPSC made informed dialogue difficult. Eventually, politicians were invited to participate at the MMPSC meetings with predictable consequences. Instead of dialogue resulting in integration of relevant activities, community requirements were presented by politicians which deviated substantially from the same requirements previously submitted by CBOs. The clashes between politicians and CBO representatives became increasingly frequent. The autonomous decision making of the community members, based upon which information was conveyed to the MMPSC became progressively undermined. The reverse flow of information to the community members from the same politicians, eroded the credibility of CBO representatives among the membership. This process was aggravated by bureaucrats who had to please their political masters for survival. In the ensuing confusion the existing MMPSC was terminated and a fresh three-tiered committee convened based upon a cabinet memorandum in mid-1994 which met only once.

The Conservation Management Plan for Muthurajawela Marsh and Negombo lagoon (CEA/Euroconsult, 1994) aims at restoration of ecosystemic structure and function by way of measures to maintain salt balance, prevent oil pollution, demarcation of boundaries to prevent further encroachment, fishery management to eliminate destructive fishing methods, promotion of recreational use, community development (youth training, women's participation), public awareness among others.

The institutional innovation is strengthening of the existing community organisations which came into existence during the conservation management planning process. This is expected to lead to a collaborative arrangement between the community and the agency representatives for implementing measures included in the CMP while forgoing changed patterns of behaviour among the diverse resource users based upon the recognition that proper management benefits all actors. The driving force is expected to be the demand for management that has emerged from the communities.

One of the activities in the Conservation Zone, that has already commenced, is the "experiment in cost recovery" for nature conservation. The mechanism used is a multi-faceted Visitor Centre that attracts local and foreign visitors. The facility opened in July 1996, and offers its paying guests, information on the area and its uses, nature trips by boat or on foot. And various leisure activities. The proceeds are used for operation and maintenance, and the surplus for conservation management activities identified in the Conservation Management Plan.

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MANAGEMENT OF MOUNTAIN ECOSYSTEMS

R. Rajamani

An overview of mountain ecosystems of South Asia shows an interesting geographical distribution of high mountains of the Himalayan and Hindu Kush ranges and their off shoots running through Afghanistan, Pakistan, India, Nepal, Bhutan, and Bangladesh while there are smaller ranges of mountains and hills elsewhere in Pakistan, India and Sri Lanka.

The mountain ecosystems have an important role to play independent of other ecosystems and in relation to other ecosystems like flood plains and mangroves. They form effective wind breaks, prevent desertification, control climate and act as catchments for rivers. The mountains nourish forests and soils and enrich biodiversity.

Considering the carrying capacity of mountain ecosystems population densities are high. Mountain people have indulged in economic activities which are often unsuited to such fragile ecosystems. Mountain people are generally poor and illiterate. They do not always enjoy good health. Gender issues dominate as women have to bear the burden of the workload. Problems of water pollution and poor sanitation are on the increase.

These problems have to be resolved by improving the socio economic conditions of the people through programmes of literacy, child welfare, health care and poverty alleviation. Agriculture has to be made sustainable. Soil and water conservation measures and organic farming should be encouraged.

MANAGEMENT OF MOUNTAIN ECO SYSTEMS

R. Rajamani

Mountains are ecosystems with a distinct identity just like the flood plains, deltas, mangroves, wetlands, and deserts. When we attempt an overview of the mountain ecosystems of South Asia, we find a fascinating variety from the high mountains of the Karakoram, Himalayan and Hindukush ranges starting from Iran and Afghanistan and ending in Nepal, India and Bhutan to the low flung hills elsewhere in Pakistan, India, Bangladesh and Sri Lanka. Thus we have the Zagross in Iran and Sulaiman and Central Makram ranges in Pakistan; the Aravallis, Sivaliks, Vindhyaal ranges, the Khasi, Naga and Mizo hills and the Western and Eastern Ghats in India; the Chittagong hill tracts of Bangladesh which are like a spur from the Himalayas and the central mountains of Sri Lanka. The highest mountains of the world are in the Himalayas with Mount Everest being the highest.

Fragility of Mountain Eco-systems

Most of the mountain ecosystems are fragile in the geological sense, prone to seismic movements, and land slides and are highly erodible. Volcanic activity has been noticed in the Andaman group of islands in India. The rocks are often loosely held together and there is evidence from the fossil findings in the Himalayas and even in the rock formations in the Deccan that many of these mountains rose from the ocean floor millions of years ago. Such movements implied the existence of sand, shale, limestone and other marine substances. Hard rocks like granite predominate. Still there is some evidence of activity, particularly in the Himalayas where the plate movements below seem to suggest that the mountains are rather young.

Ecological Role of Mountains

The mountains of South Asia as in other areas have a definite role to play in the climate of the rest of subregion. They act as windbreaks or stop the march of the desert. The mountains do have a bearing on the climatic conditions in the plains. The salubrious climate and the mountain air combined with lovely landscapes draw tourists to these mountains and hills. Their role as water conservers and moderators of water flows is however better understood and appreciated. Thus, melting snow from the Himalayas keep rivers like the Indus, Ganga and Brahmaputra perennial and help in irrigation of the plains below. In this context it is worthwhile quoting the words of Dr. M. S. Swaminathan, the well known agricultural scientist in his first G. B. Pant Memorial Lecture. He said, "the destiny of nearly 40 % of our population inhabiting the Gangetic plains depends on the management of the Himalayan hydrological estate. One of the urgent tasks facing us is the conservation and wise use of this extensive hydrological estate, spread over an area of about 6,0,000 sq. km". Innumerable springs, streams and waterfalls in most mountains help in storing water for drawals in emergencies like long periods of drought. There are many lakes among the mountains, which help stabilise the water regime helping the fauna as well as the flocks of the nomads. Some of the most beautiful wetlands of the world like the Dal Lake are fed by the waters of the mountains.

Soil, Vegetation and Agriculture

The mountain ecosystems store a great deal of soil and also add constantly by processes of erosion of the rocks to the silts of the river and deltas enriching food production potential. Downstream. Excessive run off of soil occurs when the diverse forests on steep gradients are removed. There are cold deserts too in parts of the mountains like Himalayas which have different types of vegetation and with impacts on climate of the rest of the region. There are grasslands or rangelands too in the mountains like the Alpine meadows which support large populations of domestic and wild animals. In the Nilgiri mountains of south India the grassland forest ratio is a matter of considerable debate. Recent efforts to convert grasslands into forest plantations have encountered resistance from the indigenous population of Toda tribals living there as they have a pastoral tradition. The South Asian mountains have the special feature of having to harbour, high human and animal population densities. This dictates a great deal of diversion of land for agricultural settlements and allied activities. When the agrarian practices are not oriented to soil and water conservation, a vicious cycle sets in, denuding a lot of mountain slopes of soil cover facilitating a quicker run off of water, often resulting in weaknesses in recharge of water in mountain springs. As the process continues, people go for extensive cultivation to support themselves, in the process destroying the forests and compounding the problems. The mountain regions of south Asia are subject to the greatest amount of shifting cultivation which involves opening up bio diverse areas having long duration forestry crops for mono culture and short duration crops like cereals. Absentee landlordism is noticed in several areas resulting in fallows and neglect of crop rotations. Intensive cultivation coupled with population pressure has resulted in very small land holdings. Thus the average size of holding in Himalayas is smaller than elsewhere and that of the country as a whole.

Biodiversity

This leads us to consider the biodiversity and vegetative productivity in mountain ecosystems. The mountain systems in South Asia largely lie in the latitudes nearer the Equator and thus have very rich tropical biodiversity. The Himalayas have a mixture of diversities, both tropical and temperate. They also have, in pockets like north east India some of the richest biodiversity, entitling them to the sobriquet of a "hot spot" of biodiversity. Due to the past geological events, there is vegetation of Indo Malayan origin in these areas. There is tremendous species richness and endemism. In South India, the Western Ghats mountains are considered another hot spot. Mr. J. P. Pascal of the French Institute, Pondicherry has this to say: "But it is not in terms of the number of species that the forests of Western Ghats are so interesting but in terms of quality. As a matter of fact, following the marked climate changes in the wake of the uplift of the Himalayas, the evergreen forests witnessed a shrinkage in their area, continuing to thrive only in the wettest zones. The evolution of the species in the forests of the Ghats has taken place in selective isolation, which has resulted in the appearance of endemic species not found anywhere else. Nearly two thirds of the tree species in these forests are endemic to the region and confined to these hill ranges". But the advent of roads, industrial projects, townships and mining are destroying the biodiversity; a matter for considerable worry. This is true of the entire Himalayan Hindukush belt and of mountain systems like the Western Ghats of India and those of Sri Lanka. Here pristine rain forests are being replaced by tea plantations and short duration agricultural crops with no tree cover, exposing the soil to the direct impact of rains on steep slopes. Referring to the forests of the Western Ghats J.P. Pascal says "when it is clear felled the surface horizons of the soil are rapidly carried away by the torrential monsoon rains, the steep slopes hastening the process. The chances of reinstating such dense forests on the poor

soil that is left are not bright at all". Agro forestry practices which could partially help redress the balance are also rare in the south Asian mountain ecosystems.

Socio Economic Considerations

The population concentration in South Asian mountains was already mentioned. The mountains here harbour nearly 10 % of the population of the region except in a few countries. Of course more than 50 % of the rest of the population depend on the bounties of the mountains like river waters, river sediments, timber and non timber forest produce and agricultural and horticultural produce. There are also paradoxes like a land tenure system which perpetuates, absentee landlordism and poor agricultural practices. Landless unemployed are growing in numbers, leading to "money order" economies. This also has increased the burden of work on women who have shouldered the brunt of the household chores for centuries due to social structures and the phenomenon of out migration of able bodied males. This has been well brought out by T. N. Dhar "the whole question ultimately boils down to the fact that in Chamoli we have reached a stage of disequilibrium between rate of change in population; human and cattle, their life styles etc., and resource availability and environment and development. The basic reason is that in the context of rising population, the natural resources are being depleted at a much faster rate than they are regenerated. A direct result of the disequilibrium in resources and population is that many able bodied males migrate to the plains in search of work. Knowledgeable observers are of the view that the extent of out migration from Kumaun and Garhwal hill areas is higher than that from any other part of the country. Migration by itself is neither good nor bad but its impacts can be positive or negative. The migration from Chamoli has a specific characteristic i.e. the able bodied educated and skilled manpower goes out of the rural areas leaving their families behind. The migration, which in itself is a result of disequilibrium between resources and needs causes further disequilibrium in the society in the form of skewed occupational pattern and heavy burden on females ".

Gender issues are coming to the fore as literacy spreads, albeit slowly. Also women find the environment increasingly hostile even as forests on which they depended vanish and they walk longer distances to collect fuel and fodder. The medicinal plants on which they depended for dispensing 'grandmothers' medicines are also disappearing when they are exploited commercially, rather recklessly. The conditions of health and sanitation are below par and again women and children suffer more, due to malnourishment, infant mortality and maternal mortality. It is interesting to read the observations of Dr. M. S. Swaminathan in this context: "the neglect of traditional food crops like amaranthus, chenopodium and buck wheat has not only weakened the household nutrition security system of the hill people, but also prevented the Himalayas becoming the home of the health foods of the future".

Religious sanctions and superstitions abound in hill societies. The simplicity of the peoples lives and stoicism are remarkable but inroads are being made into them by the advent of forces of development which are bringing roads, transport, telephones, television and new diseases too to remote villages. The economic development of the mountain systems have resulted in distortions in area planning and welfare of the hill people. Projects like dams generating hydel power often evacuate the power to the plains. Roads connecting villages and farms in the hills take away more produce and goods than they bring in. All this is breeding restlessness in the air. The 'Uttarakhand' agitation in the U.P. hills of India is an example. There, the people want fully fledged autonomy and a complete say in managing their own affairs. In the Eastern Ghats of South India the tribals in the hills are agitated about non tribal people from the plains taking away their lands and assets both by fair means and

foul. The fact that many of these complaints are sometimes rooted only in perceptions does not take away from the problem.

Urbanisation and industrialisation are features which are developing to the point of bringing in air and water pollution as well as waste accumulation in the hill economies, which always enjoyed clean air and good quality water, and where all wastes; predominantly organic used to be recycled. Cities like Kathmandu in Nepal, Shimla and Udhagamandalam (Ooty) in India, Thimpu in Bhutan are growing, ringing alarm bells of loss of natural beauty and onset of pollution.

Environmental Awareness

The awareness among the hill folk of the growing problems due to the fragility of the ecosystem itself, the growth of population and the new forces of modernisation and development is not yet based on detailed empirical study. Most of the anxieties are based on one-off perceptions and some limited studies. The institutional strengths are not there in most countries of the region to study the ecosystem as a whole and its carrying capacity to chart a path to sustainable development. The few institutions that do exist have to traverse long distances to make their work percolate to the people. Their studies too, with the aid of tools like satellite imagery have to reach the stage where they can influence policy makers to act in time to manage the mountain ecosystems better. The awareness has to increase in the mountain ecosystems people but equally in the non ecosystems people and others using the produce of the mountains as well. Unless the problems of the mountains and the mountain people are appreciated by the others, there will be no congruence of objectives of policy, legislation etc. Areas of mutual concern should be highlighted especially the need for water conservation, protecting medicinal plants, and preserving the sanctity of places of, Religious Worship to name a few.

Legal and Institutional mechanisms

There are no specific regulations to cover mountain development. Regulations from the plains areas are applied mechanically to the mountains. This results in mining leases being granted in areas where they ought not to be and in opening of mines without precautions. The floor space area index for buildings in the plains is adopted in the hills, adding to the congestion and loss of the mountain skyline. There is hardly any protective legislation focussing on the fragility of the mountain ecosystems. Even where they do exist as in the Aravalli hills in north India the follow-up and implementation is weak. Very often courts of law have been forced to intervene. In the Dehra Dun limestone mining law suit, the Supreme Court of India had to step in to stop the mining in mountain areas and appoint a Committee to oversee rehabilitation of closed mine areas. The same august court has intervened in the Delhi Ridge, which is part of the Aravalli mountain system that was being overrun by encroachments injurious to the ecosystem. The poor awareness and weak institutional base have not helped in putting in place a proper policy and legal regime under which sustainable development only can be encouraged. Area planning concepts with focus on mountains which are the critical part of watersheds, being at the top and nursing the catchments are yet to catch up.

Socio – Economic Priorities

In terms of priorities, it is clear that solving the socio-economic and related conditions of the mountain people ranks very high. The degradation of the natural resources is partly a function of natural factors and partly or mostly those caused by human interventions. Such

interventions occur because the mountain people and the non mountain people use its resources, and the uses are often unsustainable. The proximate causes are the interventions of the mountain people themselves. It is their demand for food, fodder, fuel, fats, and fibre, from the mountain sides and the changes in their lifestyles that make the immediate demands on the flora, fauna, water and land of the mountains. If they have to avoid degradation and engage in sustainable utilisation of natural resources, amelioration of their poverty, betterment of the lot of their women and improvement in their knowledge of the environment and of their health base should be revamped. Also, they should be made to play an effective role in managing their own resources. To achieve this, the population has to be literate, healthy and reasonably well off economically. Programmes for eradication of illiteracy especially among women, and promotion of child welfare, health and sanitation should go hand in hand with poverty alleviation programmes tailored to the situation in the mountains.

In relation to gender issues, we should endorse the findings of the Regional Conference on Sustainable Development of Fragile Mountain Areas (SUDEMAA) at the meeting convened by ICIMOD in December 1994. They are; undertake additional research in law and how it affects gender relations; ensure that the economic contribution of women is reflected in national accounting; advocate joint ownership of resources; and document case studies on the relatively higher status of women in mountain areas and incorporate them into the mountain agenda.

The cultural attributes of mountain people which are conducive to sustainable development should be protected. Ethno knowledge is one of the key attributes requiring careful attention with a view to documenting it and recording it too. One of the powerful ways of doing this is to empower communities especially women in the political, social and economic spheres. All programmes should be devised after full dialogue with the local people and this should be village based.

Sustainable Agriculture

Promotion of sustainable agricultural practices is the second major plank of both policy and people's response to the problems of management of mountain ecosystems. Transfer of appropriate technologies for soil and moisture conservation is a must. In this context Sloping Agricultural Land Technology (SALT) and Sloping Watershed Environmental Engineering Technology (SWEET) are two technologies to be studied and used as models. They were started in the Philippines and is now practised in China and other countries and ICIMOD is playing a key role in this. They are being tried out by G. B. Pant Himalayan Institute Of Environment and Development as a package for regeneration of degraded lands in Indian Himalayas.

Measures like organic farming and agroforestry have to supplement the mechanical measures for reversal of soil degradation. Areas of degradation and areas suitable for agriculture or pastures should also be mapped using GIS and other techniques in order to determine the most appropriate package for a particular area. This area specific approach must also go with a people specific approach determining what part of sustainable or traditional practices already being used by people to some advantage (and which they understand better than techniques involving mere extension) can be conveniently grafted into programmes or new techniques. Absentee landlordism which results in unnecessary fallows and neglect of conservation of slopes thus impacting on other cultivated holdings must be tackled both by the application of the law and persuasion by communities.

Management of Biodiversity

There is no gainsaying the fact that scientific research to document biodiversity and to increase productivity of traditional crops or trees as also of acceptable exotics should be put on a firm footing and scientists should ensure this is done without destroying the base of biodiversity. There should be no compromise on protection of biodiversity in the mountains and for this purpose full use should be made of the provisions of the Convention on Biodiversity.

Research and extension methods with the co-operation of scientists, technologists, government, farmers and industry should find ways of providing additional incomes and employment in mountain villages by ensuring value addition in the collection and processing of medicinal plants. Successes on this can be replicated with foods like honey, fruits, and flowers. But care has to be taken that this is in step with human resource development and total conservation of natural resources. Any wild swings in standards of living that will promote excessive consumerism and creation of wastes should be guarded against.

Infrastructure Industry and Energy

On the infra structural and industrial fronts, the field of energy deserves to be looked at closely with a view to developing alternate energy sources like solar, mini hydro and wind in a big way. They should be entrusted to communities and smaller organisations in a decentralised manner. They can also act as real alternatives to the creation of large power projects on mountain sides which may pose extreme environmental risks.

In this context it is necessary to look at the issue from a perspective different from that in non mountain areas. Kamal Rijal puts it well when he says "the slow pace of energy transition in the Hindukush Himalayan region can be attributed to the slow rate of growth in economic activities due to prevailing development barriers. These barriers are caused by mountain phenomena which are manifested by inaccessibility, marginality and fragility. Besides these constraints and the 'niche' imposed on the energy sector, the numerous barriers it faces with regard to policy, planning, technology, cost, financing, institution and information pose a serious predicament for the development of the sector. However, a more positive strategy would be to capture the opportunities generated by the mountain specific characteristics rather than harping on the constraints. It can therefore be concluded that energisation of mountain communities can be made feasible out of appropriate technological interventions, in terms of energy sources, technologies and institutional mechanisms that are conceived and translated into reality. Energy technology interventions with increased economic activities will lead to breaking down the vicious cycle of poverty and environmental degradation. If energy transformations are implemented appropriately, even the poor can contribute to it in a significant way which would affect their lives as well as the overall economy.

All industries that are to be developed must have energy and water conservation as the main plank. It is desirable that industries creating wastes, especially hazardous wastes are totally avoided in the mountains. For this purpose, a very detailed environmental impact assessment must precede the setting up of every industrial or infrastructure project in the mountains and a public hearing must be mandated in such assessments. It is worthwhile remembering observations of Dr. Harka Gurung at ICIMOD "the main agenda of highland development revolves round reconciling land-use conflicts, reducing demographic pressure and developing alternate sources of energy. The last item has much relevance to the protection of natural vegetation. Programming of activities will be more realistic through a better understanding of traditional resource management systems. Since the highlands are generally away from the

centres of economic and political power, successful implementation will be contingent on the full involvement of local institutions and beneficiary participation. In regard to area specific infrastructure development it is necessary to look at ways of avoiding man made landslides in roads or building constructions by proper risk engineering. Proper housing and road laying in seismic areas also deserves attention.

Tourism and Urbanisation

As regards tourism, not only areas for tourism should be determined using GIS and other techniques to avoid locating them in very fragile areas, but whatever tourism that does get promoted should have a wholesome ecological content. In an interesting finding of a research project of ICIMOD it was observed that "the impact and implications of mountain tourism tend to differ according to the nature, magnitude and seasonality of tourism, but commonalties exist. These include the lack of a defined policy perception on tourism, if any, the high leakages and weak linkages of mountain tourism with the production sectors; the problem of seasonality, lack of concern for 'carrying capacity' and an impact monitoring framework and the overall neglect in relating tourism to community development, local institutional development and gender concerns".

Strategic intervention by the government through local community groups was seen as an essential aspect in making mountain tourism a vehicle of local economic, environmental and community development. There were also issues specific to each country and region.

It must also be realised that due to tourism and associated economic development the dangers of indiscriminate urbanisation and build up of solid waste has already reached the mountain ecosystems. A recent study by A. P. Jain and J.C. Kuniyal has shown that problems of solid waste have invaded the high Himalayas in places like the Valley of Flowers. Mountaineering expeditions to the high peaks are leaving piles of junk behind. If that be so, the growing towns in the mountains will also soon be among the most polluted. The municipalities here should be strengthened to act soon on such issues.

Networking

In the countries themselves, both the national institutions studying or looking at mountain development and the NGO's working in the mountains do struggle against odds. This is not surprising given the nature of the subject and the conditions of work which do not always attract the best talent. This is compounded by rather low priority given to this even in area planning or national developmental planning. A change in this approach is essential for better management of the mountain ecosystems. A strong networking of all the institutions working on this, both in the mountains and plains, can achieve more than fragmented or individualistic thrusts. This should be coupled with full dissemination of scientific findings on the dangers ahead on account of natural and man made disasters etc., as well as potential for sustainable growth. This should be done by all, whether government, communities, institutions, experts, industry or NGO's. A greater thrust should be given to NGO activity in this direction and in ensuring proper spread of success stories as they start manifesting.

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PARTICIPATORY FOREST RESOURCE MANAGEMENT

Michael Victor and Cor Veer

Over the last 15 years, depletion of forest cover has been one of the critical environmental concerns throughout the world. Traditionally in many of the forest rich countries in Asia state bureaucracies have control of forest resources. These governmental agencies generally focused on forest management practices which emphasised the management of the natural forests for the development of the timber industry, without taking into account the needs and utilisation practices of local communities.

Throughout Asia, academics, field workers and bureaucrats are realising that participatory approaches that foster the active involvement of local communities in forest management are much more effective in managing and conserving forests than unilateral state control. In many countries new policies and programs have been initiated in partnership with the communities dependent on forest resources.

While assisting in the protection of the environment, these new initiatives and activities which recognise the involvement of local institutions, local government and local groups of forest users have had an overwhelmingly positive influence on the sustainable development of rural communities.

It has been well documented that forest dependent communities derive a large proportion of their livelihood and income from forest products. A range of collaborative activities has demonstrated that local communities are much more apt to conserve forest areas if they are given clear benefits and control in the management of their respective forest areas.

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At a recent village meeting in far-Western Nepal, the local people sat around discussing ways in which to protect their forests. Each year forest patches, which are used communally, are rotated and a "village watchman" is hired to guard against any would-be encroachers. In fact, one of the last acts of the village forest committee was to fine one of the villagers for grazing his animals in "closed" forest area; his fine would go to pay for the watchmen as well as for eventual repairs to the new drinking tap which the villagers had just installed. Yet, why are the villagers practicing what academics, foresters and natural resource professionals would call forest resource management? It is not because the District Forest Office or government is encouraging them; one elderly gentleman stated, "The governments in Kathmandu never do anything for us. Look around do you see anything that was built other than from what we make ourselves? The only time they come up here is when they want a bribe".

The main reason for this initiative in forest resource management is because they know that if they do not protect the environment around them, their livelihoods and their natural resources, would be destroyed. They understand that it is only careful management of their land which is keeping them away from the slums and shantytowns of the now teeming Kathmandu Valley.

Throughout Asia and the Pacific it is becoming increasingly apparent that the 19th century unilateral state control over forest resources is one of the main causes for forest destruction in the region. In India, forest cover has decreased from 40 percent in the 1840s to less than 20 percent. Until 30 years ago, in Thailand, the Philippines and here in Sri Lanka, forest cover was about 70 percent but has now dwindled to less than 25 percent (Owen, Lynch 1995). Due to this, rural populations have suffered the most: poverty and migration being the two major consequences.

The Globalisation of Forest Resources

Forest resource management and utilization policies in all Asian countries, reflect the development of the 'world system' in which the global requirements of timber and pulp determined not only the type of commodities for which the resources are to be utilised, but also the institutional framework controlling the management and use of forest resources. In many Asian countries the forest law states unequivocally that "forests are government property". The large tracts of forested land which have been placed under government control has created an unrealistic burden on its forestry officials and national forest systems. This has led to uncontrolled and illegal logging which accounts for much of the deforestation throughout the region. In response to this, commercial logging in natural forests is now banned in Thailand, Cambodia, and parts of India and the Philippines (Lynch and Talbot, 1995).

What does this mean for our village in Nepal? Well, until recently it meant that forest management practices utilised by them for generations were illegal and subject to either their or arrest. Asian forest policies tended to mimic 19th century models of unilateral state control

over forest resources which emphasised sustainable timber harvesting with little or no regard for people living in or near these areas. That such laws are more easily stated than enforced may be illustrated by the hundreds of millions of people living on forest lands in Asia. This is also illustrated in more detail in the table below:

Table 1: Non-Governmental Estimate of Forest Dwelling Populations

Country	Peoples Directly Dependent upon Forest Resources (Millions)	Peoples Living on Land Classified as Public Forest (Millions)
India	275	100
Indonesia	80-95	40-65
Nepal	18	8.5
Philippines	25-30	24
Sri Lanka	2-4	Not available
Thailand	20-25	14-16

Source: Owen, Lynch, 1992

Fortunately many of them are not aware of this, and continue with their age old practice of resource management on land that is not legally theirs (Gilmour and Fisher, 1991) However, it is particularly in those cases that outside interests are expressed (e.g. in the form of granting a logging concession, or the declaration of a national park) that local people are made aware that indeed they have no rights on the resources they have long cared for.

The process of appropriation of forest lands from villagers was aptly described by His Majesty The King of Thailand in his address to recently graduated lawyers in 1973 in the following terms (as quoted by Rao, 1992):

"...it seems rather odd for us to enforce the reserved forest law on people in the forest which became reserved only subsequently by the mere drawing of lines on pieces of paper. The problem arises inasmuch as with the delineation done, these people become violators of the law. From the view point of law it is a violation because the law was duly enacted. But according to natural law the violator of law is he who drew the lines, because people possess the right to live. Thus it is the authorities who encroached upon the rights of individuals and not the individuals who transgressed the law...."

The 'rediscovery' of the potential of local institutions and people to sustainably manage forest and tree resources, in recent decades forms the basis for community forestry defined as *self help management of forest and tree resources by rural people for their own benefit* (Arnold, 1992). This goes far beyond the present scope of what has been described as "small trees for small people", but rather provides a means "to create and maintain a system of forest practices that are both ecologically and economically sustainable." (Ascher, 1995).

In most Asian countries there is now a rapidly growing body of experiences with community forestry support strategies, demonstrating the basis for planning and implementing support activities, the nature of enabling policies and administrative arrangements, the type of research support, and the adaptations in education and training programs, that are required to provide administrators and extensionists with the needed attitudes, knowledge and skills (FAO-RWEDP, 1992). Many of these support strategies build on and are inspired by the rapidly growing, and increasingly documented, understanding of indigenous forest and tree management regimes and practices.

Indigenous Forestry

Gilmour and Fisher (1991) explain that in Nepal there is a large variety of forest management systems that are the result of villagers' own initiative. Some of these systems are rather formalised with local organizations and specific roles such as forest management committees and local forest guards. But there are also many more informal systems which are simply sets of agreed rules and practices that regulate the way people use forests. There is much evidence showing that informal systems can operate without the formal features, but that formal systems cannot be effective without the informal systems (the agreed rules and practices). They further present the diversity of other features of these management systems.

The improved understanding of indigenous system has had a major impact on the operational principles of "sponsored" community forestry in Nepal, in which the former emphasis on local village authorities has been replaced by the emphasis on user groups as the central management unit.

In northern Thailand. There are three types of community-protected forest (Ganjanapan, 1992) namely:-

- a. watershed forests, which is usually the head of the watershed, is strictly protected by the communities with minimal use of forest products,
- b. sacred forests, reserved for ceremonial purposes, as a shrine or cremation ground.
- c. communal woodlands: delineated by the community for grazing or collecting forest products like mushrooms, leaves, flowers, fruits, firewood, etc.

Over 150 cases of locally initiated community forest have been documented in Northern Thailand. (Anan and Santita, 1991). Many other cases have been reported in other parts of Thailand, such as Dong Yai Forest in the Northeast, Pa Grad Forest in the South, and Baan Laang Forest in the East. Experience in these cases shows that the disturbed natural forests, even after cultivation, can regenerate under community protection, and are often more productive than plantations.

In addition to these indigenous *forest* management systems, the understanding of indigenous *tree* management or agroforestry systems and practices, in farming systems and on village lands has rapidly evolved as well (Nair, 1989 and Mellink et al., 1991).

These and many other studies demonstrate that there are very few areas in rural Asia in which villagers do *not* manage, forest and/or tree resources, if given the opportunity. But this does not imply that there is no scope or sometimes need for improvement and for efforts from outsiders to support villagers to *better* manage their forest and tree resources for their own *greater* benefit, and for the benefit of the resources. As the initial attempts at providing such support have amply demonstrated, this is often more difficult than expected, not just because (as was often thought) of the villagers, but because of constraints and limitations in the outside agencies' capabilities to provide *effective* support.

Lessons from Social Forestry Projects

Many of the initial efforts in social forestry in Asia were oriented towards the planting of large numbers of trees outside forest lands, as well as in heavily degraded forest areas. Accordingly much emphasis was placed on the production of seedlings of species that could survive under a variety of harsh conditions and could easily be produced and planted out on a

large scale. This may have been one reason that much emphasis was initially laid on a limited number of species such as the much criticized Eucalyptus.

Often the style of operations of such establishment projects did not differ much from that in conventional forestry operations, and has been characterized by one author (Shingi, 1986) as: "I (forester) manage, you (villager) participate". Moreover, having no land or tenure rights tended to create a lopsided meaning of participation in which local people felt their labour was necessary for their continued living in a certain area. This in turn again created short sighted planning (Lynch and Talbott, 1995).

Though much of the criticism of the initial social forestry efforts may well be justified, one major positive effect of these projects should not be overlooked: Foresters for the first time in the 100 or more years have come out of the forest to talk to villagers, complementing the historical mode in which they dealt with villagers coming into 'their' forest through the force of law.

This first step in the 'opening up' of the forestry system, was followed by establishing working relationships with other professions such as agricultural extension and rural development. In many cases university based social scientists' assistance was requested to provide a better knowledge base for the planning and implementation of projects.

This has made several positive contributions. Firstly, villagers are empowered through appropriate legislation, administrative and development support to manage the forest lands through community or joint management schemes. Secondly, foresters acquire the capacity to analyse and understand the complexity of community systems and rural households' resource portfolios, plan better resource management strategies with them and assist in insuring fair returns of produce from sustainably managed resources. It is this renewal and opening of a formerly closed forestry system into an open interdisciplinary and dynamic system that represents not only a major challenge, but also an opportunity for professional renewal.

Status of Community Forestry in South Asia

Since 1989 promotion of community forestry has been the main primary forest policy in Nepal. Forest management rights have been granted to over 3,400 Forest User Groups (FUGs) covering roughly 200,000 ha. of public land. In India, 18 of the 25 states have already issued a Government Resolution on Joint Forest Management and presently over 12,000 Forest Protection Committees have been established for forest resource co-management. In Pakistan there are a number of pilot projects building upon local people's defacto control over forest resources. Also, in Sri Lanka efforts have been made in establishing some community forestry initiatives. A number of factors have contributed to the development of community forestry such as improved documentation, involvement of NGOs, social scientists and a variety of governmental agencies.

The literature on community forestry, since the 1978 World Forestry Congress on 'Forests for People' held in Jakarta, has not only grown in quantity but, also in quality. This reflects the development and dissemination of appropriate new interdisciplinary research approaches such as Rapid Rural Appraisal (KKU, 1985 and Molnar, 1989), the proliferation of innovative community forestry projects and initiatives such as the Tropical Forestry Action Plan and Forestry Sector Masterplans, that are being or have been carried out in virtually all tropical Asian countries.

Participatory Forest Resource Management

Another major cause for both the improvement of community forestry activities at field level and the documentation of these, is the greatly increased involvement of professional non-governmental organizations in community forestry activities (Taylor, 1993; FAO-RAPA, 1987). These experiences and the improved sharing of them have contributed to greater attention to hitherto neglected aspects.

Notable amongst the new directions in community forestry are:

- a. a much greater emphasis on management of existing forest ecosystems in various stages of evolution of degradation, including the co-management of local villagers of protected areas (Wells and Brandon, 1992) , and other forest areas in much better condition than the heavily degraded areas on which initial attempts focused,
- b. as a result of this, a greater variety of animals and plants and of produce needs to be considered in the assessment, participatory planning of management plans and monitoring (see for an early example Malhotra and Poffenberger, 1989),
- c. and this again, contributes to a greater emphasis on processing and marketing of a large variety of largely non-timber forest products (Campbell, 1991a and 1991b).

It is this greatly improved analytical basis that has also contributed much to more effective policies, programs, research and training activities. Though legal frameworks do sometimes pose rather serious constraints to rural people's management of forest and tree resources, there is a growing consensus that changing the letter of the law may be less important than issuing the right administrative guidelines for action, ensuring that both the foresters and the villagers are informed about the new guidelines and equipping foresters for their new tasks (Lai, 1993 and Fox, 1993).

An Integrated Approach to Community Forestry and Community Development

As stated earlier a major break through in community forestry was the recognition of common property rights of local communities which create the underlying support for rules and regulations to be effective. Throughout India and Nepal the village panchayat, or local administrative council, is devolving control to more community based committees that better reflect the communities' views. As in the case of the Nepali village, the member of the community that paid his fine had been bought into the system even though he was being penalised for it. The opposite occurs quite often in reforestation schemes. Members of the community might not see any benefits or advantages in planting certain tree species and go to great lengths to prevent their being grown.

Much has been made of the destruction of forest area by local communities. Yet, much of this destruction has not been caused so much by the villagers' wanton needs, but by ill-planned regulations on forest use instituted by governments (Arnold, 1990). When communities can derive benefits from the forest, rules and regulations set by communities are much more apt to conserve forest area than the top down government laws and protection methods (Arnold, 1990).

Originally, community forestry focused on enhancing forest cover and on the subsistence needs of rural people. In the last ten years, however, there has been a greater degree of emphasis on non-timber forest products (ntfps) that are collected by villagers. From rattan to ayurvedic plants to mushrooms, ntfps are increasingly being seen for the vital role and the substantial amount of income they provide to rural households. As are not only a major source of income for households but also play an integral role in developing community institutions. Indian states which have issued laws on Joint Forest Management allow local

communities to reap up to 25% from the sale of any mature trees grown on Forest Protection land. In Nepal communities with accepted management plans are entitled to 100% of the income from sales of community forestry products (RECOFTC, 1996). And in Bhutan because 80% of the population is active in the collection of ntfps, the identification and marketing of ntfps has emerged as a major policy concern of the government (FAO, 1996).

In West Bengal, India where the Joint Forest Management is quite strong it has been estimated that in many village communities local people derive up to 17% of their income from the collection of ntfps. In Harda Forest Division in the State of Madhya Pradesh, 163 forest protection committees now have a total of Rs. 1,652,000 in common funds. In the Udaipur Forest Division in Rajasthan more than 25 villages forest committees have built up Rs. 200,000 in common funds (Campbell, et. al, 1995). In the Ritagala Forest Reserve in Sri Lanka, research by IUCN and CIFOR shows that wild honey and fruit generated income near-equal to that earned by villagers from the sale of farm produce. About a quarter of the households derive most of their income from ntfps and in 90% of the households interviewed collection of forest products contributed to some of their household income.

These activities give communities the confidence to act on their own. Where government assistance is weak, income generated by ntfps provides a substantial resource for community development. In many cases income generated from ntfps is reinvested in protecting and managing the forest resources as well as in activities that benefit the community such as: agricultural loans, rental charges for water pumps, village lending institutions, schools and management of other resources like village fish ponds (RECOFTC, 1996). In Nan Province in Thailand, "Haq Muang Nan", We Love Nan Province, a program originally created to assist with community management of forest resources has turned into a wide range of collaborative activities within the district. Villages have started a seed bank, share information and technology concerning agro-forestry and multi-cropping, created income generating projects and have collaborated on AIDS education and projects for the youth.

Other activities look promising for the conservation of forest resources and community development. Community based ecotourism, woodlots and community saw mills are all activities that can assist in empowering and developing local institutions. Yet, there needs to be caution. While an integrated approach is easy to layout on paper and there are many convincing examples of the success of the community based approach, there are however many problems and constraints in the whole process.

In most countries forests are considered to be national assets and governments and forest departments are still unwilling to part with valuable forest land. Throughout much of Asia the theory of "small forests for small people" still prevails. Forest departments still see it as their role to protect and manage large tracts of valuable timber concession land. Community forests for the most part have been delegated to degraded lands. But what happens when communities restore degraded lands to profitable income generating plots? While central policy makers and forest departments may have accepted the transfer of rights and responsibilities because of the belief that community forests would be relegated to subsistent

needs, there is no guarantee that the same will be true if local communities are reaping substantial benefits (RECOFTC, 1996).

Another problem concerns Monopolies and Regulations that hinder the sale of certain ntfps. In many countries concessions to forest land are still in the hands of state monopolies or concessionaires. Local people might be able to act as collectors of ntfps, but cannot take part in the marketing and selling of certain products thereby decreasing their chances for profit

and a higher return. One case in the Philippines clearly illustrates the negative aspects of this practice. In the province of Palawan local people act as collectors of ntfps while the rights for transport and marketing are controlled by concessionaires. Often times food stuffs are paid to the collectors in place of cash at high rates of interest which has resulted in the institutionalisation of a debt bondage system (RECOFTC, 1996). While this might be an extreme case, all sectors of the marketing system must be decentralised in order to make fair and equitable returns.

Finally, communities are often not the homogenous idyllic societies that are often romanticised about by urban elites or NGOs. Different stakeholders (ethnic groups, castes, and individuals) will very rarely have common interests. Nor is it likely that communities are homogenous in regards to wealth, land tenure, occupation and religion (Gilmour and Fisher, 1991). If communities derive large profit from the sale of poles, timber or ntfps, then accounting, benefits, and use of the money must be transparent. It is very important for NGO and government officials and others working with the communities to be able to identify these divergent interests and see that these conflicts are solved in the most equitable fashion. In South Asia in particularly lower caste members and women are unlikely to have much of a voice in the decision making process even though they do much of the labor.

A broad range of factors must be taken into account for the successful implementation of community forestry. Cousins (1995) lays out the most important policy aspects conducive to establishing and supporting community based forest management:

- a. an appropriate legal framework, giving legal identity to common property arrangements which evolve at the local level but without imposing rigid and restrictive structures.
- b. support services which assist communities and groups to design their own appropriate institutional arrangements, using a facilitative and process oriented approach,
- c. appropriate rule enforcement procedures at a higher level in the institutional hierarchy to back those which prove ineffective at lower levels,
- d. democratic processes which guarantee the rights of the less wealthy and powerful (including women and youth) to an effective say in decision making
- e. institutional mechanisms for conflict resolution within and between user groups, through negotiation, mediation or arbitration,
- f. training skills such as literacy and record keeping which are needed for efficient local administration and organization.

(Cousins 1995: 11-12)

Unresolved Issues and New Constraints

Participatory forest management' approaches have evolved in South Asia to such an extent that in principle most of our forest and tree resources can be managed in a much more sustainable, efficient, and equitable manner than under the management regimes in which the state attempted to reserve the rights to these resources for conservation and/or for exploitation by outside agencies. The nature of community forestry support strategies and the implications for change or adaptation in policies, administration, extension, research, training and education, are pervasive, and require a well orchestrated approach and a learning process in which the various actors involved share lessons and implement changes that often go "against the grain" of a well entrenched forestry system.

Those of us sharing the new environmental concerns such as global environmental warming/greenhouse effects', 'biodiversity', and new inventions such as 'privatization', may well be advised to keep this ultimately political context in mind. If we do not succeed in explicitly linking global concerns with local concerns, we are not just turning the clock back for a century or so; we are missing a golden opportunity to develop our human and natural resources in a mutually beneficial interaction, rather than the mode in which the exploitation of nature by man, depends and reinforces the exploitation of man by man. We believe that the first mode is more in line with the basic precepts not only of Buddhism, but is of universal concern and we express the wish that such universal principles may guide the expression of our global concerns.

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14

AGROFORESTRY

B.P.K. Sinha

In India, the forests are mainly the property of the state. Through various rights and concerns under settlement proceedings, village communities are granted limited timber and other usufructs for their need. Private trees are grown only on farms and other common lands.

Uttar Pradesh is one of the biggest and most important states in the Union of India. In many respects it represents a median value for forestry in the country. The forests in Uttar Pradesh are under serious threat. They include; unregulated harvesting, uncontrolled grazing in the forest, clearing of forest for shifting cultivation or settlement activities and burning of forest floor litter to promote fresh grass growth.

Hitherto, agroforestry policies have focused on the boosting of tree planting on government and community land and lately on farm forestry where farmers are encouraged to plant trees on their own lands.

Among the assistance schemes launched were; supply of subsidised seedlings, bank loans on concessionary terms and extension services. However, despite all good intentions, hurriedly and poorly designed incentives generated negative effects on the development of agroforestry in India.

AGROFORESTRY

B.K.P.Sinha

General Features

The geographical area of Uttar Pradesh (UP), the fourth largest state in India, is 29.4 million ha, with a total population of 139.1 million (1990). It is the most populous state in the country with an annual increase of 2.5% from the level in 1981. About 80% of the population is rural. Birth, death and infant mortality rates have remained higher than the national average in UP. The literacy rate is 41.6%, which is below the national average of 52.1%. As per most other indicators of development and quality of life, the state is at the bottom of the scale.

The economy of UP is predominantly agricultural. The Gross National Income of the state is Rs. 228 billion (for the year 1992-93), resulting in per capita income of Rs 1591 per annum which is lower than the national average. Even though the per capita income has increased by 2.4% per year in UP since 1980-81, the increase has not been uniform. During the last decade, rise has been mainly in the service sector. The production sector has not shown a significant increment and the share of the primary sector has fallen. The gap between rural and urban monthly household consumption has widened, since real wages in the agricultural sector have not changed significantly.

Livestock in India in general, and UP in particular, constitutes a very important component of the rural economy as about 80% of the people live in rural areas and is depended upon agriculture, animal husbandry and forestry for livelihood. Most of the livestock near the forest depends mainly on grazing in the forests. The pressure is increasing continuously due to increase in number of livestock and reduced availability of fodder and pasture.

The Forest Resources

The value of tree forest products in UP, including timber, fuelwood and non-timber products totals Rs. 1.4 billion annually (1991-92) representing 0.6% of the gross state income. Besides that, the UP forests play an important role in protecting environment and biodiversity in the State. The total recorded forest area in UP is estimated as 5.17 million ha, which represents 17.55% of the total land area, but the actual forest cover is estimated as 3.40 million ha, accounting for only 11.4% of land area. Per capita forest cover in UP is 0.924 ha, which is only one third of the national average of 0.076 ha.

The forest area under Forest Department (FD) is 4.11 million ha, which is 62% of the total forest area. The forest area outside FD jurisdiction (Civil and Soyam forests, Panchayat forests, private and municipal forests) is 1.06 million ha. The recorded area of exploitable forests, under FD decreased by 1.5% per year in the period 1972-92.

Considerable tree wealth has also been created outside the recorded forest area through afforestation of community lands, farm forestry activities and strip plantation raised along the roads, canals and railways. The total planted area under these activities is 1.49 million ha. (1.4 million ha. farm forestry, 0.065 million ha, strip plantation and 0.025 million ha. community

village wasteland plantation), but no authentic data regarding the extent of plantations and the expected yield from these plantations exists. In addition to the above area, approximately 14000 ha has been planted under the plantation programme of Western India Match Company.

The forests are not uniformly distributed in UP. Good quality forests are concentrated in the hill and the Terai regions, accounting for 66% of the forest area. The Bundelkand and Vindhyan regions also contain significant patches of dry forests. On the other hand, the Gangetic plains are almost devoid of natural forest vegetation.

The forests in UP are under serious threat from many biotic pressures. These include (1) unregulated harvesting for self consumption and sale (2) uncontrolled grazing in the forest and (3) clearing of forest for shifting cultivation or permanent encroachment. The practice of burning the forest floor litter to promote fresh grass growth as well as soil compaction in heavy grazing areas add to the pressure. In addition, past policies that encourage industries to cut but not to plant trees, certain logging practices, inadequate funding for forest maintenance operations and illicit timber felling are all causes for the degradation and clearing of natural forests. The same forces, plus technical factors like primitive nursery practices, poor management and inadequate policies etc. have kept the productivity of plantations low.

Biodiversity Conservation

Although the total protected area follows the National Recommendations (4% of the land area), some geographical nature types are not included in the network e.g. the low-medium altitude pine oak forests and northern most areas are not represented in the system. Twenty one new protected areas have been recommended by the Wildlife Institute of India, and seven of these are included in the network.

Most of the Protected Areas do not have a management plan while some existing plans are inadequate.

Ex-situ wildlife conservation efforts in UP consists of:

- Breeding of endangered species in special facilities
- Breeding in zoological parks.
- Management of species in the river system through rearing and release programme.

The pressure on the forests caused by possible living inside or on the periphery of the areas constitutes a serious problem. To ease this pressure special eco-development schemes have been started around four National Parks, under the guidance of Central Government.

Forest Production

Both timber and fuelwood production has experienced a considerable decline during the last ten years. The sharp decrease in the mid 1980s was a result of the imposition of a ban on logging in forests above 1000 M in altitude and restrictions on clear felling of certain forests in the Terai region. On the other hand the wood supply from farm forests and agroforestry plantations has increased.

Timber extraction from the UP FD forests has fallen from 0.82 to 0.47 million m³ between 1973 and 1994. This declining long term trend (estimated to be 4.08% for timber and

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19.25% for fuelwood annually) is anticipated to continue under present policies. The production and production capacity of the FD forests are falling. Total timber productivity is projected to come down from 0.47 million m³ in 1994 to 0.45 million m³ in 2001. The corresponding decline in timber output from exploitable forests is from 0.31 million m³ in 1988 to 0.29 million m³ in 2001. Fuelwood production has fallen from 2.56 million m³ in 1973 to 0.45 million m³ in 1988. There will be a total wood deficit of 52.42 million m³ by the year 2000 if the present rate of decline in supply of wood (4.08% for timber and 19.25% for fuelwood) continues unabated.

Forest Based Industries

The most important forest based industries in the State are pulp and paper industries, and at small scale level, saw milling and carpentry. Besides these the Katha, plywood and match industries, both at large and medium scale, play a substantial role in UP. The secondary and tertiary wood industries are still underdeveloped. Non-wood Forest Products are important elements in forest management in UP. All major regions of the State i.e. the Hills, the Terai the Bhabhar, the Gangetic plain, and the Vindhyan plateau have their specific products.

Agroforestry Policies

Although policies in the country were originally designed to boost tree planting on under productive, non-forest government and community land, greater importance was soon attached to farm forestry whereby farmers were encouraged to plant trees on their own land. In order to boost the activities of Agroforestry in UP private nurseries were granted a certain amount of money (about Rs. 0.40) for each seedling raised and private producers were free to sell them in the open market. In many other states, where government was distributing free seedlings and no private market existed, a buy-back arrangement with private nurseries was promoted, whereby the Forest Department would buy seedlings and either use these on public lands or distribute them to farmers, such arrangement for buy backs were also made for U.P.

It was assumed that farmers would react to these various incentives by planting trees on homesteads on farm boundaries, primarily to meet their immediate requirements for fuelwood and other rural uses of wood and thus reduce pressure on public forest lands. The initial success of the farm forestry programme generated great enthusiasm and led to the belief that government policies had been highly effective in promoting tree planting. However, the optimism was short lived with some exceptions. The farm forestry program remained confined to the more modernised and advanced regions making little impact on the vast subsistence areas in India. Even in some regions, where the program had been successful in the early 1980s, it could not be sustained beyond 1986-87. Except in a few affluent areas, government policies were not successful in promoting farm forestry in the scale it was envisaged in the project.

In areas where the program did have success, initial response was spectacular and exceeded the most optimistic expectations. In Uttar Pradesh, the supply of seedlings had to be expanded from the originally planned 8 million to 35 million during the period 1979-84. However, after this spectacular initial boom, farmers' interest declined sharply. The success of tree planting was more a coincidence, than the result of government incentive policies. The prevailing market and uncertain conditions in different regions seem to have stimulated the boom in tree farming, and not government policies, despite their visibility.

One of the main incentives was the seeding subsidy. To foster private tree planting, seedlings were distributed by the government either free or at a very low price. The government effort was not insignificant: the total number of seedlings distributed under the farm forestry program in India was 1.4 to 2 billion a year (enough to plant 560,000 to 800,000 hectares), at an annual cost of about Rs. 700-1000 million (US\$ 50-65 million) during 1985-89.

However, the incentive does not appear to have operated for more than a short period of time. For example, in Uttar Pradesh when brisk demand caused a shortage of government seedlings during 1981-86, private nurseries sprung upto cope with the demand and sold seedlings at up to ten times the official price. After 1986, when farmers enthusiasm for planting eucalyptus in the North-western states declined and the Uttar Pradesh state government started distributing free seedlings, planting did not resume.

The government also sought to stimulate planting by increasing the number of nurseries to make seedlings locally available to all farmers. During the first phase of the programme (1982-86) there was a substantial expansion in the number of government nurseries through an ambitious "decentralised nurseries scheme". Another instrument, the extension service also seems to have had a limited impact on farmers' decision to invest in tree planting. Success depended on the effect of various restrictive policies as opposed to incentives policies-that dominated farm forestry.

Thus, against official expectations that trees would be planted to satisfy household needs of fuelwood, farmers instead planted trees for the market and for profit. Market or financial profitability reasons accounted for 96 percent of the trees planted. In fact, profitability of farm forestry activities during the first years of the farm forestry programme was generally high. A series of ten studies showed profitability levels for farm forestry investments ranging from 14 to 55 percent.

The quality of subsidised seedlings is notably inferior to that produced in private nurseries. The subsidised seedling policy alone provided little or no incentive at all to planting trees. In fact the cost of seedlings generally is not a substantial proportion of the cost of planting in the first year.

Planting trees provided a good alternative to keep encroachers out at a relatively low cost., demanding modest management input, and requiring the sporadic presence of the land owner. Planting took place when there was a relatively depressed agricultural market, it was mostly undertaken by relatively richer and often absentee landowners who were more willing to take risk, had enough cash to sustain longer periods without financial returns, and who had better access to institutional credit. Where poor farmers were concerned, the inability to wait until trees matured, the relative difficulty in obtaining credit, the lack of dynamic markets, and the modest levels of financial profitability did not encourage planting in the same measure. As subsidies appear to have had a rather limited role in shaping total profitability of forestry investments, it is not surprising that they were not effective in determining the pace of farm forestry in U.P, and also in India.

Reasons for Policy Failure

- a. Policy decisions taken in the past generated a number of complex reactions that need to be analysed to understand their impact. There was no mechanism to undertake timely policy decisions.
- b. There are host of unintended consequences which cannot be predicted in advance i.e. the case of Eucalyptus.
- c. Effective policy can work only if there is adequate institutional structure and capacity to implement it.
- d. There were technological and planning deficiencies in Uttar Pradesh Forest Department (UPFD).
- e. Also, there were the vested interests, red tape, lack of motivation and inefficiency at various levels in Government.

Financial Issues in Agroforestry

Even though a number of a schemes were forwarded by commercial banks to National Bank of Agriculture and Rural Development (NABARD) and most of them were formally sanctioned by the latter for re-finance, the disbursement drawn by the farmers was very poor. The factors responsible for poor disbursement can broadly be divided into administrative and academic aspects.

Administrative Aspects

- (a) ***Time Lag for Sanction of Loan:*** One of the major reasons for poor disbursement was the big time lag between the date of submission of the application by the beneficiary and the final sanction of the loan communicated to him. The farmers interested in taking a loan for farm forestry are supposed to submit the loan application as per the guidelines of NABARD with the help of local banks.
- (b) ***Appraisal of Technical Feasibility at Bank Levels:*** The banks also do not perform the technical feasibility as they do not have a forestry officer in the local branch. The technical feasibility is examined by the forestry wing of NABARD. In case of failure of forestry projects on technical grounds, the entire responsibility about the failure lies with the local banks. Therefore, the local banks are not motivated enough to take up the risk, particularly on technical feasibility of the projects.
- (c) ***Security Requirement Against Loan:*** The quantum of concessional finance available for classified wasteland, is much lower than the loan amount sought. Therefore, either the farmer has to arrange the security from other sources or the bank has to take the risk of sanctioning the higher amount on lower valued land. Neither the banks are interested in advancing the loan without proper security, nor are the farmers able to produce enough property for mortgaging to meet the security requirements of the banks.
- (d) ***Uncertainty Associated with Repayment:*** The banks in case of agricultural loan, get their loan repaid within a year, whereas the long gestation period in forestry projects leads to lot of uncertainties. An officer in the bank, sanctioning the loan has to

monitor the use of funds in forestry projects for 2-3 years and the returns from such investments will start only after 7-8 years. The risk involved is very high in case of farm forestry projects.

- (e) **Insurance Requirements:** The conditions laid down for financing the forestry projects, require that the beneficiary will get his tree crop insured. The premium of insurance is very high and farmers find it hard to afford the same.

Academic Aspects

- a. **Bankability of Projects:** The NABARD has put a condition of minimum Internal Rate of Return (IRR) of 15% on forestry projects. The forestry projects are typical in nature, in which the inputs are utilised in initial years and the returns will start only after 7-8 years. However, for calculating the IRR we take the cost and benefit streams at constant price. This aspect needs examination. In case of long duration projects/crops, particularly teak in which the benefits can be harvested only after 15-20 years, the value of benefit will get reduced significantly due to constant prices and discount factor. The use of IRR method in decision making, without incorporating the inflation factor, is debatable.
- b. **Criteria for Approving Forestry Projects:** The NABARD has a uniform set of criteria for judging the bankability of the projects, irrespective of the soil type, and the possible tree species that can be grown. Different bankability criteria should be adopted for various regions depending upon the potential of soil, etc. A policy decision is necessary regarding financing the forestry projects at differential rate of interest not only based on the classification of farmers into small, medium and large farmers, but also based on the potential of the land they possess.
- c. **Separate Institution for Financing Forestry Projects:** In order to overcome the above mentioned technical and administrative problems, the desirability of having a separate institution or a division under the NABARD for directly dealing with forestry projects needs consideration. Some other alternative institutional structures can also be thought of to overcome these problems, especially those of small farmers.

A New Agroforestry Strategy

A site specific standardised package for agro and farm forestry can be developed if following factors are considered in strategy formulation:-

- a. Identification and delineation of all private lands which can only occasionally be used for crops. All land categories, as large and short fallows can be considered first.
- b. Classification of identified needs according to status of ownership. While religious, social and philanthropic virtues should be put to the fore for social engineering of Agroforestry application for public land, visible private motive should be the main consideration.
- c. Research for identification and evaluation of exotic and locally available plant material of either viability, genetic variability and capability to fit into agroforestry use of such land.
- d. Provision of spearhead team of extension experts deft in handling production and marketing of Agro-forestry output mix.

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- e. Provision of spearhead team for development of Agro-forestry.
- f. Provision of constant continuous interaction of field teams, and farm leaders with researchers engaged in pursuing region-specific Agro-forestry research.
- g. Standardisation of techniques for quicker multiplication and genetically uniform propagation of useful plant material using bio-tech methodologies.
- h. Continuous evaluation and monitoring of the new technologies providing the feed back to researchers.
- i. Inclusion of agroforestry-factory curriculum in the degree programmes for agricultural graduates.
- j. Intensification of rural management training programs to graded level of field workers through 'capsules' of mass-media and computer-aided instructional techniques.

Strategy for Marketing

The strategy for improved marketing of Farm Forestry produce has to be both on a short and long term basis.

The short term strategy should be:

- a. Removal of all existing restrictions relating to harvesting, transport and free marketing of Farm Forestry (FF) produce. These restrictions have not served in reducing illicit felling nor have they served an environmental cause. On the other hand these restrictions have stifled the growth of FF which could actually have helped both causes if it was allowed to develop freely by providing the incentives of no restriction for marketing.
- b. Supply of forest produce at subsidised rates by the State Government leads to an unfair competition for FF produce; this marketing disincentive should be done away with.
- c. Denotification of all species which have been nationalised to enable farmers to market them freely.
- d. Denotification to ensure that trees of certain species are not considered as state property because they might be growing on private lands. All of these species can contribute much to meet the requirements of forest based Industries. The notification would enable farmers to market these species freely and would lead to more planting of these species on their lands.
- e. Collection and dissemination of appropriate market information needs to be ensured so that farmers can receive remunerative prices for their FF produce..

The long term marketing strategy must include:

- a. Measures to ensure high quality planting material of preferred species to enable higher yields and greater financial returns from marketing of FF produce.
- b. Opening up new market opportunities for FF produce by educating users regarding the utility of such produce. For example Eucalyptus poles of appropriate specifications when

preservative treated can well replace electricity and telephone transmission poles in rural areas at cheaper cost for the user agencies.

- c. Development of linkage between farm forester's and using industries to ensure Continuity of marketing opportunities and incomes for farmers.

The following actions are suggested. For the implementation of these strategies.

- a. Most policies, practices and legislation at the State level leading to the restrictions are the outcome of certain policy guidelines of the Central government. It should now be the responsibility of the Central Government to take a fresh look at these policies and practices so that necessary guidelines could be issued to State Governments.
- b. Certain species which have been nationalised must be denotified to enable farmers to grow and sell such species at their own free will.
- c. Steps will have to be taken to collect market intelligence and disseminate it. The methodology for this has to be worked out in detail. To strengthen the marketing opportunities of farm forestry efforts must be made to increase their market power. This should be done through the promotion of "tree grower co-operatives" on a formal or informal basis.
- d. Research must be initiated on tree breeding through genetically improved tree planting material. This activity is beyond the capacity of FDs and should therefore be entrusted to competent research organisations and the improved planting stock made available to farm foresters.
- e. Efforts must be made by FDs to promote the use of FF produce by user agencies such as the Telephone Department, State Electricity Board etc. Efforts must also be made to forge links between private tree planters and forest produce using industries.

Development of Homestead Gardens

Homestead planting is practised in different parts of the State in some form or the other. The choice of the species, silvicultural practices and tending operations have evolved over the years to meet the requirements of the social, cultural, economic and physical requirements of the setting. As a matter of fact house owners are in a way practising managers. This activity should be supported by supplying good seeds, grafted varieties, improved cultural practices, dissemination of information and making available suitable planting material.

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CONSERVATION ORIENTED AGRICULTURE

Gregory C. Ira

The current rate of biodiversity loss is the highest since the Pleistocene era, In terrestrial ecosystems, one of the major causes of biodiversity loss is the conversion of natural ecosystems into agricultural lands. For tropical forest areas, agriculture is estimated to account for as much as 60% of all forest conversion.

One approach to conservation has been the establishment of protected areas. The area covered by this form of protection has increased dramatically over the last twenty years. In these areas, special emphasis needs to be given to the conservation aspects of agriculture while at the same time providing improvements in community development.

Conservation oriented agriculture refers to farming systems which promote the conservation of soil water and biodiversity, while minimising conversion of natural ecosystems. Rather than a single practice or technology, conservation-oriented agriculture will vary from place to place.

Developing and promoting conservation oriented agriculture requires a number of steps. First, a common understanding of the conservation and development goals of the area have to be established. Second, existing local conditions, practices, goals, and priorities need to be assessed. Third, options need to be developed, tested and adapted. Fourth, promising options should be promoted through farmer-led approaches.

CONSERVATION ORIENTED AGRICULTURE

Gregory C. Ira

Food production in South Asia as a whole is growing faster than the population. Yet serious problems of poverty, malnutrition, and environmental degradation still exist. Fifty eight percent of the children in the region are currently malnourished (Rosegrant and Malik, 1995; 1). A recent estimate puts land degradation at 72 percent for agricultural lands in South Asia (UNDP, FAO, and UNEP 1993) CITED In Scherr and Yadav 1996; 16). Future population growth and the current leveling of major crop yields are additional concerns. Asia is already cultivating 80% of its arable land, which means options for brining new land under cultivation are limited. At the same time, more and more land is being set aside for conservation in the form of protected areas. These trends foretell an increasing number of situations where farmers will have to develop conservation-oriented agricultural practices in order to meet their own food security, economic needs and the constraints imposed by conservation.

Conservation-oriented agriculture refers to farming systems which promote soil and water conservation and biodiversity and which minimise conversion of natural ecosystems. Like sustainable agriculture, the specific form of conservation-oriented agriculture will depend on the particular conditions of the area and thus, will vary from place to place. The establishment of protected areas is the primary method of conserving biodiversity under natural evolutionary conditions. National protected area systems can be found in most countries in the region. The average percentage of national lands protected in South Asia (excluding Bangladesh) is 9.4, well above the 3.2 average for Asia (WRI, 1992). Indigenous knowledge refers to the knowledge that people in a given community have developed over time. Hence, it is based on experience, tested over long periods, adapted to local culture and environment, and is constantly evolving (Mathias, 1995)

Developing and promoting conservation-oriented agriculture requires a number of general steps. First, a common understanding of the conservation and development goals of the area have to be established. Second, existing local conditions, practices, goals, and priorities need to be assessed. Third, options need to be developed, tested and adapted. Fourth, promising options should be promoted through farmer-led approaches. This process combines approaches of integrated conservation and development (ICD), indigenous knowledge systems (IKS) and participatory technology development and dissemination (PTD & D). An underlying theme is the active participation of local communities in partnership with NGOs or other "agents of mutual learning."

Harmonising Agricultural Development and the Environment

Harmony between agriculture and the environment is a balance between production of crops for human consumption and protection of the natural resource base. There is no easily recognisable point of discord when the balance tips towards production at the expense of the environment. There are, however, a number of indicators which can be monitored to assess the sustainability of agricultural development. These indicators fall into two broad categories. They are; socio-economic and biophysical.

Loss of Biodiversity

Biodiversity has economic, environmental, ethical and aesthetic values. Without regular infusions of genetic variability into modern crops such as maize, wheat, rice and the like, we cannot maintain the productivity of our food base, let alone expand it; nor can we keep up with a never-ending race against newly emergent pests and diseases (Myers, 1996:2). Agriculture affects biodiversity in four different ways. They are; the homogenisation of crop diversity; the homogenization within species, the degradation of habitats, and the conversion of natural ecosystems.

The homogenisation of crop diversity has occurred in both developed and developing countries. It is the result of the large scale promotion and adoption of a limited number of crops. It is the result of the large scale promotion and adoption of limited number of crops. Today roughly 60% of all calories derived from plants are met by only three crops (Fowler & Mooney 1990 cited in Pretty 1995; 75). Biodiversity has also been lost at the genetic level; that is, the number of varieties of a given species is decreasing. India used to have roughly 30,000 varieties of rice; now only 10 varieties can be found on 75% of the rice lands (Pretty, 1995; 77).

Habitat degradation from agriculture is particularly high for aquatic ecosystems where agricultural runoff laden with sediment, salts, pesticides, herbicides and fertilizers ill aquatic life. Excessive use of pesticides and fertilizers contributes to pollution and the elimination of beneficial pest predators and other non-target organisms. These pollutants enter surface and groundwater and eventually affect a wide range of plants and animals including people. The long term benefits of these pesticides are questionable. In the 50 years since pesticide use became widespread, the percentage of crop loss from pest damage has not measurably declined (WRI, 1994; 113). In addition, recent reassessments of the costs and benefits of pesticides bring into question their net value to the farmers. A study by the International Rice Research Institute (IRRI) – the birthplace of the Green Revolution – found that the costs of addressing health problems resulting from pesticide use are greater than the value of crops lost to pests (IFPRI, 1996; 20).

The most serious impact on biodiversity, however is the complete conversion of ecosystems to permanent agriculture. This is particularly serious in species rich tropical forests. Globally, it is estimated that 60% of all tropical forest ecosystem conversion is the result of agriculture (IFPRI, 1995). The situation in India is similar, where agriculture causes five times more forest loss than the next highest cause.

Table 1: Forest Area Lost for Various Purposes in India

Purpose	Area Lost ('000 ha)
Agriculture	2507
River valley project	475
Establishment of industries	127
Construction of roads	57
Miscellaneous uses	965
Total forest area lost in '000 ha since independence	4135.7

Source: Base Paper for the Second Committee of the National Environmental Advisory Committee (DoEn, 1985) cited in Dang (1991;29)

The loss of genetic, species and ecosystem diversity as a result of agricultural development involves two processes. The first affects genetic and species diversity. It is the homogenisation process which is the result of the widespread adoption of a limited number

of crops and varieties. The second, is the loss of (or conversion of) ecosystems and ecosystem diversity will also cause the loss of the species and genetic diversity housed by the ecosystems. Therefore, while both are important, the loss of ecosystem diversity may have a greater impact on the environment. The decisions made by farmers to either maintain or deplete biodiversity is tied to the local culture, economy and demographic trends.

Use of Indigenous Knowledge

Indigenous knowledge can be defined as the knowledge that is: unique to a given community or society; adapted to local culture and environment; often transmitted by word of mouth; the basis for people's decision making; evident in local classifications; dynamic and changes over time. Indigenous knowledge is often referred to as local knowledge and traditional knowledge. While there may be subtle distinctions, they can be used.

Indigenous knowledge includes information or facts, practices, technologies, beliefs, tools, experimentation, and management systems. Some of this knowledge is common to everyone in the community. There is also knowledge shared among particular groups (e.g., women, fisherfolk, etc.) and more specialized knowledge held only by a few individuals. "who knows what," will depend on a number of factors: age, sex, profession, environment, socio-economic status and experience.

Indigenous knowledge is important to development in general because it can improve the cultural appropriateness of development projects, thus increasing the likelihood that they are sustained. Specifically, projects drawing on indigenous knowledge can reduce costs by focusing on local inputs and by facilitating the identification of potential options. For example, studies have shown that the screening of plants for medicinal properties is more efficient when guided by local ethnopharmacological knowledge. Similarly, the selection of potential agroforestry tree species from local species will be facilitated by local ethnobotanical knowledge (IIRR, 1995).

Not all indigenous knowledge, however, is useful. In some cases such knowledge may be neutral or even harmful, especially if local conditions have undergone rapid exogenous change. It is important to recognise these characteristics in order to better use it in development or conservation projects. The role of indigenous knowledge systems is of greater importance in remote, isolate, complex, diverse and risk-prone areas. This is because it plays a more dominant role vis a vis external or international knowledge. These same types of areas are commonly identified and established at the national level as protected areas for conservation. Therefore, the successful promotion of conservation-oriented agricultural practices in these areas will require that protected areas managers, rural development practitioners and agricultural extension agents give more attention to the indigenous knowledge systems of the affected communities.

Indigenous Knowledge and Conservation

Alcorn (1995) identifies seven resources that can be collected from ethnobotanical knowledge. They are principles, facts, technologies, crops, farming systems, strategies, and information about local constraints and opportunities. She goes on to explain that these resources can contribute to improved rural livelihoods, sustainable use of natural resource base, improved well-being, health and nutrition; strengthened institutional capacity to meet the needs of rural people and the generation of capital surplus for financing industrialisation. Finally, she states that these "...are especially valuable in regions of 'marginal' farmland or

pasture where high-input, capital-intensive systems are unprofitable or unsustainable. " This last point is particularly relevant in and around protected areas which are frequently the most remote and inaccessible areas in developing countries.

Fujisaka (139;1995) also emphasize the importance of farmers' knowledge, but his focus is on identifying and prioritizing research issues. He also stresses the importance of farmer participation in the design, testing, and adaptation of appropriate technologies. Finally, he considers farmer-to farmer technology transfer an efficient method of sharing agricultural improvements. Farmer-to farmer technology transfer is important especially in remote areas where government extension agents do not serve.

Haverkort (1995; 454), on the other hand, describes three sources of knowledge which characterize Low External Input Sustainable Agriculture. They are; traditional agricultural practices; indigenous knowledge; and scientific insights as developed in agroecology. He envisions a blending of these three sources of knowledge in the process of developing new technologies. Similarly, Altieri and Yrujevic (1995; 458) similarly promote an agroecological – ethnoecological approach to incorporate indigenous knowledge in the development of sustainable agricultural practice. This approach is a combination of knowledge systems including the farmers' rationale (ethnoecology) and the scientific basis (agroecology). Members of the *Consortio latino Americano sobre Agroecología y Desarrollo* (CLADES) use this approach to preserve local culture, improve local agroecosystems, develop appropriate technologies and conserve local resources. All these examples emphasize the importance of understanding and working with farmer's indigenous knowledge for agricultural development.

Indeed, indigenous knowledge is relevant to development efforts in general but has special relevance to conservation. The IUCN (McNeely, 1995; 448) suggests six major steps for incorporating this knowledge into conservation management systems. They are; give appropriate value to traditional rights, knowledge and skills; take special measures to protect rights of traditional peoples; provide information on traditional management systems; design and implement research programs aimed at promoting the application of traditional wisdom to modern resource management; design projects which benefit indigenous people; and design projects which benefit from traditional knowledge.

The distinction of IK for agricultural development and IK for conservation management systems is a result of our own preference for reductionism and professional specialisation. In most cases IK systems of farmers and indigenous peoples are holistic (Mathias, 1995; 6); that is, they do not distinguish between the agricultural components and the natural resource conservation components. For example, the farming systems of certain tribal groups in the Cordillera range of the Philippines integrate forest conservation on hilltops with their intensive rice terraces.

Conservation Oriented Agriculture

Conservation-oriented agriculture is a form of sustainable agriculture that emphasises environmental protection, particularly in the form of intensifying extensive systems in order to set free land for conservation. It seeks to achieve a balance between productivity, stability, diversity, equity, socio-cultural acceptability and environmental sustainability. It attempts to do this through sustainable intensification which relies on low-input approaches to address the following agricultural concerns: This approach is particularly important as a method of reducing the land requirements of current populations. This can reduce pressure on natural ecosystems identified for protection by freeing up land for conservation. In situations of rapid

population growth it can provide a buffer to accommodate more farmers. This is the central theme of the paper and is worth repeating. While protected areas may not suffer from high population densities, the sustainable intensification of agriculture may allow previously used lands for conservation or accommodate population increases without the need for clearing new land. Increases in productivity can be achieved on a sustainable basis, especially in areas where the previous systems were extensive.

The potential increases in yields will vary. In areas not yet affected by modern agriculture, the increases may be substantial. Pretty (1995; 2) using estimates from FAO and World Bank data, suggests that there are some 1.9 to 2.2 billion people largely untouched by modern technology. They exist in remote, complex, diverse ecosystems in humid and semi humid lowlands, the hills and mountains, and the drylands of uncertain rainfall. They produce one-fifth as much food per hectare as farms in the industrialised and green revolution lands. He suggests that these regions can benefit most from sustainable agriculture "with yields doubling to trebling with little or no use of external inputs."

Like sustainable agriculture, the specific form of conservation-oriented agriculture will depend on the particular environmental, social, political and economic situation of the area. Conservation-oriented agriculture will vary from place to place, depending on the existing practices and local conditions. Therefore it makes more sense to consider transitions to more conservation oriented agriculture rather than a specific set of cropping systems or technologies. These transitions will draw not on external inputs but on increased labour, local knowledge, and better management practices (Pretty, 1995;). While there is no single package of technologies for conservation-oriented agriculture, there are a few key areas that will need to be addressed. There are several resource-conserving technologies such as integrated pest management, use of legumes and green manure, agroforestry systems and water conservation and harvesting that can be used to increase yields without significantly increasing inputs.

Integrated pest management seeks to reduce chemical control of pests through practices such as improved cropping systems, natural predators, improved host plant resistance, improved crop health, physical barriers, cultural management, and bio-pesticides. The use of integrated pest management practices can reduce dependence on chemical pesticides, improve yields and generate savings at a national level.

Table 2: Impact of IPM Programmes on pesticide use, crop yields and annual savings

Country and crop	Average changes in pesticide use (as % of conventional treatments)	Changes in yields (as % conventional treatments)	Annual savings of programme (US\$)
India, rice	33%	108%	790,000
Sri Lanka, rice	26%	135%	1 million

Improving soil fertility and organic matter without external inputs can be done through the use of green manuring, composting, improved fallows and crop rotation. Green manure crops can add 30-60 kg N per ha annually (Greenland, 1986 cited in Reijntjes et al 1992; 168). Green manuring can be achieved in different ways: improved fallow, alley cropping, relay following, live mulching, liquid manure production and azolla production.

Table 3: The impact of green manuring of legumes on cereal yields

Country	Green manure	Cereal	Impact on yields (as % of conventional)	New yields (kg/ha)
Nepal (terai)	<i>Sesbania Cannabeana</i>	Rice	194%	3340
Nepal (terai)	<i>Srostrata</i>	Rice	218%	3690
Nepal (terai)	<i>Vigna radiata</i>	Rice	200%	3380

Source: Pretty, 1995; 116

Agroforestry systems are the most commonly promoted agricultural development approaches within the around protected areas. This is because they have the potential to support the transition from extensive and shifting systems to semi-intensive sedentary systems. The additional labour requirements alone usually limit the amount of land a farm family can manage under agroforestry systems. If the labour requirements, however, become too severe, then the use of communal workgroups can be explored.

Experience from the Philippines indicated that Sloping Agricultural Land Technologies (SALT, developed by the Mindanao Baptist Rural Life Centre) that combine soil and water conservation technologies (i.e. contour farming with contour hedgerows) with livestock and leguminous trees as hedgerows can increase yields three to four times. Additional labour requirements are met through the revitalisation of indigenous communal workgroup known by various names throughout the Philippines (e.g., alayon, bayanithan, hulungan).

The improved use of water resources is a critical component of any agricultural system. While many practices require substantial inputs of labour; the returns in yields can be significant. Water harvesting practices such as small farm reservoirs and fish ponds can extend the growing period and diversify farm resources through aquaculture.

Table 4: The impact of combinations of IPM training and fish culture on rice farming in Bangladesh

Farmer trained in:	Change in pesticide use (as % of normal practice)	Rice yields (as % of normal practice)	Food and income from fish
Normal practice	100%	100%	No
IPM only	24%	110%	No
Rice-fish	0%	117%	Yes
IPM and rice-fish	0%	124%	Yes

Source: Kamp et al, 1993 cited in Pretty, 1995; 129

Protected areas play a vital role in conserving wild plant and animal diversity. They can also help in the protection of the biodiversity of traditional species and varieties of domesticated crops and livestock. Because much of the agriculture in and around remote protected areas has not been significantly influenced by Green Revolution technologies and packages, they are useful sites for such conservation. Governments and conservation organisations should be willing to support conservation of traditional farming systems and the crops and livestock therein when there is a significant opportunity cost for farmers to continue traditional practices rather than to switch to modern ones. This particular approach has been proposed in the Nilgiri Biosphere Reserve, India (Sukumar, 1990; 32)

Semi Intensification

Semi-intensification is a key component of conservation-oriented agriculture. It is analogous to transition from single story, single unit dwellings to high rise complexes. The latter represents a more intensive use of area, thereby freeing up land for other uses including conservation. The most commonly cited example of intensification of extensive systems of agriculture related to the transition from shifting cultivation to short fallow or sedentary cultivation. Reijntes et al (1992; 103-104) describe the process:

The natural following processes used to restore soil fertility and limit pest populations are replaced by management systems requiring more inputs for nutrient supply and crop protection. These inputs may be produced on-farm or come from outside. For this, the farmer needs labour, knowledge and/or cash.

In many remote tropical forest areas, extensive land use systems are a result of low labour availability and environmental factors. The case of shifting cultivation has been well documented. Assessments of this extensive form of agriculture have ranged from extremely critical to idyllic. Much depends on whether or not the groups in question are traditional practitioners or recent immigrants. Similarly, external pressures which affect land availability and population growth will also influence the viability of the system. In any event, reducing or eliminating the fallow period are the primary methods of intensification.

One approach to sustainable intensification is the reduction of the fallow period. This should allow a faster cycle on less land. Because this approach is less drastic than a complete switch to sedentary systems, it may be more culturally acceptable. Methods to achieve shorter fallow periods include assisted natural regeneration, and improved fallows. Assisted natural regeneration facilitates succession by initiating the growth of selected pioneer or secondary growth species. Improved fallows involve the planting of leguminous cover crops which protect soils and replenish soil nitrogen during the fallow period.

The ultimate reduction in a fallow system is the establishment of sedentary cultivation. Sedentary cultivation on relatively infertile upland, tropical soils depends on the prevention of soil erosion and the maintenance of soil nutrition. Agroforestry systems – an outgrowth of many indigenous systems – provide some option for sedentary cultivation especially in sloping lands. Agroforestry combines annual crops, perennial crops, tree crops, livestock and other components in various spatial and temporal arrangements. In the Philippines, farmers that have adopted Agroforestry systems have reduced the area they cultivate. In these areas, some farmers have begun to plant trees for fruit production, timber and fuelwood production, and no-timber forest products such as rubber (Palmer 1996 personal communication).

In addition to semi-intensification, some people might take the argument one step further in order to justify high-input, intensive systems as a method of conservation. Paarlberg (1994;1) makes this case for India.

By switching to highly responsive seeds, more fertiliser use, and expanded irrigation, India was able to double its total wheat production between 1964/65 and 1970/71. This not only helped India avoid a famine, it also helped to protect the rural environment. If India has attempted to use traditional low-yield farming techniques to secure the same wheat production gain, it would have had to plow up an additional 36 million hectares of cropland, resulting in further deforestation. Substantial habitat destruction, and soil erosion. Environmentalists who criticise India's green revolution should acknowledge the need to boost total production and weigh

the environmental damage that would have taken place if this had been attempted without a switch to input-intensive farming.

While recognising the contribution of such intensive farming systems, for reasons mentioned earlier in this paper, they should neither be praised nor condemned. Instead, they should be assessed, like any other agricultural system, for ways to make them more sustainable. However, since resource-poor farmers exist in remote, diverse and complex environments such as those around protected areas, such non-sustainable, high input, intensive farming is not likely to be relevant.

Conservation Areas

Modern protected areas are established for biodiversity conservation, maintenance of environmental services, recreation, and historical reasons. The land area covered by this form of protection has increased dramatically over the last twenty years. Between 1972 and 1982, the number of parks and other protected areas around the world increased from 1,823 to 2,671, and their area expanded from 2,262,000 square kilometers to 4,160,000 square kilometers (for comparison, India's entire territory totals 3,290,000 square kilometers). Of this increase, more than two-thirds has occurred in the tropical nations (Myers, 1986; 7).

Table 5: percent of national land area protected in South Asian countries

Country	Percent of National Land area Protected
India	4.1
Nepal	6.8
Bhutan	19.7
Sri Lanka	11.9
Bangladesh	0.7
Pakistan	4.6
Asia	3.2

Source: WRI, 1992 World Resources 1992-93

The rationale for establishing these protected areas may be different over time and space but the impacts probably have not changed much. Protection implies some form of restrictions on use. These restrictions usually affect resource use and land use. Because agricultural land uses predominate in these areas, these restrictions probably affect more farmers than any other group.

The result of regulation or restriction on long standing patterns of behaviour is usually met with resistance. This is, in part, the reason why so many alternative livelihood projects for protected areas have failed. They have been imposed on local communities based on management goals, and allowable practices established by outsiders. The question, then, is what process can be used to stimulate endogenous change for conservation.

Transition to Conservation oriented Agriculture

What kind of stimulus would support and endogenous transition by farmers toward conservation-oriented agriculture? There are a number of possibilities: increasing population pressure; decreasing land per capita; regulations from the state; increasing linkages to cash economies; and information are a few. Often, these may occur in combination. Some are exogenous (e.g., state regulation), and others endogenous (e.g., population growth). Stimulus

form outside the community – as in the form of regulation – or even in the form of promised yield increased is likely to be ignored. Netting (1993; 263) points out what “Without the spur of scarcity, people do not intensify their farming for the simple economic reason that it is more work – making ridges with a hoe, grubbing up at tree stumps, carving out a terrace, or digging an irrigation ditch takes more time and effort than does firing a swidden – and the return on labor may be smaller.” This would indicate that environmental managers need to help to create conditions and support strategies that stimulate endogenous change.

The transition to conservation-oriented agriculture can be facilitated through the establishment or strengthening of certain conditions. In some cases these may or may not be pre-requisites. The investments in labour and land preparation for long-term benefits are not likely to materialise without recognition and security of land and resource tenure. The acceptance of sustainable-use within portions of protected areas, and the equitable distribution of the costs and benefits of conservation are relevant. The establishment of preferential access or control based on a combination of length of residency, proximity to the protected area, historical use patterns, and dependence on the resources is very important. The consistent implementation of protected area rules and regulations is as important as the recognition and use of indigenous knowledge of local communities. The acceptance of both conservation and development goals established for the area by a majority of stakeholders must be ensured. Co-management is considered an important way of ensuring a management role for local communities. Cooperative agreements between local communities and park managers are needed to help clarify and formalise relationships.

Participatory Technology Development (PTD) is the process where the farming communities develop agricultural technologies with the support of development workers (Haverkort, 1945; 455). Haverkort goes on to describe the role of the development worker, which is to strengthen the capacity of local communities to experiment and innovate technologies that are relevant for local agriculture. In a workshop held in 1988, the Information Center for Low External Input Agriculture (ILEIA), concluded that PTD is a necessary condition especially for complex, diverse, and risk-prone rain-fed agricultural systems. Because these are the very conditions commonly found around protected areas PTD is a relevant approach to developing conservation-oriented agricultural technologies.

An additional approach used by many groups practicing PTD is the use of farmer-led approaches to extension and sharing. These approaches include farmer-to-farmer extension, farmer trainers, and cross visits for farmers. These are all approaches to sharing or disseminating farmer proven technologies. When used in conjunction with PTD it is often referred to as participatory Technology Development and Dissemination (PTD&D).

The problems of food production, environmental protection, and peoples participation come together in the development of conservation-oriented agriculture in protected areas. While these areas represent less than 10% of the land area of most South Asian countries, they are important repositories of unique and endangered genes, species, ecosystems, and cultures. If we include lands adjacent to these protected sites, then the affected area could increase by 50 to 100 percent. This could increase the land area “affected” by protected areas to 10 to 15 percent of the total land area. In densely populated South Asia, this would include a significant amount of farmers. If we are to balance the needs of these farmers with the goals of biodiversity conservation, the conservation-oriented agriculture will play an important role.

The transition to more conservation-oriented agriculture will require the recognition of indigenous knowledge, the use of the participatory approaches to technology development. In

addition, environmental managers will need to establish the conditions that will stimulate and support conservation-oriented agriculture. The complexity of integrating conservation and development in this way would suggest the need for partnerships between local people, government, environmental non-governmental organisations, and development workers. Environmental managers play a vital role in coordinating these efforts in order to achieve harmony and balance in the conservation of biodiversity and the promotion of rural development.

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IV

INTEGRATED ENVIRONMENTAL MANAGEMENT

Integrated Urban Development

Integrated Tourism Development

Participatory Housing by the Poor

Sustainable Management of Island Resorts

Environmental Safeguards in Irrigation Management

16

INTEGRATED URBAN DEVELOPMENT

Surendra Wickremasinghe

Harmonising environment and development in the urban context has a difficult agenda, particularly in the Asian Region. Asia now accounts for 1.2 billion, or about 46 percent of the 2.5 billion global urban residents, growing at the rate of 3.5 percent per year.

Most of the South Asian cities have been plagued by environmental problems. Many cities have a wide spectrum of pollution problems, ranging from sewage and garbage to hazardous waste. In most cities there is a lack of infrastructure services such as water supply, sewerage, power solid waste disposal, transport and communications.

A major challenge for the urban planner is to adopt an appropriate strategy which would not only improve urban productivity but also conserve the environment through sustainable development. Integrated urban development in this context can be defined as an integrated, environmentally sound, urban planning and management process. This involves routinely incorporating environmental information, policy standards, techniques and monitoring into strategic urban development plans.

The Beira Lake Integrated Urban Development Project in Colombo is a fine example of the total integration of environmental considerations into an urban development project. The Environmental Improvement Plan coupled with the Business Plan for Beira Lake, affords a useful sojourn where some of the strategies of integrated urban development are used in urban planning with great finesse.

INTEGRATED URBAN DEVELOPMENT

Surendra Wickremasinghe

Environment and Urbanisation

Harmonising environment and development in the urban context has a difficult agenda. Most ardent conservationists explicitly reject development, arguing growth and protection of the environment are incompatible. Emissions and pollutants from factories are foremost in their list of items to be condemned. But factories we need for goods and jobs in urban areas. Chemical disasters and accidents make headline news. But we have to contend with the fact that chemicals are used in lipsticks, hair sprays, space ships and satellites. The car may be the ogre of the 20th century. But the astronomical growth in production and use of automobiles demonstrate its exclusive role in transportation.

The foregoing illustrates, a dichotomy, a conflict of interests, where environment and urban development are on opposite sides of the same equation. However, it does not, as claimed by the environmentalists, illustrate incompatibility, which would present an exclusive situation, where one excludes the other. This being so an urban planner has the difficult task of striking a delicate balance between the two where neither is to be compromised. A balance which is achieved by the due recognition of the mutual inter-relationships that exist between them while creating the dynamics of development without closing development options for the future generations. This is a mammoth task and it is addressed by the town planner by attempting to plan and implement what we call Integrated Urban Development.

Growth of Cities

The concept of Integrated Urban Development is crucial when we know that preserving the environmental integrity and promoting ecologically responsible development are a matter of survival for the whole planet. As Chernobyl and Bhopal incidents indicate, ecology knows no national boundaries. Our strategy for development in South Asia could have repercussions on global climatic changes, bio-sphere or the ozone layer. Asian cities are experiencing unprecedented growth, an urban explosion which it is believed can deplete resources and do irreparable damage to the global environment. It is estimated that 1.23 billion urban residents have been added to the world population since 1970, and 84% of them in developing countries. Asia now accounts for 1.2 billion, or about 46% of the 2.5 billion global urban residents, growing at the rate of 3.5% per year. It is estimated that by 2025 Asia's cities will hold 2.7 billion people. Between now and 2010 Asia's share of the world's 15 largest cities will grow from 9 to 11. Not only are more and more of us living in cities, we are living in bigger and bigger cities.

Urban growth of this magnitude has a number of positive impacts on the environment and the people. Higher population densities mean lower per-capita costs in urban living. It increases the efficiency of urban living and some times the productivity owing to economies of concentration. Urbanisation has also, historically been associated with declining birth rates which reduce population pressure on land and natural resources. Yet most of the Asian cities have been plagued by environmental problems. Many cities have a wide spectrum of problems, ranging from human excreta to hazardous waste. In most cities there is a lack of

infrastructure services such as water supply, power, sanitation, sewers roads etc. In addition there are problems of pollution, congestion, degradation of the natural support systems and the built environment.

In recent years, where many Asian Countries opened up their flood gates for development and foreign investments by liberalising their economies, economic growth and demographic growth have been astronomical. The cities in this region are seen as prime locations for investment owing to their lower per-capita cost, and higher productivity rates - urban productivity here referring to "income or output per capita." The influx of foreign investment being the only course available for development in the poor and less developed countries. In the absence of any other alternative these countries have welcomed this phenomenon either with a sense of resigned acceptance, or as maximising on opportunistic benefits.

Degradation of the Urban Environment

Population growth in the developing countries is identified as one of the major causes of environmental degradation. Most of the developed countries have established population growth at zero level. They enjoy a high degree of affluence as a result of unsustainable methods of development through the 19th and 20th centuries. They have contributed to the degradation of the ecosystems in a major way in the past and continue to do so now through unsustainable consumption patterns. The North as opposed to the South consumes 80% of the world's resources while holding only 20% of the world's population. A citizen in North America is said to consume ten times as much water as a citizen of South America. Indeed unsustainable consumption which is assuming gigantic proportions especially in the big cities has turned out to be one of the major indirect causes of today's environmental problems.

A widely held view is that poverty is one of the underlying cause of environmental degradation. Poverty is manifested in the urban environment through substandard sanitary conditions, land encroachment, depletion of natural resources and loss of bio-diversity. For the poor, who are important contributors to the productivity of the city, access to land and adequate housing has been systematically denied. With insufficient incomes, the urban poor cannot obtain land, shelter or sustenance and hence they have forced into schemes and shanties constructed on marginal lands, sometimes totally devoid of basic infrastructure facilities. However, it may be argued that low income alone is not the only reason why poor households have difficulty in coping with environment related problems. Institutional and legal barriers to prevent them gaining access to resources and at the same time lack of and public and state support may be as important.

An Integrated Urban Development Strategy

A major challenge of the modern urban planner is to adopt an appropriate strategy which would not only improve urban productivity but also conserve the environment through sustainable development. It is believed that much can be done within the domain of urban policy and planning. National urban policy should link up with the political ethos of the country, and institute fair employment practices, increased access to urban land, improved credit facilities and access to productive resources while democratising the planning process. Another major challenge is poverty alleviation, which calls for the creation and institutionalise action of the process of social decision making. Integrated urban development in this context entails the institution of an integrated, environmentally sound, urban planning and management process through community participation.

Integrated Urban Development

The Integrated Urban Development Strategy, may be further elaborated as that which entails not only anticipating change and arbitrating between social economic and political priorities in the allocation of the land uses but also that which incorporates safeguards for the environment through various checks and balances while creating a democratic urban form through community participation that sustains social equity and justice.

Concretely this involves :

- a) allocation of land uses in a Development Plan to achieve maximum efficiency and urban productivity, engendering a fine grain mixed use town.
- b) routinely incorporating environmental information, policies, standards, techniques and monitoring into strategic urban development plans. i.e. EIA's, Environmental Appraisals etc;
- c) having an integrated scheme where the provision of comprehensive infrastructure services, both physical and social, is part of the development plan proposals;
- d) including poverty alleviation as part of the strategy, with maximum public participation;
- e) a sustainable urban form which does not extravagantly use finite resources and the efficient management of the ecosystem, with concerns for social equity and justice;
- f) getting criteria based on social decision making to ensure that what we do now does not negatively affect what the future generations may wish to do;
- g) structuring urban design in such a way that the individual has choice but never at the expense of the collective, thus empowering as many of the citizens as possible to successfully determine the outcome of their daily lives in so far as the layout of the town and the location of users can assist.

This strategy spans across a range of disciplines, from Urban Planning, Economics, Sociology, Architecture, Engineering, Urban Design, Environmental Sciences, Environmental Law, Project Management, and Institutional Co-ordination to Environmental Management, thus presenting a multi-disciplinary, corporate effort on the part of the various professionals involved in this task.

It is one thing to formulate urban policies and strategies in accordance with research findings, analysis, appraisals and principles of town planning. But it is another to implement it on the ground. The UDA has policies against unauthorised filling of low lying land in the suburban areas within the Colombo Metropolitan Region. But indiscriminate filling of land continues at an alarming rate. Some of the reasons attributed to this situation are the lack of a set of enforcement procedures, a statutory framework to back enforcement, absence of institutional arrangements, lack of awareness of the need to enforce and so on. However continuous monitoring and evaluation of these policies are being carried out in the UDA for updating and amending these strategies and to make them more useful and more successful.

A Case Study on the Integrated Urban Development of the Beira Lake in the City of Colombo is presented below to illustrate how these principles could be put into practice.

The Beira Lake Integrated Urban Development Project; A Case Study

The Beira Lake Integrated Urban Development Project in the City of Colombo is located in close proximity to the Colombo Business District. It is a case in point where environmental criteria are given equal importance as the impetus for development. A Business Development

Plan superimposed on an Environmental Improvement Plan for Beira Lake, affords a useful scenario where some of the strategies for integrated urban development may be seen to be used successfully in urban planning.

The turning point in the rehabilitation of the Beira Lake was the establishment in 1989 of the Metropolitan Environmental Improvement Programme (MEIP) initiated by the World Bank, together with the UNDP MEIP-Colombo was launched in April 1990 and placed under the then Ministry of Policy Planning and Implementation. MEIP together with Roche International of Canada undertook the study for its restoration. Beira Lake Restoration Study dealt with the environmental conditions of the lake and proposed a comprehensive rehabilitation project. The present budget of that environmental project which is now underway, is well in excess of US \$ 25 Million.

At the same time, the Urban Development Authority (UDA), with the assistance of the Coginter/Urbanex Consortium, prepared a Business Plan for the Environmental Restoration of Beira Lake and its land development. The objectives of this business plan is to optimise the institutional, marketing, legal, fiscal and corporate frameworks, so that the UDA can manage and develop the lake's surroundings in a sustainable manner using public and private sector participation.

Beira Lake Restoration Study

The MEIP initiative dealt with a number of major issues. Firstly, the control of industrial effluent entering the lake. A major food processing and beverage company on Beira Lake was persuaded to divert its effluent into the sanitary sewer network and to install grease traps to its vehicle maintenance bays. Secondly, issues regarding ownership and maintenance of the lake were sorted out. The Sri Lanka Port Authority (SLPA) claimed ownership of the lake and a six-foot wide strip of its banks. The Colombo Municipal Council (CMC) maintained that if the lake was under their jurisdiction it would allow them to keep the banks and waters clean and clear of debris. The matter was not resolved but the Sri Lanka Land Reclamation and Development Cooperation SLLR &DC was contracted to keep the South West Lake and part of the West Lake clean. SLPA maintenance activities were confined to the rest of the lake. Thirdly, the relocation of shanties bordering the lake was to be given priority attention. A five acre block of land belonging to the Railway Department has been identified by the National Housing Development Authority (NHDA) for relocation purposes. The Railway Department was reluctant to release this land. National Environmental Steering Committee (NESC) sought Cabinet approval for release of this land but due to the opposition by the Minister of Transport and Highways, the matter could not be resolved.

Fourthly, the temporary lowering of water level prior to commencement of the rainy season had been proposed. This was a contentious issue with respect to management of the lake's water level. SLLR &DC was of the opinion that lowering of the water level by about two feet during the rainy season would offer some relief from flooding. The SLPA did not favour this course of action because of the fear of possible structural damage to buildings on the banks. However, a compromise was reached and partial lowering of the water by nine to twelve inches was successfully implemented; Fifthly a survey of illegal connections into storm water outfalls of the Beira Lake was undertaken. Five representative sub-catchment areas were thus analysed by the consultants and the methodology established for a complete survey. Central to the long-term success and the achievement of these goals is the reduction of pollutant loading from the catchment.

The goals of the proposed Restoration Strategy are twofold; namely environmental and developmental. In the environmental front the goals included; control and of environmental degradation of the lake; improve the sanitary condition of the lake; to remedy the problem of periodic bad smells; and to control the algae; problem. In the developmental front the goals are; to provide water conditions capable of supporting living healthy aquatic communities; to improve the aesthetic quality of the built environment and conserve the natural environment of the lake and its shoreline; to provide and improve the recreational and public use potential of the lake for the local and tourist population; to provide opportunities for mixed-use development and promote optimum utilisation of lands and increase the commercial potential of the lake shore; and to create economic and employment generating activities especially for the local population.

Beira Lake Business Plan

This is presented as a Master Plan. It recognises the relationship between the Waterfront and the Centre City. The expansion of the Centre City to the edge of the water can provide a bold new dimension to the vitality of its commercial core and the liveability of its strengthened neighbourhoods. The challenge is to guide this expansion in a way that both environment and development are enhanced, and neither compromised.

The Planning Team attempted to balance the demand for the many uses competing for waterfront land. These uses include boating facilities, utilities, recreation, housing, offices, retailing and transportation. The proposal presents a fine-grain mixed use proposal which would add vitality and life to the area.

The proposal seeks to

- a) promote optimum utilisation of lands around the Lakes' water bodies control activities causing environmental degradation and pollution of the Lake;
- b) improve the aesthetic quality of the built-up environment and ensure the conservation of the natural habitat while providing public access to the lake and recreational facilities in and around the lake for the local and tourist population with a 6 to 12 reserve of waterfront without construction;
- c) facilitate the view and or visibility of the lakes by preserving or creating "windows" or "vistas" in between or through buildings, walls, bridges and fences; and
- d) create economic and employment generating activities especially for the local population.

When adopted, this Master Plan will become a guide for the regulation of private development. The plan will also offer guidance to other public agencies involved in making decisions relating to waterfront development.

Appraisal of the Beira Lake Urban Development Project

(a) Allocation of Land Uses

The sites around the East side of East Beira Lake will be developed as a mixture of office, retail, housing and hotel; the piers will also serve as a place for public activity. The West of East Beira Lake will be developed as a resort area with a small marina designed to serve residents and tourists. There are a number of opportunities for the construction of new housing. About two thousand housing units could be developed in the larger sites while a mixture of new town-houses, retailing, open space and parking is proposed for other small

sites. The proposals specify a fine grain mixed use development with a rich mix of uses which would not only nurture variety and vitality but also provide natural surveillance at night. They would provide an economically viable environment where a multiplicity of urban activities can take place at the same time.

(b) *Environmental Improvement*

Components of the restoration strategy of the lake primarily involve reducing entry of pollutants by disconnection of sewers, reduction of industrial effluent, solid waste management and street cleaning. This proposal also includes upgrading of squatter settlements, a public awareness programme, and collection of environmental and engineering data. The second part of the restoration comprises of In-lake Restoration which involves dredging of approximately 600,000 cubic metres of sediments, filtration of algae and the stocking of algae eating fish. Environmental improvement involves not only cleaning of the lake but also reducing the entry of pollutants in to the lake thus ensuring environmental quality over a long term.

(c) *Infrastructure Development*

Access within the Core Area is improved to serve the proposed new development. Improving access to the road network serving the Core Area requires the completion of the many connections, especially west-east connections. New North Road Bridge and South Foot Bridge will improve the access to the Core Area and link it with the city. The development of the "Central Waterfront" will also require improved public pedestrian access to and within the district. The access to the water will be a major part of all new development, capitalising on the recreational opportunities offered by the lakes.

A public parking facility will be needed to serve the Core Area. Measures to meet the increased parking demand will be adopted. These would include construction of new open spaces for parking under new constructions and conversion of some existing buildings into stored garages where appropriate. Regular bus services must be increased and special transit service during special events and night time instituted.

The infrastructure proposal for transportation optimises the possibilities for people travelling in either public or private transport. This would improve accessibility and connectivity of the area in an equitable way.

(d) *Poverty Alleviation*

More than 2000 people live in squatter settlements along the banks of Beira Lake. This number is rapidly increasing. The repeated encroachment of the lake shores by squatter settlement communities has contributed to the reduction of the lake surface area and the degradation of water quality. These populations use the lake for different purposes that contribute to its degradation. Among other things the lake is used as an open sewer, a garbage disposal site and even as a landfill, where residents encroach upon the waters and enlarge their property. The slum and shanty dwellers have no access to urban land and proper employment opportunities. The proposal is aimed at creating employment especially for the local population, while procuring urban land for relocating the people living in the squatter settlement either in alternate locations or within the development area itself.

(e) Conservation of Resources

The existing industrial and commercial buildings will be converted to new uses where appropriate. The existing warehouses alongside piers will be converted into housing units. One of the principal attractions of housing on the piers will be the magnificent views offered by the waterfront location and the use of the lake for recreation. The rehabilitation of existing residential neighbourhoods and buildings will also be encouraged. Most of these units should be rehabilitated where possible for retail use on ground floor and residential use above. The use of existing built form whenever possible conserves resources and creates an urban form which has a link with the past. Demolishing and re-building has not been adopted as a strategy owing to its extravagant use of resources.

(f) Democratic Urban Form and Urban Design

The Plan proposes urban design standards intended to promote a high quality in the new development. These urban design standards are intended to address a number of concerns including scale of development, orientation, rhythm, buffers, use of existing piers and facade preservation, improved access for the public, maximising visual access and extending the public realm. Around West Lake and South West Lake most of the development will be new. Here, a mixture of different-use towers designed to capture the tremendous views of the ocean and the lakes will be built along with a much lower scale complex on lands adjacent to the lakes. Throughout the Core Area, the new housing and other uses will have direct access to the lakes and the overall design will be sensitive to the water's edge.

A major formal public Plaza-Park opening onto the water and a new Complex-in-the-Park area will serve as focal places for special events and public gatherings. In addition to the proposed public uses, which include boat terminals, a museum, and parks, other public attractions will be created, including an exhibition centre and sculpture garden. Public enjoyment of the waterfront will be enhanced by encouraging access and activity at the water's edge. A water walk running along the lakes is a major recreational feature of this plan. The water walk will connect all of the activity centres of the district, and pedestrian links from the adjacent communities to the waterfront will be enhanced. Boat terminals will be developed to provide active utilisation of the lakes. One marina will be part of the new resort area.

The proposal improves and extends the public realm. The entire scheme maximises on visual access to scenic part of the location for all users. Public access is provided to the edge of the waterways which is the most value added part of the scheme. In addition public outdoor spaces have been provided showing a measure of social equity and justice in access to resources.

Conclusion

The citing of the case study highlighted a comprehensive approach to integrated urban development. But it also showed up some shortcomings. The planning process did not constitute any community participation provision. Public consultation and participation in the planning process is a widely felt need but without the institutionalising of social decision making, it is virtually impossible to integrate it into the planning process. We have a long way to go in perfecting and fine-tuning our strategies for implementation of sustainable integrated urban development. Our perception has evolved since the inception of the UDA in 1978. Eighteen years ago, "implementing economic, social and physical development of

Urban Development Areas” was perceived as Integrated Urban Development. Currently the emphasis has moved to implementing sustainable developments. It is inevitable that it would continue to change and evolve, to help us create urban environments which are more and more sustainable. Monitoring, evaluating and revising strategies for implementation is also a complex process. This involves political consensus, institutional co-operation updating of statutes, procedures, and information, technical strengthening of professional staff, and improving working methods,

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INTEGRATED TOURISM DEVELOPMENT

M. Y. M. Thahir

Tourism can be defined as the temporary migration of people as individuals or groups from “home” to another “home” in or outside one’s country. It is the World’s largest industry and the largest generator of jobs.

Integration in tourism takes two forms; internal integration and external integration. Internal integration is the tying up of attractions, facilities, services, amenities, modes of access, the product range and the markets or market segments. External integration is the tying up with national goals: physical, social, cultural and economic to achieve the greater goal; “highest possible degree of well being of the individual or the best possible quality of life”.

The tourism development criteria largely determined by the physical environment are; the need to be in harmony with the ecological and aesthetic environment; carrying capacity; tourism density and resident feelings and area compatibility. The local community is the key player. There is need for community consultation, local capital participation, development of domestic tourism, accessibility of the community to tourist areas, community education on tourism and social impact assessments.

Integration with the economy is important. Tourism development should be in line with the national tourism policy and objectives and should boost the economy, while contributing to balance of payments, net foreign exchange earnings, development of backward areas and arresting the flight to the cities.

INTEGRATED TOURISM DEVELOPMENT

M Y M Thahir

Travel and Tourism

Tourism in its modern sense has been described as "temporary large scale annual mass migration from home within and across national borders". This definition highlights the pivotal feature of the tourism industry - the temporary movement of persons-individually or in groups-for an essentially temporary stay in another country to spend their leisure time, and from the destination angle, the presence of a transient population in the midst of the indigenous community. This description is equally applicable to domestic tourism movements even though there is no crossing of frontiers.

The needs of any indigenous community are many and varied as well as essential and non-essential. But the needs of a transient population- a tourism community as it were - are more compact being a community on leisure. The presence of this transient population also leads to an interaction of different cultures backgrounds, way of life, social habits, dress, behavior, and many more. It encompasses a vast area where the impact is an impression, an experience and an attitude-favorable or unfavorable. This of course is a variable factor depending on the destinations, and according to its level of development.

Travel and tourism is an irreversible process with the trend towards higher living standards, growth in leisure time, longer life expectancy. It is the World's biggest industry and the largest generator of jobs. In the year 1991 it generated US \$ 2.9 trillion of Gross 10% of direct and indirect GDP, 180 million direct and indirect jobs, that is, 1 in every 10 workers worldwide, and contributed US \$ 557 billion to Government revenues.

When one looks at tourist movements, one should look at international tourism movements as well as domestic tourism movements. International tourism movements in 1995, were around 567 million whilst domestic tourism movements exceeded 2,700 million approximately. International tourist arrivals in 1995 in some selected destinations were as follows:-

International Tourists Arrivals - 1995

Destination	Population	Tourist Arrivals
France	56 mn.	60 mn.
Spain	39 mn.	45 mn.
U.S.A.	265 mn.	43 mn.
U.K.	59 mn.	22 mn.
Hong Kong	6 mn.	10 mn.
Malaysia	17 mn.	9.5 mn.
Singapore	3.5 mn.	6.4 mn.
Ireland	3.5 mn.	4.4 mn.
India	934 mn.	2.0 bn.

Domestic Tourism Movements in 1995 were more impressive.

Domestic Tourist Movements – 1995

Countries	Population	Domestic Tourist Movements
India	934.0 mn.	500 mn.
China	1.1 bn.	330 mn.
Japan	125.5 mn.	200 mn.
Indonesia	177.0 mn.	64 mn.
Sri Lanka	17.5 mn.	0.45mn.
Canada	30.0 mn.	80 mn.

In the context of the intrinsic nature of tourism as a temporary movement of people with a range of needs and expectations, the volume of the travel movements, the composite nature of the industry and its links with the national structure, there is need to integrate the tourism industry within and without.

Integration in Tourism Development

In this context integrated tourism development can be defined as a right fit of the tourism sector in the national structure - physical, economic, social and cultural. The national structure is a mesh, as it were, may be a square. Tourism is just one single square within the larger the national structure. Other development sectors too, should fit into the mesh in the right manner. Integration in tourism takes two forms, external integration and internal integration. Integration needs planning of some magnitude.

External integration must necessarily be in line with national goals and objectives. All goals and objectives converge on one benchmark - "highest possible degree of individual well being or the best possible quality of life for the individual." This implies pursuing qualitative and quantitative objectives encompassing the natural and man made environment, life and working conditions, health, recreation, economic development, employment and population. quality.

In the context how does tourism integrate with the national goals; physical, social, cultural and economic? The integration should be dynamic and positive. It should contribute towards individual welfare and add to the quality of life. The integration should avoid harmful effects and protect or enhance the components of the national structure.

Physical and Manmade Environment

Environment can be looked at as the sum total of land and its attributes which also includes every form of life and its activities on the land. It can be broken up into 2 distinct categories. Firstly, natural endowments covering- air, sea, water, light, relief, vegetation and wildlife. Secondly, man-made endowments covering - living space, working space with its structures and buildings, recreational space, the cultural and social amenities, lifestyles, customs, music, history, archaeology, etc.

This constitutes the raw material of tourism, the resource input for the "manufacture" of the tourism product. The resource input whether natural or man made should be wholesome, pollution free. Tourism resources, natural or man-made are finite and fragile. The emphasis should therefore be to establish and maintain a touristically sustainable environment. Long term needs require that this input should be developed and used with care. Business prudence as well compels such an approach.

Some Physical Environment Criteria

In Tourism development the environment's natural parameters and ecosystems must be given due regard. Accordingly, all developments should be in harmony with the ecological and the aesthetic environment. Areas with tourism potential should be identified and zoned for tourism development. In doing so it is necessary to ensure availability of land over the long term, while integrating with existing land use plans. Zoning should take into account the need to channel development into designated tourism areas. No development should be permitted in areas not so designated. Developments which is incompatible with tourism such as medium and heavy polluting industries should not be permitted. Scenic routes and locations should be designated and subject to development control.

All tourism developments should be subjected to environmental impact assessment and varying monitored periodically after commencement of operation. Tourism areas such as the beaches, mountains and slopes should be protected from erosion and over exploitation. Beaches and inshore waters should be kept clean from pollution, sewage and solid wastes. Exposed coastal areas should be protected to arrest wind and sea erosion. Visitor management plans should be drawn up for wild life areas, coral sanctuaries, forests based on carrying capacity studies.

There should be comprehensive infrastructure management plans for all developments. Infrastructure facilities and services should not be a strain on the public utility system . They should not be setup at the expense of present users such as the community, industry, business. Due consideration should be given to the requirements of sewage treatment, solid waste disposal, water and power supply, storm water drainage, fire, transportation and communication. The quality of the water supply and discharge of effluent are critical. Income substitution and product substitution studies should be undertaken to eliminate activities which have an adverse impact on the environment. Public awareness should be created and public support enlisted for environmental conservation and sustainable development. Tourist awareness and support is of vital importance.

Carrying Capacity Criteria

Carrying capacity is an age old concept. It started with the nomad moving from green patch to green patch or from one waterhole to another with his livestock. There is physical carrying capacity of a beach, archaeological site or historic buildings. This is, the absorbable limit of he number of users and activities. Also there is perceptual capacity. That is, the maximum levels of recreational use before decline sets in. There is environmental amenity capacity meaning the level before visual deterioration sets in. There is also socio-cultural capacity. This is the extent of development that can take place without detriment to the lifestyle of the community, monuments, arts, customs.

In simple terms, carrying capacity should answer the question how much use is too much use. Carrying capacity models are now being questioned on the basis of the impact/use paradigm. Another model suggested is the limits of acceptable change and how much change is acceptable. This too is not easy to apply because what is and what is not acceptable is intangible. However, the carrying capacity model has been in vogue since the 60s and there is sufficient experience in various locations which can be looked at as guidelines: Of course, the capacity of tourism resources does vary a good deal from one location to another and from one destination to another.

Some of the guidelines are 1.7 sq m of beach area per beach user in Northern Europe, 3 sq m. in Southern Europe, 30 sq.m in some destinations; 40 persons per km of hiking trail; one boat per acre of water; 5 persons per sq.m of hill land; 25-80 persons per km of riding trail; 5 m of linear beach front for each room.

The Carrying Capacity Study for Goa (UNDP/WTO) of 1989 estimates an average width of sandy beach of 40 m. Providing 1 meter of beach front per bed, the result is 40 sq.m of beach area per bed. The standard of 1 m. beach front is applied to the 46 km of beach set apart for beach visitors. This results in 46,000 tourist beds or 23,000 rooms. Based on the 46,000 tourist beds and other assumptions, the Study projects 4 million tourist arrivals a year and employment of 60,000 persons in direct services. Sri Lanka's Bentota beach resort complex has a beach density of 450 beach users per 1.6 k.m. of beach.

Tourism Density

This is an extension of the carrying capacity concept. A common form of analysis is relating the no. of tourists to the no. of inhabitants and the area. There is tourist/population ratio and tourist/area ratio. Although it is a simplistic approach, there is merit if used on an area specific basis rather than on a country basis coupled with peak arrivals to identify crowding in a region, urban square, resort or at a tourist attraction.

Perception of crowding varies. South Europeans will tolerate more crowding than North Europeans. Some Asian countries accept a higher level of congestion. Spain registered 45mn. tourist arrivals and has a population of 39 mn. Sri Lanka attracts 400,000 tourists and the population is 18 million, India attracted 2 mn. Tourists for a population of 934 mn in year 1995. There is no easy single measure of maximum or tolerable density. A near empty theater will not add to the enjoyment of a performance. A full and enthusiastic audience will.

The best units for measurement are tourist nights in the peak months, resident nights and sq.km by region/sub-region. A 3rd dimension is resident feelings about tourism. A British study came out as follows:-

Density of Tourist Nights

Region	Area (per sq.m.)	Population	Resident Feelings (per 100 residents)
London	270	6%	76% (positive)
West country	30	18%	53% (positive)

Note: Only 2 regions shown here.

London shows a high tourist density per sq.m., just average number of tourists by population, and a survey finding of 76% residents saying tourism benefits outweigh disadvantages. West country has a low density per sq.m, high density by population, and preferred 53% only. Though it is a 1978 study, the technique is valid even today. The results can help tourism planning strategy, community education measures or corrective actions. Further examination by sub-regions can support intended strategy for expansion of tourism, where resident feelings are highly favorable.

Area Compatibility

An important element in integration is the desirability of harmony between a tourist development and the neighborhood. Particular attention should be paid that all developments are compatible with the natural environment of the area and will not conflict with the general tenor and tone of local structures and the overall local landscape. Setback standards according to the type of attractions are relevant. Some setbacks are:

Beach Development	Maldives - 5m. ,	Philippines - 30 m.
	Sri Lanka - 35-70m,	India - 100m.
	from vegetation line	
Buildings	5 m. from green areas	
Archeological Monuments	180 m. from declared boundary.	
Wildlife Parks	No development in parks in Sri Lanka.	

Building Densities - high density - 60 - 80 rooms per ha, medium 30 - 45 rooms; low density 10-15 rooms are desirable. Outside urban areas, building heights should not be higher than a coconut/palm tree. Buildings should have a local flavour using local materials as far as practicable.

The first Tourism Master Plan of Sri Lanka (1967). Outline the reason for zoning and design control for tourist facilities, cluster developments. Some of the architectural recommendation included low density and garden-oriented developments with 20-40 hotel rooms per acre other than in central or high rent districts of a city, extensive use of indigenous building material such as brick, stone, wood-frame walls and tile roofs, brass hinges and other hardware items, local pottery and ceramics, traditional furniture and cane and rattan products.

The Master Plan states that "An examination of traditional architecture and building methods all the way from the ancient Sinhalese, Tamil and Muslim through the Dutch period to the colonial British is very revealing of the care taken to provide shade and coolness, protection against the heat as well as the monsoon and preservation of unique and distinctive styles. The meda-midula of the Sinhalese (the center courtyard) was for instance heavily used by the Dutch to produce cool spacious homes. These styles must be preserved and fostered because they stimulate the tourist." Landscaping should give preference to local indigenous plants, avoiding conflict with the local vegetation. This is a feasible approach in the context of the local climate and the physical features, or by the sea. Landscaping should provide privacy, absorb noise and serve as wind barriers.

Tourism Regions and Zones

Tourism regions and zones are logical geographic and planning entities. They should be selected on several considerations such as tourist attractions relating to market needs, convenient access, internal transportation network, and suitability for integrated resort developments. All development should be channeled into these regions and zones. The best approach should be cluster developments in place of dispersed developments. Attendant advantages are development, design and environmental control, more efficient provision of infrastructure with economies of scale, more efficient waste disposal systems and prevention and monitoring of air and noise pollution. Cluster developments provide a variety of facilities, services and activities for tourists. Cluster developments are also conducive to containment of any adverse effects and act as a deterrent to anti social activities.

Role of the Community and Social Considerations

Tourism should fall in line with the needs and wishes of the community and social and cultural framework. Tourism is a movement of people - a visitor population coming into contact with the local population at various points. Friendly people is a determinant in the choice of a destination. Any hostility or indifference by the local community can be a negative factor. A hostile community attitude can lead to non-co-operation and discourtesy. There should be community interest and involvement in tourism development. Community consultation would be relevant. Local capital contribution, local entrepreneurship, local labour should be fostered. This will provide the local people a stake in the industry.

Tourism Liaison Committees representing local interests, social worker, and opinion leaders, is a useful institutional device. It can function as a permanent body and help in monitoring development and operation and undertake community education. In areas of high social vulnerability, the Committee should have a community Liaison Officer, as a link between the local community and the development. Community reaction to tourism should be periodically monitored through surveys by regions or sub regions.

Job creation is significant in travel and tourism. Travel and Tourism is considered to be the world's largest generator of jobs. In 1991, Travel and Tourism created employment for much more than 180 million people, that is, one in every 10 employees world over, and provided 10.3 % of global wages as much as US \$ 1.5 trillion. Spain is the largest employer - 1 in 5 of total employment, Asia and Pacific, 1 in 10 and Japan, 1 in 11. Travel and Tourism pays its employees 4.6% higher wages than other employers. Jobs in travel and tourism span the spectrum from low skills to high skills from waiter and chambermaid to pilot and general manager. Resort developments, farm tourism, village tourism, arrest the flight to the urban areas and contribute to community stability.

Social impacts are major considerations in the development of tourism. They are critical in traditional societies. Most judgements on social impacts are perceived judgements. Educating the community about tourism will enable the community to analyse the tourism specific impacts. Public awareness of tourism advantages and disadvantage will help create a favorable attitude. The local community should have convenient access to recreation, beaches, scenic views, shopping and parks to the same extent as the tourist. The fishermen should have access to the beach and the sea to pursue his occupation and berthing of boats. The local community is a key player in tourism. The local people should not feel left out. Resorts should cater to and be accessible to foreign and local tourists. Even special facilities should be provided to the local market in the resorts. Development of Domestic Tourism should be given special consideration in developing countries interested in developing foreign tourism.

Drugs, illegal gambling, prostitution, paedophilic activities, crime in tourist areas are attributed to tourism. There is no definite causal link between the two. Tourism can accelerate the growth of anti-social activities. Community perception that tourism is the cause can lead to a hostile community action. It is not appreciated that these activities can grow despite tourism. Strong deterrent legislation with heavy penalties are desirable. Tour operators should advise their clients of the penalties involved. Public opinion in the destinations decrying such activities and local education is relevant important aspects. Tourists and their operators should also be advised of the 'dos' and 'don'ts' during their holiday. Tourists should not expect privileged treatment. Hospitality should be spontaneous.

Cultural Considerations

A tourism product with a cultural identity distinguishes one destination from another. A tourism product with a distinctive cultural identity stands out in the market as strongly as an internationally known designer label to a simple garment.

The cultural content of tourism consists of ancient cities, places of religious, archeological or historical interest; heritage sites, old houses and buildings; museums, art galleries, theater, cultural centers, folk art and; arts and crafts, folklore, festivals, customs and traditions; and industrial archeology, vintage transportation; traditional agricultural; pristine indigenous communities like the Veddas of Sri Lanka; food and cuisine; and indigenous medicine system - herbal therapy. Culture in the context of tourism means contact with a different cultural experience in another country or place; experience of activities and viewing of objects which reflect different forms of creativity and expression; and different ways of life.

The cultural contact may be peripheral or indepth depending on the nature of the tourist trip viz general purpose, holiday, or special interest, or professionally interest. There is of course a trend towards extending general interest holiday beyond relaxation with a cultural sight seeing tour. Cultural tourism contributes towards producing a unique image of any region. It enhances the quality of life and providing employment. In turn, cultural tourism generates a sense of pride in the community in their culture.

Tourism can be a stimulant for the development and upgrading of cultural resources and contribute substantially towards the costs of maintaining and improving the asset through admission fees, international fund grants etc. Almost 50% of the tourists visit the Sydney Opera house which bring a revenue of US\$ 2.5 mn per year. The Cultural Triangle in Sri Lanka earned US\$3.5mn. in 1994. If the benefits from these cultural resources are to the community, the national, regional and local bodies they should be protected from overuse by visitation, deterioration by natural forces and sometimes vandalism.

A balance should be maintained between the interests of tourism and the protection and development of cultural resources. Local committees should be set up to prepare an inventory of the cultural resources, location, use, quality, and protection level and at the same time prepare a programme for their development, maintenance, conservation, promotion.

There are several appropriate measures that can be taken to enhance the cultural resources and maximise the tourism potential they are conserving the cultural heritage of an area, such as traditional dance forms, music, drama, arts and crafts, ceremonies, life styles, and traditional economic activities. Promotion of national pride and cultural awareness in heritage, crafts, performing arts, festivals. Upgrade the amount of culture in the tourism product by the use of local handicrafts in hotels, presentation of traditional dance and music and provision of local cuisine.

Facilitate communication and interpretation of local cultures and traditions for foreign and domestic tourists through interpretation centers, publications, slides, brochures, cassette tapes, heritage trails, and town trails.

Conserve and enhance standards of arts and crafts for use in tourism through dance competitions, education of artists and craftsmen, and assistance to master craftsmen. Encourage small cultural enterprise through improved marketing and design, and financial support.

Increased access to tourist markets, by making available calendar of festivals, register of performing artists, sale of authorised replicas, visits to villages, and information of local fruits, vegetables, and fish. Protect small communities from privacy invasion by providing buffer zones and shields, meeting areas, display space. Limit tourist visits for small local community festivals and rituals. Otherwise it destroys local interest and participation.

Integration with the Economy

Economic development contributes towards a country's goal of "highest possible welfare of the individual or best possible quality of life for the individual." Tourism integration to be meaningful, should therefore be another sector contributing towards economic development. Hence tourism development should be assessed in terms of the benefits that will accrue to the economy by such development. This assessment can be made in relation to the targets of the national plan or programme.

Tourism's role in the economy would be dependent on the national tourism policy, the range and quality of the tourist attractions and the potential of the international and domestic market. Some of the tourism inputs to be looked at in an assessment of tourism's role are:- Contribution to gross output; Tourist receipts as % of Gross National Product; Value added contribution to GDP. Foreign exchange benefits and costs and linkages. Value added is made up of salaries, interest and rent, profit and depreciation. Foreign exchange leakages (costs) occur in terms of direct and indirect costs of imports. The extent of the leakage will depend on the level of the economy and the extent to which the economy can supply capital and consumption goods for tourism. In Sri Lanka the foreign exchange surplus after leakages was 70.7% in 1990. There can be backward linkages, that is, purchases and use of outputs from other production sectors for the production of output by any one particular sector and forward linkages, that is, the output of one particular sector for sale to other sectors. In Sri Lanka 13 economic sectors supply the tourist sector. There are no forward linkages since the tourist product is an end product for final consumption.

Internal Integration

The predominant characteristic of modern tourism is the integration of a wide range of activities to serve a particular kind of customer. These activities are; tour arrangements planned and organised in advance; reservation of transport and rooms; transportation to and from the destination; internal transportation; accommodation, food and beverage; recreation, entertainment, sightseeing, shopping. This superstructure of tourism is ever widening. It needs to be supported by a range of infrastructure facilities such as; seaports, airports, road, rail and ferry services, public utilities, telecommunication; computerised reservation systems; and use of sophisticated promotion techniques via satellite T.V., Internet, Worldwide Web; Institutional arrangements play an important role in the effective development and management of tourism. Some of these arrangements are appropriate legislative and institutional infrastructure; education and training programmes; capital mobilisation; marketing and promotion; and facilitation including immigration requirements, visas, and customs.

Internal integration is a putting together or tying up of the different components of the tourism industry. With the level of inter-relationships within the tourism sector as well as the inter-relationship with sectors outside the tourism sector, that is, internal and external integration, benefits from tourism development will accrue if planned in an integrated manner, referred to also as comprehensive tourism planning.

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PARTICIPATORY HOUSING BY THE POOR

Susil Sirivardana

Housing development by the poor, is by definition, a political concern; in a different way. It should be above party and at the level of national policy. It must be underpinned by a value frame and sensitivity to the struggles of the poor, on experiential understanding of their initiatives to come out of poverty, the massive creativity and humanity locked within the poor, their wisdom and knowledge bases, and finally, their pivotal role in the making of societies and civilisations.

The articulation of a housing policy and programme is the responsibility of the state and none other. There is no question of permitting the state to divest itself or absolve itself of this responsibility. But very importantly, a 'lead' role is not necessarily a 'doing' role. Instead, a lead role has new functions like supporting, legitimising, mediating, complementing, financing, monitoring and offering strategic guidance.

The housing facilitators should not "tell" poor people what to think or decide or do. On the contrary, they use their intuitive empathy with the hidden capacities and wisdom of the poor, to facilitate their thinking and articulating with their peers in a process of collective self-development. A vibrant process of action reflection-action-reflection should be set in motion which becomes the normal way of thinking and acting. In other words, doing and learning must be inextricably combined.

Leadership is a critical factor in the pro-poor housing policy and housing programme process. A really national process which can encompass the whole nation and also sustain it over regime changes must have a critical mass to lead it. The elites and leaderships freely available in the establishment do not constitute such a critical mass because they are believers in the top down delivery model, where the poor are objects and not subjects.

PARTICIPATORY HOUSING BY THE POOR

Susil Sirivardana

The Sri Lankan Case in **housing by the poor**, both rural and urban, is highly instructive for the student of community participation in development. Further, it is illustrative of many environmental implications, implicit in the development process, itself. There are several reasons for the Sri Lankan Case to be a useful point of departure. It has been amply tested and proved on the ground, regarding the issue of sustainability. It had countrywide scale. It was home – grown and Sri Lankan in its design and redesign over time. It clearly circumscribed both the macro and micro levels, was well articulated, analysed and documented. Its intellectual underpinnings were so clear, and its process of internal learning from practice so vibrant, that it had the qualities of coherence, perspective and depth, which are always hard to come by.

The housing development experience by the poor was so deeply internalised, that it proved capable of catalysing a much larger process of nationwide poverty alleviation. That is the logic of including the Janasaviya National Poverty Alleviation Programme into a discussion on housing. In other words, it had a strategic impact on the reconceptualisation of development policy in general. It was nothing less than a case of paradigm change from delivery to participation, spearheaded by the state. The intriguing question is how was this done, what are its limitations, and what are the lessons to be drawn?

The Case aptly lends itself to tracking the macro-micro nature of the process and also examining a representative sample of its elements. By doing so we can better understand the methodology and criticality used for the practice of a sustained process of action-reflection-action-reflection, whose products were the very processes we are focusing on.

Twin Policy Shifts

Within the short space of only seven years, namely between 1983/84 and 1988/89, there were two critically significant macro policy shifts in the overall Sri Lankan development landscape. The first was in the sector of Housing by the Poor. The second was in Poverty Alleviation.

The first policy shift in housing development was a hundred and eighty degree change from the provider-based Hundred Thousand Houses Programme to the support-based Million Houses Programme, with 1983 being a transitional year. Both programmes were national and countrywide. But where the basis of the first was still discrete projects, the second was very much a process. Both concerned the rural and the urban poor. Methodologically, the transition was from state and bureaucracy dominated aided self-help housing, to poor people designing and managing their own housing development, with critically needed support being provided by the state. The aided self-help package included centrally derived type plans exclusively for new houses and all materials provided at the site, with the actual construction being done and managed by the family. In the alternative model, the house-building family participated in a wholesome self-managed process, which consisted of choosing their specific housing solution, accessing a small loan, designing their own housing solution, managing the construction, taking full responsibility for the outcome, and finally, learning from the whole experience.

Therefore, there had taken place, a fundamental change of vision regarding the critical issues of who does what, how, when, where and who pays, regarding poor people's housing needs' satisfaction. It involved poor people coming to the centre of their own housing cum self-development process. For the first time, they had become subjects of their own development and were no longer objects of other people's development. The role of the dominant and dominating state had radically altered to that of sensitive but strategic supporter. Strategic because, without it, the people's initiative would not have come to fruition. In fact, the roles had got reversed. The state was now participating in the housing development process of the poor : the poor were no longer under the compulsion of participating in a process of the state. However, it may be noted that the state led the process. But importantly, the lead role was neither a deciding nor a doing role. It was only one of complementary support, especially in those areas where the poor families could not solve problems on their own.

But the second policy shift from 1988/89, was much more strategic and systemic. No longer was it to do with one or two sectors. It was cross-sectoral and enveloped all sectors. It was nothing less than making participatory development national policy and realising it on the ground with all the necessary supportive elements. It was a serious attempt at addressing the issue of structural poverty head on through the Janasaviya National Poverty Alleviation Programme. Here our interest in this Programme is limited to the fact of noting how the housing experience catalysed a much larger process of poverty alleviation.

The single most critical factor in how a sectoral process helped in generating a substantive systemic process is, the role of learning. There was a continuous marrying of action and reflection, doing and learning, throughout the course of the Million Houses Programme process from its inception in 1983. As a result, the implementation was being questioned and critiqued all the time, in order to draw the lessons for its own consolidation. The larger, non-housing implications of the paradigm change were also well known, but objectively there was no opportunity for taking it beyond the shelter domain. Historically, the space for such a breaking in, opened in late 1987. Seizing the opportunity within both the national-systemic crisis [two fold insurgency in the North and the South] as well as the development crisis [increasing poverty and deprivation consequent upon the short term impact of opening the economy and practising structural adjustment since 1977], the then Prime Minister and Minister of Local Government, Housing and Construction, Ranasinghe Premadasa, proposed to Cabinet that an intellectual shock study be prepared in the form of "An Action Programme on Poverty Alleviation through People-based Development".

The proposal was accepted and the study was done in eight weeks. It was done by an eight person High Level Committee of Officials, chaired by the then Governor of the Central Bank of Sri Lanka. It was basically a synthesis study which enunciated an explicit pro poor value frame drawn primarily from internal Sri Lankan experience in participatory development but also externally from the region, analysed and generalised the lessons from the breakthroughs in the Rural and Urban Housing Sub Programmes of The Million Houses Programme, and reformulated innovative operational principles and the organisational structure for a radically rethought national poverty alleviation policy and practice. It was this act of bold reflection, which provided the intellectual underpinning to the future Janasaviya Policy and Programme. While the recommendations were debated several times in the Cabinet of Ministers, there was no action which followed. But this substantial and authentic piece of homework proved to be invaluable, when Ranasinghe Premadasa got his chance on becoming the presidential candidate of his party in October 1988. He used the findings of the Action Programme extensively in his manifesto and made the Poverty Alleviation Programme, its centre piece. That was the path taken by the catalysing process under consideration.

Decentralisation and Devolution

Coming to the corresponding micro element, the whole implementation process was fully devolved and decentralised. This new dimension was implicit in the conceptualisation of all operations. But the single instrument which encapsulated this inverted vision, was a set of Implementation Guidelines in point form. These guidelines clearly conveyed the message that the mission was to understand and then interpret them creatively and dialogically with the thousands of poor families at the base. Starting from the grassroots level, the division of tasks and functions at each superior level, was clearly stated. All the different groups of actors read, digested and practised from this single set of guidelines. The Implementation Guidelines were highly successful in providing a consensual implementation framework to a far-flung diversity of actors.

Starting at the base, the devolution first functioned at the level of the household with individual poor families and communities. They took all the decisions regarding the type of housing solution, its design and construction. Additionally, they managed the whole construction process. So, it was deeply participatory in an organic way. There was also a significant contribution from local government. In rural areas, the Gramodaya Mandalaya or the Village Council, played an integral role in selection of the eligible families. Correspondingly, in urban areas, the Urban Local Authorities like Municipal and Urban Councils, played a critical role. A special institutional mechanism was generated within these bodies solely to service the housing programme.

Within this devolved and decentralised framework, the bureaucracy and field level technocracy had the major role of providing sensitive support. Sensitive because, they had to react to each family on its own particular terms. The house-holders were no longer passive recipients of uniform type plans: they were active subjects who interpreted their own needs according to their own choices, tastes, knowledge and capacities. The supportive interface involved a long and dynamic process of dialogue and mutual help between two human beings and or groups. The support actors were morally under compulsion to trust the builder families, legitimise and validate their autonomous initiatives, advise and guide them where needed and finally learn from people and enable people to learn from them.

Family and Community

We have already referred to the replacing of the family, and in the urban case more specially, the poor community, at the *centre* of their own self-development process. This was a part and parcel of the new support-based and people-based macro policy. By doing so, there were new values and attributes which were generated by it. We have three attributes in mind, First, the newly released freedom to choose and build. This is the first time in modern Sri Lankan history, when the state has not "told" people "what materials to use" in their own building. Actually, the experience is noteworthy as an authentic aspect of the decolonisation of knowledge. Second, the new policy really enabled the operation of a successful housing loan scheme based on affordability. This was almost totally absent in the previous Hundred Thousand Houses Programme. Third, is the implication on technology. There was a strategic nexus between the small housing loan and the right technology, and by implication, between technology and its impact on the environment.

The micro mechanism corresponding to the macro attitudes of freedom to choose, practice of affordability and the invocation of the right technology, was called the Housing Options and Loan Package or HOLP for short. There were two HOLPs, one for rural and one for urban. They

were the mode of embodying the above mentioned attributes as well as the means of the poor accessing them as a matter of everyday practice. They were simple, direct and transparent charts or matrices. The rural HOLP was designed in 1984 and the urban in 1985. They have been in continuous and intense use from then upto now. Of course, over time, the loan ceilings have been revised. Given below are the two HOLPS.

The HOLPs did several things simultaneously: informed and 'spoke' to user-families, offered varied choices, catered to diverse needs, matched needs with affordability, gave freedom and flexibility, set loan limits and conditions directly and simply, and was extremely user-friendly. Immediately, we must note an important change in the issue of monitoring of performance. The diversity of loan responses meant that no longer are we counting units constructed. Instead, we can now only count families benefitted. Actually, the methodology of designing the HOLP, was basic though not simplistic. The task entailed making a series of equations, namely needs with choices, with loan limits, with interest rates and repayment periods. We may note in passing that the HOLP lends itself to infinite adaptation. For example, if you wanted to add an environmental or sanitation dimension to it, all you needed to do was to incorporate those choice components in the list of choices and equate them with the specific input forms available. If it is a Food for Work Programme, you only needed to substitute the Choices of Work Items and related Food Packages in lieu of Housing Choices and Loans.

The proof of the success of the HOLP mechanisms would be in its performance. The numbers, however they are reckoned, are impressive.

MILLION HOUSES PROGRAMME PERFORMANCE (1984-1989)

<u>Sub-Programmes</u>	<u>Families Reached</u>	<u>Families Completing</u>	<u>Disbursements</u> <u>[Rs. mns]</u>
RHSP	258,762	231,752	1,301.1
UHSP	38,125	33,664	313.4
* RHSP Loan ceiling			* Rs. 7,500.00
Actual average RHSP loan disbursed per completion			* Rs. 5,614.00
* UHSP Loan ceiling			* Rs. 15,000.00
Actual average UHSP loan disbursed per completion			* Rs. 9,312.00

These encompassed exceptional scale. It was truly nationwide in a spatial and horizontal sense. Hence, its realisation of distributive equity was truly impressive. Its cost effectiveness was equally noteworthy. The direct cost to the state was minimal, but the value added component of family labour and the expansion of asset bases were almost exceptional. Above all, was the factor of human satisfactions. Each of these houses was different and distinctive, because it had the user family's individual needs, priorities and tastes stamped on its design and appearance.

Regarding community organisation and mobilisation, the reflective practice produced its own methodology of Social Mobilisation, which was given the housing specific name Community Acting Planning or CAP. CAP was an open-ended method of engaging poor house-building communities, women's groups and groups in a dialogic two-way process of action-based learning and self-mobilisation, doing various types of construction, savings and credit, organising women, providing basic infrastructure and land filling, etc. Whatever the community specific problem or need was, it could be engaged in by CAP. In housing, the main mode or vehicle used was the

issue-based short-duration workshop, held in the settlement and organised by the community. The method was prolifically used for the following core tasks: community mobilisation and organisation, on site land regularisation, on site generation of building guidelines, savings and credit, enterprise development for women, an upgraded and streamlined method of construction by and for communities called "community construction", role of urban local authorities, maintenance of common amenities, making micro plans or community plans and for community-based monitoring and evaluation of settlement improvement.

The implication on the kind of technology was quite strategic. The point to realise is that the level of loan determined the quality of technology. The virtue of fixing the loan ceiling at a critically but minimum level meant that only indigenous and traditional technologies were functional, and nothing else. So, conventional cement, sand and mortar technology was unaffordable at that level of loan. Local mud-based technology however, was. This meant that the programmes moved by mobilising ample resources of traditional knowledge, skill and material. This enhanced local economy, created additional employment and validated the hitherto marginalised skills and resources.

Land

The macro attitude to land also changed. For one thing, the new policy meant an exponential expansion in the scale of demand and participation. Hence, the response was to innovate, experiment and rethink the issues of access to land and stable tenure in partnership with the poor. Extremely significant was the overall policy of looking at high value urban public land squatted upon by the poor, in terms of its *use value* and not its *exchange/market value*. In other words, the customary right of the urban poor to the land they had lived in was recognised by the state as a right they had earned by virtue of the concrete contribution they made to the sustenance of the town's or city's life. It became the duty of the state to correctly understand and value this contribution and relationship. Hence, perceived tenure, both urban and rural, was very high. Urban relocation was very much the exception.

The micro level initiatives on land were equally productive. An important legal initiative taken in the early 1980s by the state, inserted a special provision to declare a particular settlement occupied by the poor as a low income settlement area, which would thereafter be exempt from the normal regulations for the city, but nevertheless would have its own settlement specific set of regulations. This was an enlightened appreciation of the relative inapplicability of colonially derived bourgeois and middle class standards and criteria to the standards prevalent under low income compulsions. This was a wise facilitating measure. Accordingly, practically all upgrading and sites and services settlements being developed in the city were planned under this enabling provision. As a result, we have been able to regularise very small plots of land and confer tenure.

Another response was to reduce the scale of colonial land reservations, thereby optimising on habitable land. This strategy has been effectively used in the major Canal Redevelopment Project in Colombo, still in operation.

Institutional Changes

Key here was the reorientation of the primary institution, namely the National Housing Development Authority (NHDA). From having handled distinct projects under the Hundred Thousand Houses Programme, now the NHDA had to service the needs of thousands of builder-families in thousands of villages and all the small and large towns at one and the same time. It meant a far-reaching change in all operational and interfacing processes. For one thing, all

interactions and communications had to be transposed from partitioned rooms to the outdoor field. Support staff had to make themselves freely available and accessible at times and in places when it was convenient to the 'working' poor. This meant working irregular hours and practically seven days of the week. In sum, the whole spectrum of technocracy, irrespective of hierarchy, de-trained and re-trained themselves to become trusting supporters and active helpers of the poor. In institutional terms, when the process went full circle, the NHDA, a state agency, began thinking, working and behaving like a committed non-governmental organisation.

Limitations and Weaknesses

What were the limitations and weaknesses, both internal and external, in this huge national experience in participatory housing by the poor with the state as supporter? By internal, we mean infirmities within the process chiefly. By external, we mean limitations within the society and the system. Both types of limitations also reflect the reasons which led to their unravelling. The first concerns the *nature and quality of leadership*. The programmes took off with lightening speed and sustained their momentum through the inherent creative capacity of the critical mass they successfully built up to lead it. Fundamental in that critical mass was the role of its political architect and visionary, Ranasinghe Premadasa.

President Premadasa had a concrete and authentic vision for Sri Lanka. It was a vision in which all people in the nation, *especially her poor people*, had the most pre-eminent role and responsibility. It was a holistic vision. It involved a fundamental restructuring and reordering of society. And housing was the seed which rapidly nourished the growth of a larger and denser perspective. It was politically led all the way. This was its foremost characteristic.

The weakness lay in the fact that the critical mass was far too small. It was a mere handful of people, including the President. The others were deprofessionalised professionals. It happened that this critical mass dwindled for various very obvious reasons like people going abroad, the President being pre-occupied with urgent issues and some people being required to transfer jobs. So, when the hard core critical mass got scattered, there was no centre of excellence to offer strategic leadership. Leadership was critical for two key reasons, among others. Only committed leadership could give the process direction and momentum. It was needed to protect the integrity and content from being appropriated by lip service and tokenism.

Second was the fact that the initiative was so ahead of its time, that it drew fairly antithetical responses from the poor and the elites. The poor understood it, participated in it fully and liked it immensely. The proof lies in the exceptional performance, qualitative as much quantitative, and of course, in the faces and lives of the families living in the houses. This is as it should be, because really, it is *their* programme. They are its *owners*.

But the elites in general, could not comprehend it in the last analysis. According to conventional professional wisdom, they found it too simplistic. They suspected that there must be a hidden catch in the dynamism with which it unfolded. They could not conceive that the poor people had such capacities and creativity. For example, the issue about the index of counting changing from *Units Constructed* to *Families Benefited* has never been comprehended or acknowledged by them upto this day. Another instance is the failure to understand the rationality of the issues involved in the extremely radical policy on urban land. In short, they proved themselves incapable of understanding the issues inherent in the long drawn out debate between provider-based and support-based housing strategy, between genuine participatory housing by the poor as owners and subjects and conventional delivery of housing to a group of passive recipients called beneficiaries.

Third was a genuine limitation in the area of loan repayments. After a satisfactory start and a promising improvement in the rate of loan recoveries, with the prospect of the General and Presidential Elections in 1988/89, political considerations entered the programme in a destructive manner. Up to then, party politics had been effectively contained and corralled. Equity was genuinely practised. The needs of the poorest of the poor, with no affordability at all, were catered to by the complementary and parallel Sevana Sarana Grant housing programme. But in 1988, there was introduced a scheme of temporary loan repayment exemption for the category of poor borrowers, who were from among the receivers of Food Stamps. In the pre-election environment, this was interpreted by the public caught up in the campaigns, as a familiar politically-derived loan write off. With that, repayment rates which were going steady at 55 percent to 60 percent and rising gradually, plummeted to zero within months.

The fourth limitation concerns the depth and quality of the community mobilisation. We have to remember that the period 1984-89, only represents a first and initial mobilisation. Further and importantly, it was limited to being confined to the housing sector. At that time, the understanding of social mobilisation among the state actors themselves was limited. It was mechanistic and superficial. As a result, community organisations weakened and caved in after the immediate construction objective was realised. The dimension of women-led savings and credit and the need for a deeper and more internalised quality of mobilisation were missed out. The point being made is that the depth of mobilisation was insufficient to make it *transformative* in terms of overcoming structural poverty.

Lessons

What are the generalisable lessons that can be extracted from the analysis of the Sri Lankan Case? The first lesson is the need for a political approach and a holistic pro poor policy on housing as an entry point to generalised poverty eradication. Housing development by the poor, is by definition, a political concern. Political however, should not be taken to mean of a political party or of a regime. No, it should be above party and at the level of national policy. It must be underpinned by a value frame and sensitivity to the struggles of the poor, on experiential understanding of their initiatives to come out of poverty, the massive creativity and humanity locked within the poor, their wisdom and knowledge bases, and finally, their pivotal role in the making of societies and civilisations. By holistic pro poor policy, we mean that this awareness must be enriched with an explicit value frame, which is also holistic and not fragmented. The policy that is sought to be hammered out for housing, is sectoral nevertheless. Thus, it is not an end in itself. Instead, it is a means to the ultimate goal of eradicating poverty. That is why we have called it an entry point to a further and more longer term process.

The second lesson concerns leadership of the pro poor housing policy and housing programme process. A really national process which can encompass the whole nation and also sustain it over regime changes must have a critical mass to lead it. The elites and leaderships freely available in the establishment does not constitute such a critical mass because they are believers in the top down delivery model, where the poor are objects and not subjects. The critical mass could be drawn from every available source and must be aware of political dynamics. They must have an experiential knowledge of the values and processes being advocated. Book knowledge alone is too stereotyped and insufficient. The critical mass must be sufficiently large in terms of numbers - at least a dozen - to make up for unexpected departures. They must be able to articulate the new vision at a macro level while being capable of working out the implementation details on the ground. So their tested capacities must be at both macro and micro levels.

The third lesson has to do with a clear and correct understanding of the lead role of the state. The leadership must be crystal clear on the relative roles of the state and the poor. As far as the state goes, the articulation of a housing policy and programme is the responsibility of the state and none other. There is no question of permitting the state to divest itself or absolve itself of this responsibility. But very importantly, a 'lead' role is not necessarily a 'doing' role. Instead, a lead role has new functions like supporting, legitimising, mediating, complementing, financing, monitoring and offering strategic guidance. This is not the heavy-handed domination that we are all too familiar with. Rather, it calls more for values and sensitivity, empathy and trust, which are relatively rare in the system. Therefore, a major responsibility of the leadership is to reorient and sensitise people in the establishment to the new pro poor thinking. The lead role also requires that the state builds up positive partnerships between different actors in the support system, like banks, co-operatives, local governments, private sector and voluntary organisations, and the poor.

A very important consideration here is to openly acknowledge that the process must be led by the organised and informed poor themselves. In other words, in a pro poor process, the poor themselves are the potential owners and the holders of sovereignty. The poor must therefore not be relegated to being agents or sub-contractors of the state. In this context there is one other important point, namely to depoliticise the operations in a party political sense. The politics of the poor has its own integrity and richness. Party politics is inimical to the genuine politics of the poor, which is solely need-based.

The fourth lesson is about the core methodology of social mobilisation. One must understand social mobilisation in depth, because it is through it that the poor are made aware, are made to understand their social reality, and finally to organise themselves to use their empowered state to negotiate as equals in the society in which they live. Today, social mobilisation is a learnable and trainable skill. It has its own complexity and therefore must be learnt at the hands of a core trainer and practitioner. Thereafter, you have to train thousands of facilitators, and animators who will in turn interact with the poor. The facilitators do not "tell" poor people what to think or decide or do. On the contrary, they use their intuitive empathy with the hidden capacities and wisdom of the poor, to facilitate their thinking and articulating with their peers in a process of collective self-development. In this process, they confront and question the reasons for their poverty. They confront their key problems and accept the challenge to find practical solutions for them on the basis of self-reliant experience.

The poor are only one constituency of the attention of the animators. Simultaneously, they have another constituency, the members of the support system. While they mobilise the poor, they also engage the support system personnel in a dialogue which helps them to reorient their attitudes and appreciate the virtue of pro poor values. Designing implementation mechanisms like the HOLPs as well as drafting of guidelines in dialogue with the poor, are all integral functions of social mobilisation. Planning and monitoring are equally organic parts of the overall process. The last component is to help the poor to build up their own organisations of the poor, which will use a variety of entry points - housing, environment, sanitation, savings credit, water supply, agriculture, forestry, women, and primary health to challenge the systemic burden of poverty.

The fifth and last lesson relates to the need for a vibrant process of action-reflection - action-reflection to become a normal way of thinking and acting. In other words, doing and learning must be inextricably combined. Throughout the process, there must be a wholesome capacity to seize the lessons thrown up by the practice and quickly reincorporate them back into the process. Once this culture is developed, there is at hand an internal process of correcting mistakes and turning weaknesses into strengths.

These five lessons are central to any thought and practice on pro poor housing development policy. They provide a critical undergirding to a systematic and holistic study of the subject. The purpose has been to provide a sound and coherent perspective on a subject where there is considerable confusion.

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SUSTAINABLE MANAGEMENT OF ISLAND RESORTS

Simad Saeed & Mohamed Inaz

A central precept that is being preached in the Maldives in regard to tourism is not to kill the goose that lays the golden eggs. The tourism industry in the Maldives began in 1972 evoking the image of a lost paradise. Tourism in Maldives is entirely dependent on environmental quality.

The environmental consequences of resort construction and operation in the Maldives unless carefully managed can be disastrous. In considering the environmental impacts of tourism, particular attention should be given to solid waste disposal, sewage disposal and impacts on freshwater, coral reefs and island vegetation.

Today, Maldives has developed a form of tourism, appropriate to the small island environment. This has been accomplished through careful management. The government has applied strict regulations and standards over a period of time and success has been achieved because of the understanding, willingness, commitment and co-operation shown by the private sector developers.

At present, the environment of Maldives is in a sufficiently pristine state and with responsible management it is likely to stay that way for a considerable period of time. In the years to come, slowly, but surely, tourism development is bound to damage the environment through over construction, excessive visitor numbers, and pollution.

SUSTAINABLE MANAGEMENT OF ISLAND RESORTS

Simad Saeed & Mohamed Inaz

The Republic of Maldives is a small island developing state consisting of 26 coral atolls dominated by the sea and is situated in the Indian Ocean, south-west of India. The 26 coral atolls contain about 1,190 very small islands of which only 200 are inhabited. The capital of the Maldives is Male', an island by itself, and the Male' International Airport also has an island (Hulhule) to itself.

Tourism development in the Maldives is based on the principle of isolation of tourists from the bulk of the indigenous population and the physical configuration of tourism development is an unusual one. In the Maldives, the "tourism industry" is synonymous with "resort islands" and each resort occupies a separate island and is totally self-contained. This isolation is practical because of the availability of a large number of uninhabited islands that can be developed into tourist resort islands.

According to a tourist opinion survey conducted by the Ministry of Tourism in 1991, the main attractions in order of priority are white sandy beaches, opportunities for snorkelling and scuba diving among coral reefs and spectacular marine life, sunny weather, clear lagoons and scenic peaceful environments. The expectation is one of a 'Robinson Crusoe' existence without any problems where the 'Art of Doing Nothing' is practised in a relaxing atmosphere.

Tourism History

Maldivian tourism entered the international scene only in the early 1970s. Tourism commenced with the opening of two resorts in 1972 and about 1000 tourists visited the islands. Until then the Maldives were virtually unknown to the tourist travel trade. By the late 1970s, tour operators, notably from West Germany and Italy, started to feature the islands within their programmes and international tourism had become an important source of income for the Maldives.

The first decade (1972-1982) in the development of the Maldives tourism industry evolved essentially in an un-planned laissez faire manner. Hulhule Airport was the basic and the only gateway to the Maldives and the natural hub for tourism development. Thus the first two resorts to be developed were Kurumba and Bandos islands in close proximity to Hulhule Airport and Male'. In 1973, along with three other resorts, Club Med established itself on Farukolhufushi Island, also only 20 minutes by boat from Hulhule Airport.

Tourism in Maldives originated from excursions from Sri Lanka because of the reputation of Maldives as a diving destination. Tour operators identified the ideal combination of packaging the cultural orientated product of Sri Lanka with the unique island paradise holiday of the Maldives. During the 1972-1980 period the market changed from the more limited and specialised divers' market to the much bigger mainstream market for beach holidays. With the growing importance of the mainstream market for sand, sea and sun holidays, the tour operators found that the market base was sufficient for introducing the Maldives as a separate destination.

With the completion of the runway at Hulhule' International Airport in 1981, direct charters from Europe, using wide bodied planes, flew in tourists. The expansion of air travel assisted by various promotional and other concessional fares on scheduled services, together with the rapid growth of charters, has helped the growth and development of the Maldives as a tourist destination.

In the beginning the facilities provided for tourists were basic. The room was furnished with just a bed and the essential cooling fan. Food with no exotic flavours was served by local people with no formal training, and scuba diving and island hopping were the only recreation facilities besides sun bathing and swimming. At present, a diverse range of facilities are offered at different resorts. At the luxurious end of the spectrum, public spaces have expensively tiled finished floors, vast varnished and carved timber frame roofs, elaborate light fittings and plush furniture, impressive reception areas, international cuisine, swimming pools, fountains, piped music and a lush landscape incorporating many ornamental imported species.

Tourism Indicators

Two resorts with a bed capacity of 280 opened in North Male' atoll in 1972. By the end of the first decade (1972-1982), 44 resorts became operational and bed capacity rose to just under 4,000. With the spatial policy shift towards opening of Ari Atoll, together with consolidation and upgrading of existing resorts, the next decade (1982-1992) saw the addition of 36 new resorts with over a doubling of bed spaces to reach a total of almost 8,500. By 1995, there were 74 resorts in operation in the Maldives.

During the year of inception of tourism in the Maldives, 1972, only 1097 tourists visited the Maldives. The number of annual tourist arrivals (reaching over 300,000 in 1995) now exceeds the total indigenous population of about 244,000. Europe is the leading generating market followed by the Asian market. Germany and Italy are the two main suppliers of tourists and in 1994, shared 40 percent of the total tourist arrivals to the Maldives.

In the late 1970s, international tourism became an important source of income for the Maldives. The readiness of the Maldives to develop its tourist sector can only be understood in terms of its very limited economic possibilities, especially the absence of local raw materials to diversify into exports of manufactures. At 17% of gross domestic product which provides over 25% of the government revenue and contributes around 60% of the country's foreign exchange earnings, tourism is the second largest contributor to the economy and it is increasing in importance year by year.

Tourism and Environment

Tourism depends on environmental quality more than any other activity and a central precept that has been preached in tourism is not to kill the goose that lays the golden eggs. Yet, in general, it is characterised by rapid, short term development which more often than not damages the very environment the tourists come to enjoy and simply moves off elsewhere. Without careful attention to the balance between the volume and type of tourist activity, and the sensitivities and carrying capacities of the resources being developed, tourism projects can be not only environmentally harmful but also economically self defeating.

Tourism in the Maldives exists solely due to the physical and geographic features of the coral islands. The beauty of the underwater world at the reefs, clean water in the lagoons, white and pristine sandy beaches, a rich island vegetation and ideal tropical climate form a virtual paradise that attracts tourists from Europe and Australasia.

Environmental Impacts of Tourism

The first proper evaluation of tourism in the Maldives was carried out in 1983 after 10 years of tourism development. It was then found out that the pollution of the sea with garbage, piles of waste found in the resorts often close to the tourist cottages, the picking of corals, the use of spearguns were features present that did not fit into the tourists' image of the Maldives.

In 1991, after almost two decades of tourism development in the Maldives, the perception of impacts has changed. According to the present perceptions, the islands offer uncommon visual beauty unspoiled by human settlement and a virtually unsurpassed marine environment and the strongest impression was of unspoilt, under populated tiny tropical islands replete with natural beauty and abundant sea life.

The Environmental Protocol prepared in 1992 by the Ministry of Planning and Environment to determine the carrying capacity constraints in the tourism sector concluded that the natural resources of the Maldives are in a sufficiently pristine state, and of such high aesthetic quality, that a period exists in which environmental deterioration can occur without an adverse effect on tourism. However, concern was expressed that the duration of this period cannot be predicted and with increasing environmental pressures, rising environmental sensitivity, and without compensatory environmental management, adverse effects may be felt sooner than later.

According to a survey carried-out in August 1995 involving the management of 47 resorts, beach erosion was identified to be the major existing environmental problem facing the resorts. The highly dynamic Maldivian beaches erode and build in response to wave action associated with storms, the tidal cycle, and the change in monsoons. The results of a survey carried out in 1992 showed that 12.8% of the total shoreline of 32 resorts surveyed consists of seawalls and groynes and is not sandy. The same survey also showed that 12 of the 32 resorts surveyed (38%) had offshore breakwaters to protect the beach. The maintenance of natural beach is of paramount importance to attract clients to the resorts and the construction of artificial structures designed to control and limit beach erosion are not only unsightly but expensive too.

Rubbish on beach is the next environmental problem identified by the resort management. Rubbish on beach mainly results from waste dumped at sea irresponsibly by neighbouring resorts and inhabited islands that get washed ashore onto islands with the current and to some extent from the messy habits of certain tourists. The resort management is quite emotive on this issue as this is one issue that will reflect very badly on the image of the resort environment.

Solid waste

Solid waste disposal is one of the commonest impacts of tourist resort operation and one of the easiest environmental management problems to deal with and thus has been addressed in a number of reports on tourism development in the Maldives. The pollution of the sea with garbage and piles of waste found in the resorts often close to the tourist cottages were

identified in 1983 among features that did not fit into the tourists' image of the Maldives. In 1985 the Department of Tourism reported that the disposal of non-biodegradable waste was then a serious problem and that there was a need for education to increase environmental awareness, and for the use of re-cycling technology.

In the new Tourism Master Plan solid waste is identified as a major issue for resort islands and it is stated that at current tourism levels, problems are probably more aesthetic than environmental. The Plan also points out that while solid waste itself may not currently pose a serious environmental threat, its impact in conjunction (e.g., synergistically) with the effects of other human activities should be considered.

Sewage disposal

In 1980 only two resorts were reported as discharging saltwater flushed toilets to the open sea. In a survey of methods of sewage disposal reported from 34 resorts in 1992, 23 resorts disposed sewage into the ground while 11 discharged sewage to the sea.

A survey in 1993 revealed that at 67% of tourist resorts sewage effluent is piped into septic tanks, and the untreated sludge is dealt with by natural processes and soil absorption. In 33% of the resorts analysed, septic tanks and sea outfalls were the reported practices. Measures that are being taken to protect the environment in cases of direct sewage discharge include the siting of outfall pipes 100m from the island and 30m below mean sea level (Hameed, 1993).

Sewage disposal has both health implications and environmental consequences. Aquifer contamination by faecal coliform bacteria or the contamination of bathing waters could give rise to health problems. Since a very small percentage of resorts pump sewage into the sea and even so, these resorts have a very small population it might be concluded that the current levels of sewage emission into the coastal waters of the resorts do not pose very serious problems to human health. The capacity constraints survey carried out in 1992 showed that the sewage discharges from resorts are relatively small and the observed effects were limited (MPE, 1992) Hameed points out that even though the volume of waste matter disposed is quite small, nutrients from sewage could build up over time, especially if the process of discharge is not managed well. However, volumes of water and rates of water exchange are large and in view of the productive fisheries, the atolls are probably already subject to relatively high nutrient input from upwellings as oceanic currents hit them. Hameed also suggests that the seaweed growth found in the lagoons of certain resorts could be related to nutrient enrichment from sewage effluent despite the small scale nature of the discharges and concludes that the long-run accumulated effect is significant in terms of pollution (Hameed, 1993).

Groundwater

There is an increasing move away from using groundwater as a resource in tourist resorts. Drinking water in tourist resorts come from rainwater which is collected on roofs and stored in large tanks and is now supplemented by desalinated water and imported bottled mineral water. There has also been a move away from the system in which groundwater was used for showering and flushing toilets to one in which saltwater is used for flushing with the wastewater pumped out to sea and desalinated water used for showering.

Groundwater quality deterioration could be caused through increasing abstraction of groundwater which depletes the already thin freshwater lens; salt water intrusion into the

Sustainable Management of Island Resorts

freshwater aquifer; and contamination of groundwater from sewage discharges. In addition to sewage, groundwater can also be contaminated through the use of contaminated soils; the excessive use of fertilisers; the use of pesticides; and inappropriate solid and liquid waste disposal.

An analysis of groundwater quality and pollution in tourist resorts, based on the results of Maldives Water and Sanitation Authority Surveys and consultants' opinions showed that groundwater quality in the resorts is deteriorating (Hameed, 1993). However, the capacity constraints study in 1992 concluded that whilst there is some evidence that groundwater quality has deteriorated in some resorts through tourism, the deterioration is not significant and is unlikely to be irreversible (MPE, 1992). The study also suggested a number of factors mitigating any possible deterioration and they are:

- a. the sources of pollution are relatively benign though more and more pesticides are being used and rubbish buried on islands.
- b. high rainfall backed up by evidence that salinity vary widely on many of the islands between the wet and dry season indicates that flushing rates, and oxidation, of contaminants are likely to be rapid.
- c. before upgrading resorts traditionally used groundwater flushing for toilets and for showering this minimised the historic loss of groundwater.
- d. the contaminant adsorption properties of coralline soils are generally extremely limited. One advantage of this is that any contaminants should be flushed out eventually. This is good for the state of the groundwater but not so good for adjacent lagoon waters.

Coral Reefs

On tourist resort islands reef damage has been caused by scuba divers, and by snorkellers and bathers walking out across the reef flat. The greatest threat at present almost certainly arises from snorkellers and bathers, from both inadvertent breakage and deliberate removal of coral and coral fauna for souvenirs. A study at Kurumba Village (MOT, 1995) has assessed the effects of snorkellers on the reef flat/crest at depths up to about 1.5 m. Results indicate breakage of 18% of all *Acropora* corals/month. Hence most or all coral colonies of this genus stand to get broken each year, suggesting a significant effect from snorkellers.

The present evidence on reef degradation from sewage in the Maldives is inconclusive. The Environment Protocol reported that none of the 32 resorts surveyed in 1992, and none of the 70 dive base operators on 41 resorts, identified sewage as a problem causing reef deterioration.

Direct and indirect damage to reefs is caused by divers and tourists' demands. However, the greatest impact to reefs in the Maldives has originated from coral mining for construction purposes (Brown and Dunne, 1988).

Island Vegetation

The image of a palm fringed sandy beach and lush tropical vegetation is integral to the perception of, and satisfaction, with Maldives as a tourist destination. At present there is no requirement to survey and consider the vegetation of an island as part of the planning

approval process prior to resort development. In the construction process trees and shrubs are cut down and coastal vegetation is removed. Exotic ornamental and fast growing species are imported to replace the vegetation removed and for new resort gardens. The introduction of exotic species not only reduces the ability of the island to recover to its natural state but also the exotic species may oust local ones directly or through introduction of pests.

There is also the matter of maintaining the natural perception of the island for marketing purposes. Whilst the palm is the most important vegetation feature on an island there are local plants that have historic and cultural importance and so have marketing value which imported exotics do not have.

Soil and fertiliser have largely been imported to improve the growth prospects of exotic imports. These imports are very much on a trial and error basis and there is little doubt that many soils and a variety of fertilisers have been tried. This process detracts from efforts to use local vegetation which is already adapted to local conditions, and so should not have to be sustained artificially. Imports may also introduce soil associated pests and diseases for which local plants have limited resistance.

National Legislation

Act no. 15/79, the main law on tourism in the Maldives was passed by the Citizen's Majlis in November 1979, outlining the basic regulations for the resorts on registration and operation, and tax policies. The original law had seven clauses in it and amendments were made to the original law through laws Nos: 11/80, 14/80, 4/82, 6/83 and 2/87. The present law came into force on the first of November 1989.

With the Tourism Law as the basis, a number of regulations, standards and controls have been specified by the Ministry of Tourism for operations within the tourism sector. The book of tourism regulations comprises of important regulatory measures including the Building Standards, Sanitation Standards, Disposal of Garbage, Carrying Capacity, Electricity Code and Tourist Behaviour. A review of the environment related tourism regulations is presented in the Environment Protocol (MPE 1992).

In April 1993, the Citizen's Majlis approved the Environmental Protection and Preservation Act which provides the Ministry of Planning, Human Resources and Environment with wide statutory powers of environmental regulation and enforcement. This umbrella law covers issues such as environmental impact assessment, protected areas management and pollution prevention.

Institutions

The Department of Tourism and Foreign Investment was established in 1978 and made responsible for supervision, co-ordination and maintaining standards of tourist services in the country. To develop and regulate tourism, and simultaneously to strengthen the institutional framework, for administering and monitoring the industry, this department was renamed the Department of Tourism in November 1982 and made solely responsible for tourism management. In 1984, the Tourism Advisory Board was established as a consultative body affiliated to the tourism authority.

The tourism sector was given elevated status in 1988 with the establishment of the Ministry of Tourism and according to the designating law 3/68 J under 1/69 J as at 1993 : to provide ways to develop the tourism industry in the Maldives, to plan methods of income earning through tourism to the Government, and to provide guidelines, and to administer the industry is the responsibility of the Ministry of Tourism.

The Ministry of Planning and Environment was established in 1988. This Ministry is responsible for the formulation of policies on environment, giving environmental guidance to other development sectors, implementation of environmental impact assessment and designation of protected areas.

Policy and Planning

During the first decade of tourism development there was no specifically planned development. It took place according to individual private sector initiatives in locations that offered market advantages principally related to the access opportunities offered by Hulhule Airport. During the first decade this essentially informal development managed to generate almost 3,500 bed spaces of international quality and the industry was achieving enviable occupancy rates of up to 80% in the high season.

The first formal initiative to plan, in an integrated way, the future development of the tourism industry in the Maldives, came when the Department of Tourism and Foreign Investment commissioned Dangroup International in November 1980 to carry out a Maldives Tourism Development Plan. This long range (10 years) Tourism Development Plan was prepared for the Maldives in May 1983 and some, but not all, of its recommendations were considered feasible for implementation.

The Tourism Development Plan prepared for the Maldives provided some ideas for development. However, most of the tourism planning and management has resulted from government initiatives, based on its evaluation of the best forms and standards of development. Many of the government's present approaches and standards have evolved through monitoring of the earlier phases of development to determine what is most suitable. Approaches and standards are refined - and some may be discarded - based on the experience gained from previous types of development.

By government policy, the resorts are located on uninhabited islands. This reduces any possible socio-cultural impacts. Also most islands are too small to contain both resorts and traditional villages. These islands are owned by the government and it can allocate them for resort use as needed. The resort developer receives a long-term lease and pays an annual rent that is calculated individually for each island. The resorts must supply their own infrastructure of electric power, water supply, sewage and solid waste disposal, boat dock and recreation facilities. They must also provide housing and related facilities for the resort employees. The families of employees remain on their home islands, often some distance away.

The government policy has been to expand tourism for its economic benefits, but in a systematic manner of staged development. In the late 1980s, Kaafu Atoll was considered saturated with resort development. This decision was made within the framework of maintaining high environmental standards for the existing resorts, and retaining sufficient land for village and urban expansion, recreation and parks.

All new resort development was then programmed to take place in Alif Atoll, which is accessible by sea and air from the international airport. In parallel the government policy turned to encourage expansion and upgrading of existing resorts to higher standards, including meeting present environmental quality standards. This upgrading was considered necessary to maintain the viability and competitiveness of these resorts and to maintain all tourism development at a reasonably high level, catering to quality tourist markets. As an inducement to achieve these objectives the resort leases were extended from 10 to 21 years and much of this upgrading has been accomplished.

The third National Development Plan (1991-1993) recommended the development of a ten year zoning plan (1991-2000). Under strategies and policies to achieve the main objectives of tourism development, the NDP (1991-1993) included a proposal to assess environmental impacts of resort developments and operations, and further strengthen measures taken to protect and conserve the environment and the natural setting for tourism, and adopt remedial measures on environmental degradation (MPE 1991).

The issues that are examined in the new draft Tourism Master Plan include new markets, priority markets, air travel and other transportation issues, tourism infrastructure development, legal aspects, human resource development, gender issues, socio-cultural aspects and environmental impacts (Noorwed Consultants, 1995).

Environmental Impact Assessment

The Environmental Protection and Preservation Act of Maldives (4/93) provided the basic framework for the Environmental Impact Assessment (EIA) process in the Maldives and under article 5 (a) of the Act, an impact assessment study shall be submitted to the Ministry of Planning, Human Resources and Environment (MPHRE) before implementing any activity that may have an impact on the environment. According to the EIA guidelines issued by MPHRE all new resort developments require an EIA study before approval for development can be made.

Carrying Capacity Limits

As an important basis for deciding the number of rooms and extent of resort facility development allowed on each resort island, the government has established carrying capacity standards. These are based on several factors. The cutting of trees is controlled so that the natural appearance and facade of the island are maintained and no buildings are allowed to appear above the tree tops. The maximum island area to be occupied by buildings is 20 per cent, with two storey buildings allowed to conserve land area if there is sufficient vegetation to conceal these buildings from the ocean view.

To preserve the tourists' perception and image of beach orientation, all guest rooms should be facing the beach, with a minimum of 5 metres of linear beach available in front of each room. Only 68% of the beach length can be allocated to guest rooms as 20% has to be allocated to public use and 12% left as open space.

Construction on reef flat and lagoon are discouraged. However, as over water bungalows are very popular among tourists they are permitted provided equal open space is left on the land for each building developed on the lagoon.

Architectural and Design Controls

The design of resort buildings are controlled so that they are well integrated into the island environment, take advantage of the tropical climate and use local building materials, such as thatch roofs, to the extent possible. Previously many buildings were constructed from coral mined from the reefs. However, the use of coral is now restricted and use of imported materials is now encouraged, although these are expensive by local standards. Coral and sand mining from resorts and their house reefs is strictly prohibited.

Hard engineering solutions for dynamic coastlines are discouraged and construction of solid jetties and groynes are controlled. Design of boat piers and jetties should be in such a way that they do not obstruct the original flow of currents or disrupt the wave climate within the lagoon. Construction of seawalls, detached and submerged breakwaters are restricted and natural methods of shoreline protection are encouraged.

Biodiversity Conservation

To protect and preserve marine biodiversity a number of measures have been prescribed. Spear, poison and dynamite fishing are strictly prohibited. Net and trap fishing are controlled and confined to certain areas. Removal of shells, juvenile lobsters and lobsters ready to lay eggs are strictly prohibited.

The catching of turtles is strictly prohibited and trade in all turtle products is banned. The commercial exploitation and export of a number of other species is also banned. Resort operators also voluntarily prohibit the catching of reef fish from the house reef or tourist resorts. Fifteen important dive sites have been declared as protected areas in 1994, where fishing, anchoring, removal of coral and other destructive activities are prohibited.

The Ministry of Tourism recognises the importance of vegetation in maintaining the natural beauty of the islands and there are a number of regulations which aim to secure this resource. These include a limit of 20% of the islands for building, the requirement that no buildings be put up that disrupt the natural facade of the island, that there be a minimum setback limit of 5 meters from the vegetation line of the island, and that no buildings should appear above the tree tops.

Waste Disposal

According to the regulations issued by the Ministry of Tourism, garbage from tourist resorts should be disposed in a manner that would not cause any damage to the environment. All garbage disposed into the sea should be done as far away into the sea as necessary in order to ensure that it does not get washed onto any islands with the current. Tourist resorts are required to have incinerators and compactors adequate in size to burn all flammable materials and crush all the cans respectively. Those who lack these facilities are not allowed to operate. Plastic or polythene bags should not be thrown into the sea and such material should be burnt. Those who contravene these regulations are subject to fines and penalties.

Under sewage and excreta disposal the tourism book of regulation specifies that the sewage system should be prepared such that pollution of water supplies, beaches and other areas are prevented; nuisance, ugly sights, and unpleasant odours do not occur, human wastes do not come into contact with people, animal and food; and breeding of flies and mosquitoes will be prevented.

Conclusion

Tourism in the Maldives began in 1972 and it then evoked the image of a lost paradise. The tourism industry of the Maldives is dependent entirely on environmental quality and since it established itself in the tourism market it has maintained its strong position in a rapidly growing market. A few critics in the 1980s proclaimed that environmental pollution had begun to rear its ugly head in the Maldives. However, the natural resources of the Maldives are still in a sufficiently pristine state and of very high aesthetic quality and environmental concerns are few.

Environmentally unsound practices in solid waste and sewage disposal pose the most serious threat from tourism to the delicately balanced coral reef ecosystem of the Maldives. Though solid waste is a cause of environmental concern, at current levels it is more of an aesthetic problem. In the past the portion of waste and garbage which could not be burned was dumped into the sea. This practice is now prohibited by law and waste incinerators and crushers have to be used in all resorts. Sewage effluent is discharged into the sea by the resorts. However, the discharges from resorts are very small and the evidence on reef degradation from sewage discharges is inconclusive. Some of the resorts are turning to the latest technology in sewage treatment using UV radiation to produce virtually pure water.

The Maldives has developed a very suitable form of tourism, appropriate for the small island environment. The present form of tourism development has not generated any serious environmental impacts. This has been accomplished through careful management. The government has developed appropriate policies, legislation and plans and instituted mechanisms to apply strict standards and regulations.

20

ENVIRONMENTAL SAFEGUARDS IN IRRIGATION MANAGEMENT

Poorna Bhadra Adiga

The East Rapti Irrigation Project in Nepal is a good example of the integration of environmental considerations into the development process. It is an irrigation project, previously rejected on environmental grounds presently it is being implemented through the incorporation of mitigation measures as proposed in the environmental impact assessment of the project.

The reformulated project is an example of infrastructure development with the incorporation of social engineering, resource management and traditional engineering. In order to ensure the environmental quality, particularly water quality of the entire ecosystem, an extensive environmental monitoring schedule is being implemented.

Once completed it would ensure people's participation in the operation and maintenance of the project; facilitate optimum agricultural yields, minimise the dangers of chemical pollution and safeguard the resource base for present and future generations of people.

ENVIRONMENTAL SAFEGUARDS IN IRRIGATION MANAGEMENT

Poorna Bhadra Adiga

East Rapti Irrigation Project

Chitwan valley is one of the fertile valleys in Central Nepal. The Royal Chitwan National Park (RCNP) is also located in the valley. East Rapti is a major river flowing through the valley from east to west. The river forms the northern boundary of RCNP and the southern boundary of the East Rapti Irrigation Project (ERIP). ERIP was initially conceived and designed to provide irrigation to 9,500 ha of twelve Village Development Committees (VDCs) in the eastern part of the Chitwan district in central Terai (plains) by diverting water from the East Rapti river. The project is funded by a loan from the Asian Development Bank. The East Rapti River is also the main source of water for the wildlife of the RCNP. During the implementation of the project, serious environmental issues were raised.

There were a number of Farmers who Managed Irrigation Systems (FMIS) within the project area. These farming communities diverted water for irrigation from the East Rapti River and its tributaries by constructing temporary brushwood weirs using local knowledge and technology. These brushwood weirs get washed away during the monsoon floods. The project intended to provide reliable irrigation to these systems and extend irrigation facilities to irrigable land not covered by FMIS. An EIA was carried out with the Bank's assistance in April 1991 which confirmed that the project as originally designed would create adverse environmental impacts on the Royal Chitwan National Park. The Project was reformulated in November 1991 on the basis of the environmental concerns. The reformulated project was approved by the Bank in October 1992.

Royal Chitwan National Park

RCNP adjacent to the ERIP is one of the largest wildlife parks in Nepal. RCNP was officially established in 1973 and enlarged in 1977 to include a total of 93,200 ha. The protected area located in the central Terai region is renowned for its diversity of flora and fauna. RCNP has been included since 1984 as a World Heritage Site for Nature in recognition of its outstanding global significance. It is one of the few remaining natural areas of high biological diversity; a habitat for 40 species of animals including the endangered tiger (*Panthera Tigris*), one horn rhinoceros (*Rinoceros unicornis*), gaur (*Bos gaurus*), gharial (*Gavialis gangeticus*) and Gangetic dolphin (*Platanista gangetica*). Vegetation in the park is dominated by Sal (*Shorea robusta*) forest, riverine forest and grasslands. Sal forests comprise about 70 percent of the park. Riverine forests cover about 7 percent of the park and occur along rivers, oxbow lakes and on river islands. Grasslands consisting of over 40 species of grasses comprise about 20 percent of the park. The park area is often encroached upon by the local people of neighboring VDC.s for forest products.

Reformulation of the Project

During the initial implementation of the project, prior to reformulation, serious environmental issues were raised. The major issue was the construction of a diversion weir across the river which would cause reduced discharge in the downstream portion of the river affecting the RCNP habitat.

The reformulated project excluded the construction of the controversial diversion weir and the scope was scaled down to minimise the environmental impact from the project. The revised project was designed to increase the efficiency of water use without increasing the abstraction of water for irrigation from the East Rapti River. It also aimed to enhance the value of RCNP. The major project components were:

- (a) Rehabilitation and improvements of the existing FMIS of the eastern Chitwan valley including those in the extended project areas.
- (b) Provision of irrigation facilities by the construction of shallow tube wells/open wells in areas not covered by FMIS.
- (c) Construction of river embankment along the right river bank to protect valuable agricultural land against floods.
- (d) Establishment of community forest along the river embankment. These forests would not only strengthen the embankment but also would serve as the buffer zone between the project area and RCNP. This forest would provide the necessary fuelwood and fodder to the community which would reduce the pressure on RCNP for these forest products.
- (e) Construction of farm/service road within the project area.

However there were still environmental concerns in the revised project expressed mainly by the RCNP management. The concerns were mainly due to following reasons:

- a. With the implementation of the irrigation project there is a possibility of increased use of chemical fertiliser and pesticides in the command area which would leave residual traces in both surface water of East Rapti river and groundwater of the project and RCNP. The East Rapti River being one of the major water sources of the habitat/wildlife of ECNP; the traces of pesticides and chemical fertilisers in the water could be harmful to them.
- b. Efficient FMIS might abstract more water from the river during low flow period resulting in lower discharge down stream if the river is not recharged from the groundwater.
- c. The intensive exploitation of groundwater resources by the construction of shallow tubewells open wells might deplete the groundwater resource affecting the growth of riverine forest in RCNP.

Responding to the above concerns, an additional Technical Assistance to the Project in the form of Environmental Monitoring and Management component was incorporated in the reformulated East Rapti Irrigation Project with the following objectives:

Environmental Safeguard in Irrigation Management

- (a) To undertake comprehensive environmental monitoring of data related to the water flows and water quality of the Rapti river and its tributaries as well as the groundwater table of the project area, so as to ensure and confirm that the activities undertaken by the revised East Rapti Irrigation Project will not impact the water levels of the Rapti river, the groundwater levels in the project areas and the water quality of the water resources in the project area;
- (b) To generate information necessary for designing environmentally sound plans and policies for water use, in particular, irrigation, in the project area; and
- (c) To facilitate the provision of sustainable and effective embankment stabilisation of the East Rapti river by planting trees that will stabilise the river bank and provide fodder and fuelwood to the target population.

Environmental Monitoring and Management

Under the Environmental Monitoring and Management Programme of ERIP, the following activities are being carried out.

- (i) Surface water quantity monitoring
- (ii) Groundwater Level Monitoring
- (iii) Water quality monitoring of both groundwater and surface water
- (iv) Assistance in establishment of the community forest along the river embankment.

Surface Water Quantity Monitoring

Two surface water monitoring sites in the East Rapti river were selected, one at the beginning of the project area at Semara, Pratappur and another at the end of the project area at Sauraha. River gauge staff are placed at these sites. Daily gauge recordings are made.

Regular monthly river flow measurement at the gauging stations are carried out. The discharge measurement is not possible during the monsoon period (July – September) by this method. Apart from these measurements, discharge measurements in the FMIS off taking from East Rapti river and in the tributaries are also made during the dry period.

These measurements enable to draw the hydrographic of the East Rapti river at beginning and end of the project area. These measurements also enable to prepare the water balance of the river between the beginning and end of the project area. Meteorological station for the measurement of rainfall, temperature and evaporation is established within the project area.

Groundwater Quantity Monitoring

Aquifer maps of the project area were prepared and inventory of the existing wells in the project area were carried out. Based on these two surveys, wells were identified for the monitoring purpose. The water depth of the selected wells are monitored monthly. Contours of water depth will be prepared.

Relationships among these monitored data of surface water and groundwater will be established and an attempt will be made to assess the sub-surface flow in the East Rapti river at Sauraha, at the end of the project area.

Water Quality Monitoring

Residual effect of chemical fertilisers and pesticides in the surface water and groundwater are the main concern of the water quality monitoring. The identification of the timing of the application of chemical fertiliser and pesticides and their type was quite important. Hence a household level survey on agriculture practice with specific emphasis on chemical fertiliser and pesticide was carried out. The commonly used chemical fertilisers were Urea, DAP, Complex and TSP where as commonly used pesticides were BHC, furadan, malathion, ripcard, dithene, inofil, thodidan, sumidon and desis. Some of these pesticides are highly toxic. Even the traces in the water could be harmful if consumed.

Water samples in the East Rapti river at the beginning and end of the project area are being collected and analysed. The result will provide the level of pollution contributed by the project area in the river. Similarly water samples are collected and analysed from the selected tubewells for the groundwater quality monitoring.

Embankment Stabilisation Component

Initially the project intended to establish the community forest along the flood embankment in about 150 ha. Response from the local people for community forest were quite encouraging. Peoples participation was positive. Plantations have been established in an area of 250 ha so far.

V

ABATEMENT OF POLLUTION

Air Pollution Control

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AIR POLLUTION CONTROL

Dr. A. L. Aggarwal and S.K. Goyal

Air pollution is a problem experienced by the urban dwellers since the inception of industrialisation. Over the years, this problem has been aggravated by rapid industrialisation, population explosion and tremendous increase in vehicular traffic. Therefore, there is a paramount need to protect man, animal and vegetation as well as material from damaging exposure to air pollution.

There is considerable variation in air pollution control strategies for major source categories namely; industrial, domestic and vehicular. Technological options and various air pollution control systems are discussed with their advantages and disadvantages from application point of view and their adaptability in each industrial sector.

Pollution control through raised stacks is discussed as an alternative option. This may be important for different meteorological conditions in the country. There are other options such as cleaner technology and possible change in the fuel.

The air pollution management strategy for a typical large urban area having multiple emission sources is elaborated with control at three stages; pollution generation stage, propagation between source-receptor pathway and finally at receptor stage. In this manner air environment of an urban area can be repaired to a great extent.

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Air pollution is a problem experienced by the urban dwellers since the inception of industrialisation. Over the years, this problem has been aggravated by rapid industrialisation, population explosion and tremendous increase in vehicular activities. Therefore, there is a paramount need to protect man, animal and vegetation as well as material from damaging exposure to air pollution particularly in the cities where on the one hand it has been increasing since the industrial revolution and on the other, the deficiencies in planning and in implementation of management strategies have aggravated the problem.

The earth's atmosphere is finite and also its capacity to clean itself is limited in critical areas having high air pollution potential/lower ventilation rates due to prevailing topo-climatic conditions or excessive toxic emissions from various air pollution sources. And when air pollution levels in such areas are significantly high, it would be a grave error to delay ameliorative actions. Before discussing the air pollution control technology and management strategy, environmental status of India, particularly megacities viz. Delhi, Bombay and Calcutta, major sources of air pollution and environmental status of industrial sectors is highlighted.

Ambient Air Quality Status

The data base on ambient air quality status in major Indian cities is being generated by National Environmental Engineering Research Institute (NEERI) since 1978 under National Air Quality Monitoring Programme. The cities identified to monitor ambient air quality are based on demographic density, industrialisation / urbanisation, and topoclimatic conditions representative of the geographical region. Ten cities viz. Ahmedabad, Bombay, Calcutta, Delhi, Hyderabad, Jaipur, Kanpur, Kochi, Madras and Nagpur are identified primarily because of the availability of infrastructure facilities such as established laboratory/equipment and trained manpower. Data for the three megacities; Bombay, Calcutta and Delhi, are also reported to Global Environmental Monitoring System on Air (GEMS/Air), the data bank maintained by UNEP/WHO worldwide.

Particulate air pollution is a serious problem in Indian cities. The ambient concentrations are persistently above WHO guidelines for long term averages (60-90 $\mu\text{g}/\text{m}^3$), 98th percentile values (CPCB standards as given in Table 1) and peak concentration values. The annual average levels across these cities are typically in the ranges of 200 - 600 $\mu\text{g}/\text{m}^3$ and peak concentrations cross even 1000 $\mu\text{g}/\text{m}^3$. In combination with high exposure to SO_2 , there can be significantly notable effects of particulates on human health. The inhalable fraction varies between 30 to 50% of total SPM, which causes health problems.

Table 1 National Ambient Air Quality Standards (CPCB) Concentration, $\mu\text{g}/\text{m}^3$

Pollutant	Averaging Time	Industrial	Residential/Rural Area	Sensitive Area	WHO Guidelines
SPM	Annual	360	140	70	60-90
	24 hrs	500	200	100	100-150
RSPM	Annual	120	60	50	40
	24 hrs	150	100	75	70
SO ₂	Annual	80	60	15	40-60
	24 hrs	120	80	30	100-150
NO ₂	Annual	80	60	15	
	24 hrs	120	80	30	150
Lead (Pb)	Annual	1.0	0.75	0.50	0.5-1.0
	24 hrs	1.5	1.00	0.75	
CO	8 hrs	5000	2000	1000	10000
	1 hrs	10000	4000	2000	30000

The annual average concentrations of SO₂ and NO₂ range between 18 to 85 and 12 to about 80 $\mu\text{g}/\text{m}^3$ except in one year, when as high as 140 $\mu\text{g}/\text{m}^3$ concn. was recorded in Calcutta. However, mostly the SO₂ and NO₂ levels are well below the national standards of 80 $\mu\text{g}/\text{m}^3$ for residential/rural and mixed use area category. The annual pollution trends in Indian megacities; Bombay, Calcutta and Delhi are depicted through Figs. 1 to 3 respectively for SPM, SO₂ and NO₂.

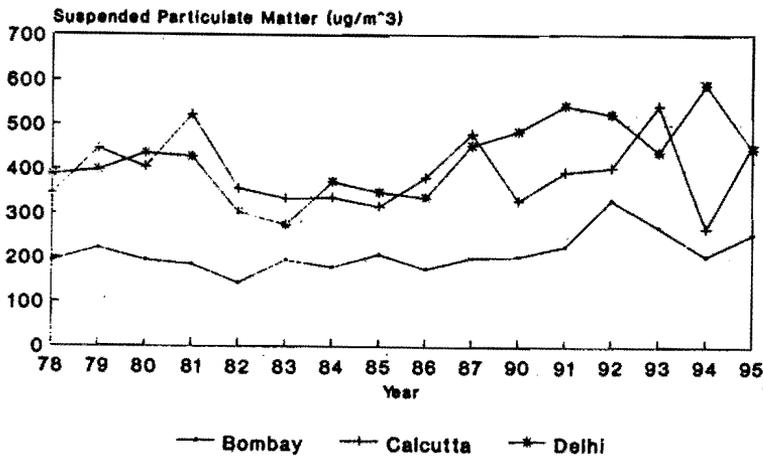


Fig.1 Annual Mean Concentration Trends of SPM in Megacities

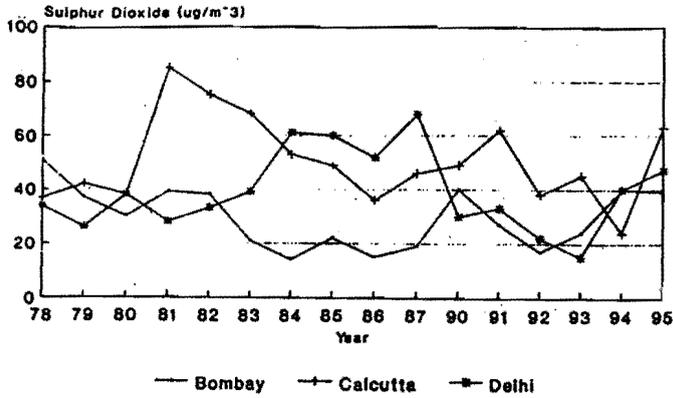


Fig.2 Annual Mean Concentration Trends of SO₂ in Megacities

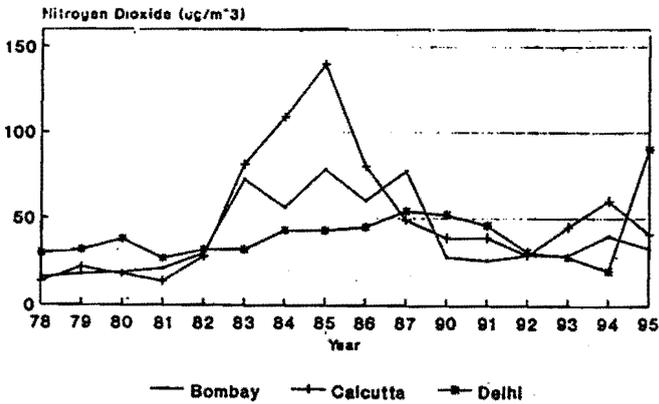


Fig.3 Annual Mean Concentration Trends of NO₂ in Megacities

Sources of Air Pollution

The major sources of air pollution in an urban area can be categorised into industrial, domestic and vehicular sectors, which have grown to many times in past two decades. All the major air pollutants and their sources are present in these urban centres in India though in varying degrees. Some sources are common to all of them while others are of importance in only in metrocities. Well documented source emission inventories were prepared for three Indian megacities (NEERI 1990 viz. Bombay, Delhi, Calcutta vol. 1,2, 3).

The contribution of source categories in these three megacities as presented in Table 2 shows that motor vehicle traffic is a major source of pollution due to tremendous growth in petrol as well as diesel powered vehicles. As a result the emissions of SPM, CO, SO₂, HC, NO_x and Pb are high. Vehicular emissions in Delhi have increased from 23 to 63% in two decades (1970-71 to 1990-91) and is likely to be 72% by the end of the century. Correspondingly, industrial source emissions have reduced to almost half (56 to 29%) in the same period. Similarly, in Bombay and Calcutta, the proportion of vehicular emissions has increased alarmingly.

Table 2 Contribution of Major Source Categories

Year	City	Percent Contribution		
		Industrial	Domestic	Vehicular
1970-71	Delhi	56	21	23
	Bombay	68	07	25
	Calcutta	70	27	03
1980-81	Delhi	40	18	42
	Bombay	65	04	31
	Calcutta	75	14	11
1990-91	Delhi	29	08	63
	Bombay	54	04	42
	Calcutta	73	08	20
2000-21*	Delhi	20	08	72
	Bombay	48	04	48
	Calcutta	74	04	22

* Projected

The growth of vehicles under different categories (2 & 3 Wheelers, Mopeds, Car-Jeeps etc, and Bus-Trucks etc) is depicted in Fig 4, which shows that 2 & 3 wheelers and diesel driven vehicles (bus, truck etc.) have doubled in a decade, whereas, mopeds and petrol driven vehicles (car, jeeps etc.) have become more by 6 times and 1.5 times respectively, in the same duration and is likely to be increased further by manifolds by the end of this century. The trend shows that the total number of vehicles will double in a decade causing major threat to the air environment which can very well be experienced in any urban area.

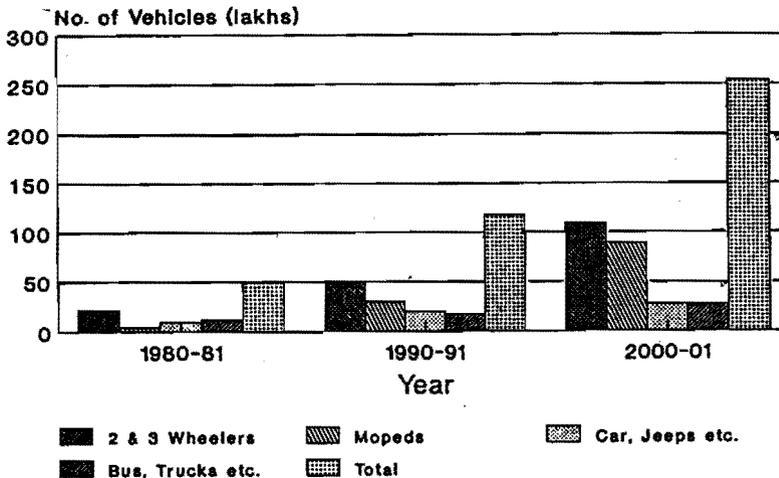


Fig.4 Vehicular Growth in India

Emission from power generation and industries are likewise a problem in Delhi, Bombay, and Calcutta. The multitude of other industries are however, dominant sources of air pollution

especially of SPM, oxides of sulphur and nitrogen. In Indian metrocities the problem of industrial emissions is compounded by the bulk of the industrial sources being interspersed with industrial areas, thus creating the potential for particularly high human exposure.

At present, the fuels used in metrocities vary as coal, oil and natural gas. Coal is still the predominant fuel for industry and energy in Delhi and Calcutta. A high degree of domestic coal or biomass fuel use is a very serious problem for health as there may be substantial indoor and outdoor exposures. Concentrations of SPM, HCs and SO₂ originating from domestic sectors are typically higher than other cities of the world. High levels of natural wind-blown dust-particulates are another characteristic feature which complicate the air pollution problems. The proximity to desert areas/barren lands leads to high natural loadings of SPM in cities like Delhi, Kanpur and Jaipur.

Environmental Status of Indian Industrial Sectors

The pollution control status of five major air polluting industries viz. thermal power, cement, iron and steel, non-ferrous, aluminium smelter is presented in Table 3, which shows that about 35% of the large industries do not comply with the standards.

Table 3 Pollution Control Status in major Air Polluting Industries

Industry	No. of Plants	Complying with standards	
		Yes	No
Thermal power plant	69	28	40
Cement	97	81	11
Iron & Steel plant	07	01	06
Non-ferrous metallurgical industries (Cu, Zn)	06	02	04
Aluminium Smelter	07	01	05

The remaining units are closed for different reasons

Source: CPCB Database

Further, the environmental status of small scale industries (SSIs) is far from satisfactory. It has been recognised that the small scale sector plays a major role in the industrial and economic development of a developing country in particular. In India, almost one third of the gross national product (GNP), and one fourth of the exports, is contributed by SSI sector, and as a result, it has taken an important place in the priorities of national development. Further, SSIs provide the support that large industrial enterprises require through ancillarisation and reduces the need for imports. The annual growth of SSIs sector for past 18 years is depicted in Figs 5 & 6, which show that SSI units have been increasing continuously and so the employment opportunities in this sector. But, in economic terms (production and export capacity) a substantial increase has been achieved after 1987-88 which is being continued.

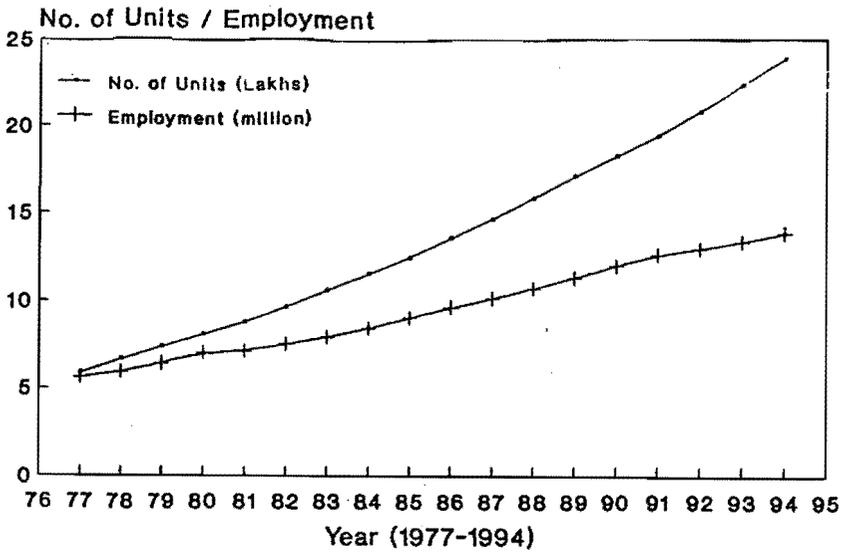


Fig. 5 SSIs : Growth Indicators

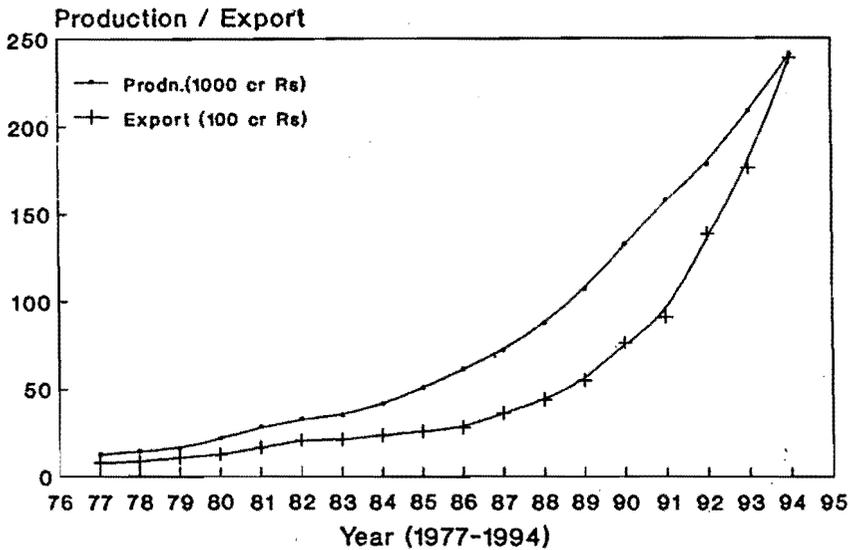


Fig. 6 SSIs : Growth Indicators

SSI's operations have a tremendous impact on the environment. Though the pollution load per unit is lower than for large or medium scale industry, yet the total pollution from SSIs is enormous due to their sheer numbers. Further, these industries are less efficient in their utilisation of materials and energy, thereby creating a higher specific pollution load, (per unit of production) for two reasons. Firstly, because of their small size, economics of scale do not apply, making them more inefficient. This is specifically true in the case of air pollution resulting from SSIs, normally clustered in an industrial estate. Secondly, within the low capital investment of a SSI, the high cost of pollution control becomes unaffordable. The SSIs, with inadequate pollution control arrangements are posing a grave threat to the environment.

Strategy for Air Pollution Control

The overall air pollution control strategy may be at best termed as Air Environment Management Plan (AEMP). It involves a three stage mitigation scheme starting from the pollution generation stage (at source), propagation between source and receptor and finally at receptor exposure stage, as shown in Fig 7.

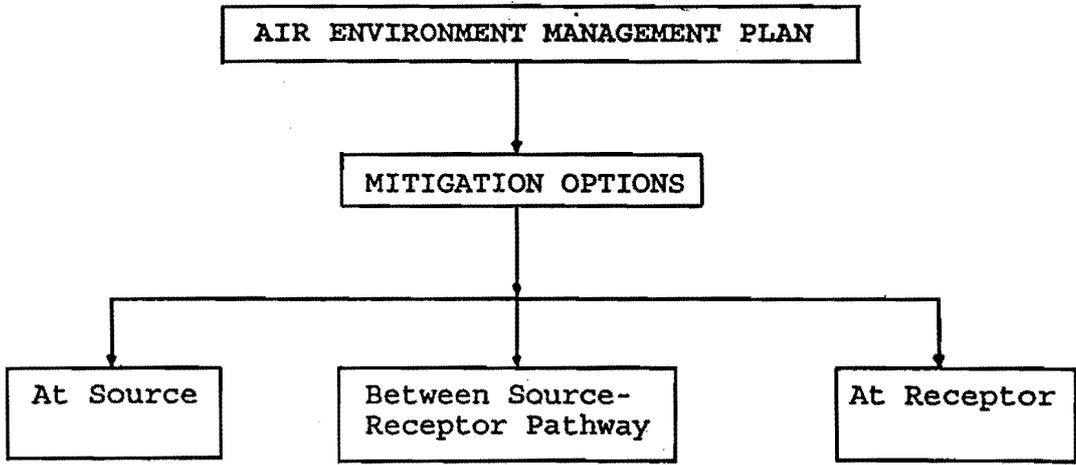


Fig. 7 Air Pollution Control Strategy

Control of Emissions at Source

The strategy for air pollution control at source can further be divided into three categories namely; (a) Industrial (Point) Emissions; (b) Domestic (Area) Emissions; (c) Vehicular (Line) Emissions.

Control of Industrial Emissions

Air pollution control strategy for small as well as large scale industries is possible through the following technological options namely; (a) End-of-the-pipe treatment / control equipment; (b) Process modifications; cleaner technology; (c) Change of the fuel; (d) Stack heightening.

Discharge of pollutants from small as well as large scale industries may be controlled or eliminated through a number of techniques, ranging from in-plant changes in production methods to the installation of equipment designed to remove or reduce specific pollutants or otherwise change the characteristics of the contaminated gas. The overall air pollution control strategy can be summarised as shown in Figure 8.

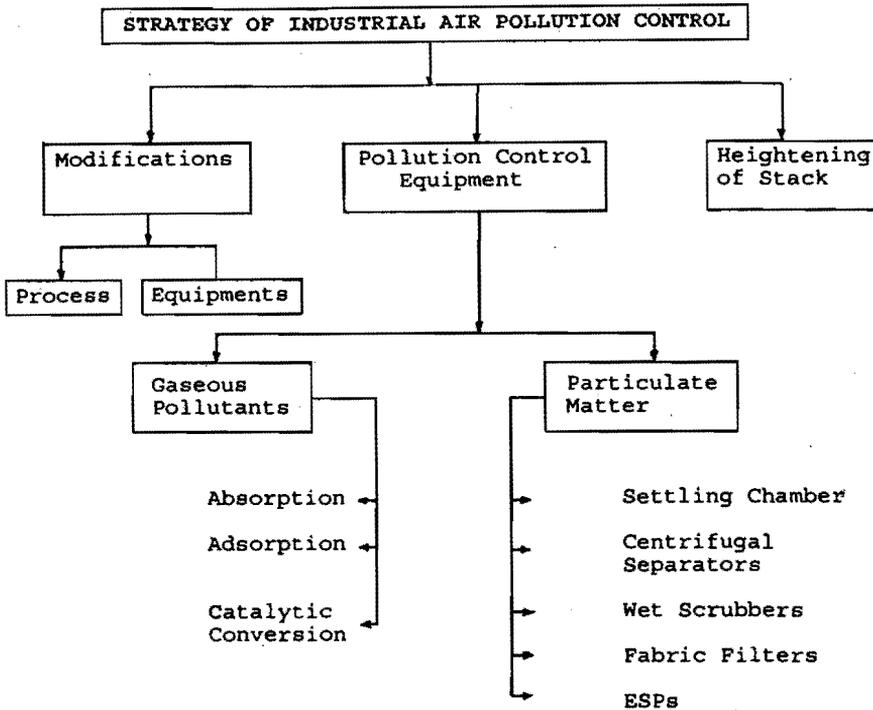


Fig 8 : Strategy for Industrial Air Pollution Control

End of the Pipe Treatment / Control Equipment

Gaseous Pollutants Control Systems

Gaseous pollutants can be removed by either absorption, adsorption or through catalytic conversion. But, here more attention is being paid on particulate matter removal as gaseous pollutants emissions in small scale sector mostly remain well within the range of regulatory standards. However, for large industrial units particulate as well as gaseous emissions need to be controlled to achieve prescribed limits.

Particulate Matter Control Systems

Particulates, greater than 100 μm settle out quickly and can be removed easily before atmospheric discharge. Even, if discharged, quick settling causes less problems. Particulates smaller than 0.01 μm are not easily distinguishable from large molecules and can be treated as gaseous pollutants, thus particulates in the size range of about 0.01 to 100 μm are of significance to air pollution.

Various dust control systems viz; gravity settling chamber, standard cyclones, wet scrubbers, ESPs, bag filters, venturi scrubbers and centrifugal collectors are available but the choice for a particular system depends mainly on size of industry, emission characteristics, desired removal efficiency, space availability etc. The overall collection efficiency and pressure drop

for different control equipment are summarised in Table 4. Table 5 summarises advantages and disadvantages of various pollution control equipment.

Table 4 Overall Collection Efficiency and Pressure Drop Different Particulate Control Equipment

Control Equipment	Overall Efficiency (%)	Pressure Drop (mm water)
Baffled settling chamber	50-60	15-25
Simple cyclone	60-70	40-75
Multi cyclone	80-90	100-150
Packed tower	90-98	50-150
Venturi scrubber	99-99.5	200-800
Fabric Filter	95-99.9	100-150
ESP	95-99.9	15-25

Table 5 Pollution Control Equipment: Advantages and Disadvantages

Advantages	Disadvantages
<p>Gravity Settling Chamber</p> <ul style="list-style-type: none"> • simple construction and low cost • less pressure drop (< 2.5 cm water) • low collection efficiency • no water requirement 	<ul style="list-style-type: none"> • large space requirement • removes only large & abrasive particles • less power requirement • used as precleaner
<p>Centrifugal Separators (Cyclones)</p> <ul style="list-style-type: none"> • low cost of construction • relatively simple equipment with least maintenance problems • relatively low system pressure drops (2-6" water) • withstands high temp. & pressure conditions • subjected to material of construction • dry collection and disposal • relatively small space requirement 	<ul style="list-style-type: none"> • relatively low overall collection efficiencies, especially for particulates < 10µm • inability to handle tacky materials

<p>Wet Scrubbers</p> <ul style="list-style-type: none"> • relatively small space requirements • ability to collect gases as well as dust • ability to handle high temperature, high humidity gas streams • low capital cost • higher collection efficiency • no secondary particulate sources 	<ul style="list-style-type: none"> • high pressure drop & power requirements • high solids build up at wet dry interface • relatively high maintenance cost • corrosion problems more severe than with dry systems • disposal problem of wet product • cannot take variation in load
<p>Fabric Filters</p> <ul style="list-style-type: none"> • high collection efficiency over a broad range of particle size • extreme flexibility in design provided by the availability of various cleaning methods and filter media • reasonable operating pressure drop and power requirement • ability to handle a diversity of solid materials • dry collection and disposal • negligible problems of corrosion and rusting of components • relatively simple operation 	<ul style="list-style-type: none"> • large space requirements • possibility of explosion if sparks are present in vicinity of a bag house • hygroscopic materials usually can not be handled owing to cloth cleaning problems • relatively high maintenance requirements (bag replacement) • medium pressure drop requirements (4-10" water) • high cost of construction and operation
<p>Electrostatic Precipitators (ESP)</p> <ul style="list-style-type: none"> • extremely high particulate (coarse & fine) collection efficiencies attainable (at a relatively low expenditure of energy) • dry collection and disposal • low pressure drop (< 0.5" water) • designed for continuous operation with minimum maintenance requirements • relatively low operating costs • capable of operation at high temperatures • capable of operation under high pressure or vacuum condition- • can handle large gas flow rates effectively 	<ul style="list-style-type: none"> • high capital cost • very sensitive to fluctuations in gas stream condition viz. flow rates, temp. particulate & gas composition, dust loading rate etc. • certain particulates difficult to collect owing to extremely high or low resistivity characteristics • require large space for installation • explosion hazard when treating combustible gases and/ or collecting combustible dust • ozone produced by the negatively charged discharge electrode during gas ionisation

Prior to proposing technological solutions to the industry, it is necessary to carry out techno-economic feasibility studies in the form of an engineering cost-benefit analysis, calculating the internal /external rates of return, etc. such that the solutions may be specifically appropriate for the highly cost-sensitive SSI sector. The control equipment design approach should be to develop solutions designed for the specific conditions of the environment, raw materials and operation of the unit. Standard off-the-shelf packages commercially available, or those designed using thumb rule methods, do not solve the problem at hand.

Air pollution control systems for small scale industries

Technology for controlling pollution from large industries is readily available and consulting design and engineering firms are fairly experienced. However, knowhow for cost effective control of pollution for SSI sector is not readily available. Due to the size of the SSI sector, cost-effective and technically - feasible pollution control becomes exceedingly difficult, if not impossible. Also due to the small size, the units often operate in an inefficient manner. For example, the small lime kilns and traditional cupolas operate at low thermal efficiencies, losing significant amount of heat as waste heat. Also, the heat content of the flue gases are so small that economical heat recovery is not possible.

The cost of pollution control has traditionally been compared with the initial investment required to set up the industry. As is the case with many highly polluting small units, e.g. glass, lime kilns and dye-stuffs industry, the initial investment is of the order of 2 to 5 lakhs. Pollution control design to reduce the pollutants to reasonable levels, would cost about the same amount and therefore, the entrepreneurs do not install pollution control devices in normal cases. The cost of pollution control should, however, be compared with the annual turn-over of the industry, which could be many times the initial investment. Hence, only simple control equipment like cyclone and wet scrubbers are preferred in small/medium scale industries.

Given this picture of high pollution potential, low energy efficiency, and a high overall negative environmental impact, and, the need for rapid growth of the small scale sector to fulfil national priorities of boosting employment, per capita income on one hand and exports on the other, it becomes imperative to review policy considerations related to the SSI's and sustainable development.

Air pollution control systems for large scale industries

For control of particulate emissions from large scale industries electrostatic precipitators (ESPs) and fabric filters/ baghouse are the two commercially proven techniques. These two technologies can meet the most stringent limits for particulate emissions by sizing the units accordingly. However, with the large quantities of ash present in some of the Indian fuels, a mechanical separator, such as a cyclone, may be an effective way of reducing the dust burden on the ESPs.

Electrostatic Precipitators are available both in horizontal and vertical gas flow as well as with dry or wet collection system. However, in general, dry horizontal gas flow type precipitator is predominantly used. For a better performance, the range of design parameters of ESPs for Indian coals are:

• Collection efficiency %	99.6 - 99.8
• Collecting plate height M	9 - 12
• Aspect ratio (length to height of ESP)	1.2 - 2.48
• Specific collecting area, ($m^2/m^3/sec$)	80 - 170
• Gas temperature C	130 - 160
• Inlet gas concentration, (g/Nm^3)	45 - 88
• No. of fields in series	3 - 5
• Collecting plate area/TR set (m^2)	1800 - 2900
• Normal operating current density (UA/M^2)	120 - 150

In the design of an ESP, to meet a specific emission standard, allowance must be made for normal variations in ash and sulphur content that occur in various coal seasons, as well as for possible changes in fuels. The precipitators should be designed conservatively for the lowest operating gas temperature expected, while burning coal with the least favourable combination of sulphur - ash content. In the design, emphasis should also be upon reliability and availability to assure that design efficiencies will be maintained throughout the life of the equipment without significant outages being required for major repairs and maintenance.

The main factors that dictate the sizing of an ESP is the ash resistivity and the volume of flue gas generated. For the low grade fuels, typically used in India, flue gas volume will be relatively high per KW electricity generated and ash resistivity will vary from one source to another. Further, the ash surface acidity affects the capture efficiency and in some cases where the flue gas SO₂ concentrations are low, additional SO₃ is sometimes injected into the flue gas stream to improve the performance of ESP.

Fabric Filters are widely deployed. Fabric filter or a baghouse involves large cloth filters with a pore size suited to the gas flows and the ash type under consideration. Bag filters are highly efficient and available in two types. The first type is the pulse jet type which collects ash on the outside of the bag and blows the bag outwards with compressed air. The second type collects ash on the inside of each bag and shakes and deflates the bag to remove the ash.

There are a number of advantages of the baghouse system, namely the non-dependence on ash surface characteristics and their high efficiency under all conditions. However, the pressure loss is much higher than ESPs which require a higher fan power. The merits and demerits of both of these systems were summarised earlier in **Table 5**.

Control of Gaseous Pollutants

There are essentially four different approaches for the reduction of gaseous emissions viz. SO₂, NO_x as namely; (a) lesser fuel consumption; (b) use of less polluting fuels; (c) prevention of pollutants formation during combustion; (d) flue gas treatment before atmospheric discharge.

Various combinations of these approaches are also possible to produce a final emission to atmosphere below specified levels, if individual approaches cannot achieve the desired results. Emission control of major gaseous pollutants viz. SO₂ and NO₂ is discussed next.

Control of Sulphur Dioxide Emissions

Flue Gas Desulphurisation (FGD) essentially involves chemical conversion of SO₂ contained in flue gas with lime or limestone to some useful by-product; CaSO₃.1/2H₂O or CaSO₄.2H₂O (gypsum).

For low 'S' Indian coal to liquid fuel or Natural gas, the lime based FGD system leading to formation of CaSO₃.1/2 H₂O and/or CaSO₄.2 H₂O (gypsum) are not cost effective solutions. However, spray drying type FGD system may perhaps be one of the most cost effective systems for low 'S' coal, where, these systems use a concentrated slurry of slaked lime to absorb SO₂. The water present is completely evaporated by the heat of the flue gas to give a dry powdery substance mainly CaSO₃.1/2 H₂O, a material with limited reuse applications and possible disposal problems. In all cases to date, the plants are disposing of their wastes to convenient landfills.

SO₂ reductions of 85% or more are being achieved in commercially deployed fluidised bed plants. Attention is now turning to scaling these plant up to larger size applications but the technology is likely to be limited to the small-to medium-scale of application.

Control of Nitrogen Oxide Emissions

Modification in Combustion Process (Low NO_x Burner)

The first approach to control nitrogen oxides (NO_x) formation in pulverised coal fired furnaces is to modify the combustion process by altering the distribution ratio of fuel and air in the burner itself (giving a so-called 'low-nox burner') or possibly in the furnace, while maintaining the same overall combustion stoichiometry—the combustion process of carbon and the other combustible substances in the fuel in their reaction with atmospheric oxygen. In particular, combustion modifications tend to reduce the temperature or increases the time over which combustion takes place.

NO_x reduction upto around 60% can be achieved in purpose-designed new furnaces having low-NO_x-burners. The mechanisms of NO_x production in fluidised bed combustion are less well under-stood than those in pulverised fuel furnaces but since the combustion temperature is lower (generally <900 C) the production of NO_x is lower. Circulating fluidised beds may also display intrinsic fuel staging. As a consequence, fluidised bed combustion can generally meet lower NO_x emission limits than conventional pulverised plant with the best combustion controls, although some form of flue gas treatment may still be necessary to meet the stringent NO_x emission limits.

Flue Gas Treatment

In the category, NO_x can be reduced by any one of the following options:

- a) by injecting a reducing agent such as ammonia or urea into the upper, superheater region of a boiler, or into a fluidised bed to react with the nitric oxide. No catalyst is necessary for this reaction;
- b) removal by catalytic reaction with ammonia downstream of the boiler with specifically designed technology ;
- c) by simultaneous removal of SO₂ and NO_x. This class may be sub-divided into those plants which have been originally designed to do this joint removal and plants which were originally having FGD units alone but where relatively minor modifications are possible in plant to give an appreciable level of NO_x removal as well. In these plants, the level of NO_x removal is seldom as high as that achieved by purpose-designed systems.

Cleaner Technology Options

In the literature we find examples of cleaner technology applications in liquid waste as compared to air pollution. Conceptually, cleaner processes are the ones which produce minimum waste and there is more stress on the prevention, thereby, the long term risk to the human beings and to the ecosystem, wherein the wastes are absorbed or minimised. Hence, the cleaner production is essential for sustainable development. Besides, the control measures should be preventive and integrative.

As far as air pollution is concerned, the cleaner technology applications may be cost-effective to the processes of major industrial sectors like refineries, cement, fertilisers, thermal power stations etc.

Information on 510 case studies has been collated for major 14 industrial sectors. The analysis of the studies in terms of waste minimisation at the source (including product changes, input material changes, technology changes and good house-keeping), waste utilisation and resource recovery based on end-of-the-pipe (OP) treatment technologies (including raw material recovery and by-product recovery) for India and abroad is presented in Table 6.

Table 6 : Cleaner Technology Case Studies in India and Abroad

Technology Option	Case Studies	
	India	Abroad
Waste minimisation at the source	81	173
Waste utilisation	28	11
Resource recovery based on EOP treatment	42	132
Total number of case studies	194	316

Source : NEERI Database

Adoption of cleaner technology option shall be extremely useful for combating industrial air pollution. For example, in cement manufacturing, where fuel (coal) is burnt with limestone and clay in rotating inclined kiln to yield clinker which is then ground with gypsum to give cement. This process is complex and the firing temperature affects greatly the quality of product and gaseous emissions (Ox and NOx) which increase with higher temperature. The process must, therefore, be operated under controlled optimised temperature conditions and this can be achieved by installing proper instrumentation. This will result in many advantages like;

- a) the wastage of coal at high temperature is avoided
- b) high quality clinker is produced
- c) less energy is required for clinker grinding
- d) the life of the lining of the kilns is enhanced
- e) NOx and SOx emissions are reduced (a NOx level of around 500 ppm is reduced to 200 ppm)

Change of Fuel in Industrial Sector

Coal is a major source of fuel for industrial sector as well as domestic sector in the country. The constituent characteristic of this fuel is typical, as on one side ash content is very high (upto 45%) and on the other 'S' content in major coal belts is low (<0.5%). Even the supply of fuel is not regular and adequate. If end-of-the-pipe treatment strategy is to be followed than ESPs should have more than 99% efficiency. The similar problem is faced by the industries like thermal power plants, lime kilns, cement industry, coke ovens, brick kilns, foundries etc. It will be desirable if the traditional fuels can be replaced by low pollution generating fuels like natural gas.

Air Pollution Control through Stack Heightening

India being a tropical country where large mixing depths and high wind conditions are prevailing during most part of the year, utilisation of the natural dilution capacity of the atmosphere may be a cost-effective proposition. In fact, control through stack height regulation has been adopted in many developed countries. For example, Japan has integrated this aspect in determining the emission standards for SO₂ by inserting an appropriate K-value into the equation.

$$q = K * 10^{-3} * He^2$$

Where, q is the permissible hourly emission rate of SO₂ (kg/hr), and He is the effective stack height (m). The value of K varies according to the dilution capacity of the respective air basin and the present status of pollution. Whole of Japan is now controlled under 16 'K' rankings ranging from 3 to 18. Based on coal consumption and capacity of the thermal generation, minimum stack height is recommended by CPCB (Table 7).

Table 7 Minimum Stack Height for Different Capacity Steam Generation Units

Steam Generation Capacity (TPH)	Coal Consumed (TPD)	Stack Height (m)
< 2	< 8.5	5 & 1/2 time the neighbouring building height or 9 m (whichever is more)
2 to 5	8.5 to 21	
5 to 10	21 to 42	15
10 to 15	42 to 64	18
15 to 20	64 to 104	21
20 to 25	104 to 126	24
25 to 30	126 to 168	27
> 30	> 168	30 (Whichever is more) or using the above formula

Such an approach in India, because of availability of a large dilution capacity (reflected in ventilation coefficients of different regions) and utilisation of natural dissemination capacity of the atmosphere, will be essential for air pollution control programme of the country. However, one should keep in view that the use of high chimneys does not reduce the total load of the atmosphere and in due course of time undue stress may result on the self-cleaning processes of nature. Particularly, for highly stable primary or secondary pollutants with very high half life, the arguments against tall-stack provisions for densely populated areas located in downwind directions seem strong and self-evident. But as a stop-gap arrangement, till appropriate clean control technologies, viz, Bio-technology for 'S' removal from normal coal, FGD for low 'S' coal, fluidised bed combustion for SO₂ and NO_x control, etc, are developed indigenously, high stack tactics may prove fruitful.

Control of Domestic Emissions

Variety of fuels like LPG, coal, kerosene, wood, dung-cakes and other combustible agricultural wastes are being used in the country depending on the economic status of population and easy availability of the fuel type. To abate the pollution from domestic sector, shift over to cleaner flues like solar energy, is essential, which however needs technological innovations, social awareness and general acceptance breaking the traditional norms of biofuels usages. Secondly, use of more cleaner fuel, LPG over traditional fuels (coal/kerosene/biofuels), should be increased, which has high calorific value and being energy efficient requires less cooking time. However, this way result in marginal increase in NO_x levels due to high temperature combustion, but still much better than traditional fuels.

Control of Vehicular Emissions

Auto exhaust emission standards in India have recently been proposed for petrol and diesel driven vehicles as given in Table 8. Exhaust emissions at the source can be controlled through several approaches.

- operation norm alterations
- engine design modifications
- fuel modifications
- exhaust gas treatments

Table 8: Mass Emission Standards for Vehicles

Vehicle Category	Mass Emission Standards (g/km)			
	From April 1995		From April 2000	
	CO	HC + NO_x	CO	HC + NO_x
Petrol Driven				
Two wheelers (all categories)	3.75	2.4 ⁺	2.00	1.50 ⁺
Three Wheelers	5.6	3.6 ⁺	2.00	1.50 ⁺
Petrol Driven (Passenger Cars) and Diesel Driven (all Categories)			2.72 2.72 (SPM 0.14 g/km)	0.97 0.97
Reference mass (R, kg)				
R < 1020	5.0	2.0		
1020 < R < 1250	5.7	2.2		
1250 < R < 1470	6.4	2.5		
1470 < R < 1700	7.0	2.7		
1700 < R < 1930	7.7	2.9		
1930 < R < 2150	8.2	3.5		
R > 2150	9.0	4.0		

OR
For Diesel Driven Vehicles (All Categories)
 (Unit is g/KWH for all except smoke)

From April 1995				From April 2000				
HC*	CO*	NOx	Smoke	HC*	CO*	NOx	SPM	Smoke
2.4	11.2	14.4	***	1.1	4.5	8.0	0.61	***

+ HC only

Note:

- * The test should be as per 13 mode cycle.
- ** The test should be as per Indian driving cycle with cold start.
- *** The emission of visible pollutants (smoke) shall not exceed the limit values of smoke density, when expressed as light absorption coefficient

II Conformity of Productions Tests

A relaxation of 10% for the values of Type Approval Test given above would be permitted for Conformity of Production Test for all vehicles.

For Indian automobiles there are distinct differences viz. average life (>15 years), low compression ratio engines, low fuel efficiency and vast number of two stroke vehicles on urban roads. With the standards currently applicable, CO (idling) reduction through carburettor tuning can achieve, 30% reduction for passenger cars and 20% for 2 & 3 wheelers. Engine design modifications such as reduced compression ratio, improved combustion chamber design, stratified charged engines etc. help greatly in the total exhaust emissions reduction. Further, fuel modifications including the use of gaseous fuels like LPG and natural gas in place of gasoline can extensively reduce CO and HC emissions. There are however, some important problems to be solved on engine side as well as on the storage and safety problems associated with such gaseous fuels.

As the major shift in existing engine technology as well as fuel use pattern is not envisaged in near future, the exhaust gas treatment is the only option to meet the emission control limits for all the important pollutants. The most prominent methods to mitigate pollution through tail gas treatment include:

- a) Exhaust Manifold Reactors
- b) Direct Flame Afterburners and
- c) Catalytic Converters

Among these options, exhaust manifold reactors require high temperature resistant materials which are very costly. Some undesirable metal oxides are also formed inside the reactors at the high temperatures and they come out with the treated exhaust. Whereas, the second option (direct flame afterburners) need supply of additional air and triggering device for initiating combustion which makes the unit complicated. However, these options are not considered feasible for near future.

Catalytic Converter Technology (CCT) on the other hand, works on the principle of chemical conversion of pollutants to harmless gases, needs no triggering device and operates at moderate temperatures obviating the need of a specific high temperature resistant material.

Today CCT is identified as the best practicable technology for automobiles which meets world's most stringent emission standards. For Indian application of CCT, the catalyst configuration should be free from lead and sulphur poisoning. Otherwise, it will be necessary to incorporate essential changes in petrol as well as lubricant refining in India.

NO_x formation in case of diesel engines can be minimised either by restricting the air availability using exhaust gas circulation (EGC) or by lowering the peak cycle temperature by retarding injection timing.

The major problem in the deployment of three way CCT for including NO_x control besides CO and HC is the blocking of catalyst pores by soot and particulates which should be removed prior to the converter. A particulate trap (ceramic honeycombs, wire mesh or cyclones traps) which collects the particulates can be used before the converter. This will give about 60-70% reduction in CO, HC and NO_x emissions with about 30% reduction in SPM.

In view of non conformity for indigenous CCT availability, the projections of line source emissions for 2001 are made (**Table 8**) assuming that proposed mass emissions standards meant for 2001 shall be met through indigenous CCT technology made available within next five years.

Air Pollution Mitigation on Source Receptor Pathway

While evolving the total mitigation plan to minimise pollution exposure of receptors Green Belt application around sources as well as receptors forms an important component of air environment management plan. Green belt primarily helps in attenuating pollutant of low emission heights of fugitive nature.

The proposed green belt plan for the protection of monuments have been designed adopting two stage approach:

- a) control at the source - to attenuate the intensity of pollutants generated at the source
- b) control at the receptor - to mitigate the pollution exposure of sensitive receptors

Thus, location specific green belt development plans and plantation schemes should be evolved to encircle the sensitive/specific receptors and both sides along the heavy traffic avenues as well as major industry/ industrial estates. Besides pollution attenuation, green belt development will enhance the aesthetic view also.

Air Pollution Mitigation at Receptor

Air pollution levels at specific/sensitive receptors can be reduced significantly by specifically designed green belt around the receptor.

For pollution abatement through green belt, the appropriate selection of particular type of trees/shrubs is guided by their performance/response to pollution and also upon their economic/aesthetic value. Furthermore, the selected plant species should preferably be

indigenous, fast growing, requiring minimal maintenance and self-rejuvenating. The appropriate afforestation should also be based on mixed type of cultivation to support bio-diversity perpetuating local ecosystem. Further the thickness of green belt should be optimised keeping in view the pollutant concentrations and prevailing micro-meteorological conditions in the region. Optimum thickness of green belt to be developed around a sensitive receptor, along the roads and industries may be 200 m, 5-10 m and 100-300 m respectively. However, this will depend on the free land available for plantation.

A mixed plantation of trees, lianas and shrubs in the first 2-3 rows followed by trees growing upto 10-20 m height with spacing between the trees of 1.5 m within green belt is recommended depending upon the importance of the receptor. Planting of trees should be undertaken in appropriate encircling rows around the receptor in alternating numbers to avoid the fanning effect. The first few rows facing the receptor should be allotted for evergreen and bright flowering plants.

Thus, the problem of air pollution can be reduced to a great extent and any urban area/country can be made sustainable, if the above discussed measures are taken care properly and honestly.

MANAGEMENT OF SOLID WASTE

Dr. Sumith Pilapitiya

The management of solid waste, be it municipal or hazardous, poses a difficult and complex problem for society. In the case of municipal solid waste, some of the difficulties that arise are due to the solid waste stream being quantitatively large and qualitatively heterogeneous.

The composition of municipal solid waste in South Asian countries is predominantly organic in nature; often in excess of 75 percent by weight with very high moisture contents. Biological treatment processes, such as anaerobic digestion or composting, would naturally be more feasible and economical over any physical, chemical or thermal treatment for such wastes. Composting would be a more favourable choice for waste treatment, especially when considering the institutional capabilities of local bodies in South Asia.

The current practice is landfilling in disposal sites with little or no environmental safeguards could lead to irreversible environmental consequences. In the event that there is inadequate funding for sanitary landfills, it may be viable to have properly operating open dumps with the components of the waste that generate the largest volume of leachate removed from the stream. If the organic waste is composted and disposed of on land, the remaining wastes would generate little or no leachate..

MANAGEMENT OF SOLID WASTE

Dr. Sumith Pilapitiya

The management of solid waste, be it municipal or hazardous, poses a difficult and complex problem for society. In the case of Municipal Solid Waste (MSW), some of the difficulties that arise are due to the solid waste stream being quantitatively large and qualitatively heterogeneous, reflecting the myriad of consumer goods and products manufactured and used in rapidly industrializing countries in South Asia. MSW is largely generated in densely populated areas where its management is cumbersome and complex.

The situation in, the Colombo Metropolitan Area (CMA) of Sri Lanka, would be used as a case study in developing an affordable and appropriate strategy for dealing with the dual problem of MSW and Hazardous Waste Management (HWM). The CMA is the most densely populated part of the country. It is associated with significant environmental problems, especially in regard to MSW management.

With little or no data available the area of hazardous waste is not clearly defined in Sri Lanka. A study is currently underway to assess the hazardous waste situation in the country. Preliminary data have indicated that the situation is not serious, yet it is an emerging issue. The study recommends that immediate action be taken to prevent the situation from going out of control, so that affordable solutions could be found.

Landfilling

The dominant contemporary practice is to landfill MSW enmasse, or nearly so as a collective undifferentiated waste. Yet mass landfilling is increasingly being recognised as an environmental anachronism. A major objection is the design and management of landfills as is commonly practiced in developing countries. A majority of the landfill sites are "open dumps", with a handful of the so-called "sanitary landfills" being open dumps with some soil used to cover material periodically.

Proper sanitary landfills are sites that are engineered to mitigate negative environmental impacts, especially the installation of impermeable barriers to prevent ground water pollution, necessary precautions for containing surface water runoff, treatment of leachate and collection of landfill gases. While a landfill is an integral part of an overall solid waste management system, it is necessary to decrease reliance on landfilling as it is becoming increasingly difficult to locate sufficient vacant land for landfills in close proximity to metropolitan areas.

The manner in which landfills are being operated in Sri Lanka has given rise to public opposition to siting such facilities in densely populated areas. While landfill economics or more aptly, "open dump" economics uniformly discouraged development of alternatives for treatment and disposal, it is now becoming clear that mass landfilling cannot be sustained as the norm in the long-term. Therefore, it is imperative that integrated solid waste management strategies which promote the existing informal reuse/recycling system and develops appropriate methods for treatment of wastes to reduce the demand on the landfill space be initiated in cities in South Asia. However, even with advanced MSW management techniques, selective landfilling is

necessary to dispose of some irreducible amount of non-recoverable, non-biodegradable waste. The CMA generates MSW in excess of 1000 tons per day, with the Colombo Municipal Council (CMC) accounting for approximately 700 tons daily. Lack of uniform methodologies and categorization schemes makes the precise analysis of waste composition somewhat problematic, nevertheless, studies conducted by CMC have determined that the waste stream is predominantly organic. A waste characterisation study conducted in 1993 by the Secretariat for Infrastructure Development and Investment (SIDI) has revealed that 85 percent of the waste stream is organic matter with 7 percent paper and 5.5 percent plastics. The composition of the waste stream should be a major determinant in selecting suitable management options for the waste.

Environmental Impacts of Landfills

Any landfill, regardless of its scope or scale, would result in creating some form of environmental impact. The impact is not necessarily detrimental to the environment, although in most instances, the adverse effects of a landfill tend to overshadow the potential benefits. This could be avoided by assessing the environmental impacts of the proposed landfill and developing mitigatory measures to address the possible adverse impacts prior to project development. In addition to identifying mitigatory measures to minimize adverse impacts, an environmental assessment would also provide a rational basis for conducting an economic feasibility of the proposed project when environmental costs are included.

Alternatives

An analysis of the alternatives available for solid waste management in the Colombo Metropolitan Area was undertaken based on the following information.

- a) A description of the quantity and composition of solid waste output and the existing waste management system.
- b) A comparison of the feasibility of alternative options for future waste management, including their advantages and disadvantages, with a view to providing recommendations for the best practicable options. The options considered are; materials recovery and recycling; composting; incineration (with and without energy recovery); and landfill.

The key conclusions of the evaluation of options are;

- a) the development and extension of materials recovery is not feasible; the existing informal scavenging network should be promoted and formalized making it more sanitary;
- b) composting has potential over the medium-long term, it is a potentially viable component of a future MSW management system;
- c) incineration is not feasible;
- d) landfilling is feasible, and is the most appropriate technique to be applied in Sri Lanka.
Hence, it is recommended that the disposal option for solid waste is a landfill with organic waste being removed as a source of pollution and subject to biological treatment such as composting.

Composting

The predominantly organic nature of the MSW in the country lends itself ideally to biological treatment processes of waste management. In this context, the process of composting can be used to convert the waste to a stable "humus like" product commonly known as compost which could be applied on land as a soil conditioner. Composting is a solid-phase process based on the phenomenon of microbial self-heating of organic assemblages. The material being composted is

its own matrix, permitting gas exchange, hence aerobic metabolism. Similarly, the material would serve as its own source of nutrients, water and inoculum in the form of diverse, indigenous, widespread microbes. Lastly, the material serves as its own waste sink and thermal insulation. As such, heat generated microbially at the expense of the material is retained. This causes a temperature elevation, which is the hallmark of composting.

Self-heating occurs spontaneously, provided that the conditions noted above are met, at least marginally. The underlying events may be portrayed in reference to the simplest of operations, that of informal composting of leaves and other residue as commonly occurs in the agricultural sector. In the ordinary course of events, such materials become colonised by diverse bacteria and fungi. As long as the waste is assembled in such a manner that it lacks thermal insulation, any heat generated metabolically is dissipated and there is no discernible elevation in temperature. The situation is fundamentally altered if the waste is assembled into a pile large enough to be thermally self-insulating. This sets in motion a rapid succession of events that are directed by an interaction between heat generation and temperature.

Initially, the temperature elevation stimulates mesophilic growth and decomposition with its attendant generation of heat. At the same time, the elevation dynamically selects for microbes with ever higher temperature optima. The rate of heat generation peaks at around 35 degrees C, during which time the temperature elevation continues to the point of becoming self-limiting to the mesophilic population which self-destructs around 40 degrees C. But this temperature initiates the growth of thermophilic organisms leading to a repetition at higher temperature of the pattern represented under mesophilic conditions. Ultimately the system will bring itself to a peak of 80 degrees C at which time the thermophilic population is severely self-debilitated. Diverse microbial populations must be maintained for rapid decomposition. It is also a well established fact that decomposition at thermophilic temperatures occur at a much greater rate than at mesophilic temperatures. In addition, if gas exchange is severely restricted through heavy compaction and loss of matrix structure or plugging of pores by extreme wetness, fermentations rather than aerobic metabolism tend to dominate the system. This results in slow degradation under mostly anaerobic conditions.

For composting to play a major role in MSW management, facilities must be designed for high, near-maximal rates of aerobic decomposition. Rapid decomposition serves to optimize the following interrelated factors: cost of facility construction; cost of routine operation; materials throughput time; inventory and space requirements; needs for structural and mechanical appurtenances; materials handling. It is a truism for many types of industrial activities, including large scale composting, that time and space are functionally equivalent and in combination affect costs. Moreover, the faster the aerobic destruction of putrescible substances, the less potential for malodor generation. This aspect of public acceptability alone warrants high rates of decomposition as most of the compost plants that have been shut down in developed countries have been due to odor problems.

Benefits of Compost

In general, soil fertility is linked to the amount of Organic Matter (OM) in the soil. Fertility is enhanced by the volume of organic matter present. Soil organic matter can be increased by the addition of biomass. The necessary biomass must be supplied to the soil by the use of much, addition of livestock waste or of compost.

Benefits derived from the addition of compost to soil are many. Firstly, compost increases the size of macropores in the soil. This allows for more water absorption and retention. Consequently, the greater rate of absorption reduces runoff during heavy rains, decreasing erosion. Water holding capacity is improved in sandy soils and water is made more easily available in soils with high clay content. The soil temperature is lower with the addition of compost that results in lower evaporation.

Secondly, compost addition reduces bulk density, allowing deeper root penetration. This increases the surface area available for extraction of water and nutrients. Drought tolerance and crop growth are improved. Increased OM makes tillage easier and faster. It allows for reduced tillage without reduction in yield. Soils can be more quickly worked after a rain which enables farmers to beat the weeds in the rainy season. It improves seed germination rates and reduces soil cracking, while minimising root and soil exposure to drying winds.

Thirdly, compost acts as a buffer on soil pH. It increases pH of acidic soils and decreases pH in alkaline soils. The change can be as much as one unit on the pH scale. It provides N and K directly to the soil and improves efficiency of any chemical fertilizer applied. It favours the growth of N-fixing bacteria and algae residing in the soil and encourages micro organisms that "fix" P, making it more available. It supplies micronutrients and improves overall soil health and reduces nutrient leaching. In fact, yield increases are greater with OM application than with direct application of micronutrients.

Fourthly it favours the development of micro-organisms which compete with insect pests and disease-causing organisms (pathogens), reducing insect and disease damage. Gases released during OM decomposition are toxic to several pathogens. Balanced plant growth improves resistance to pests.

Soils with high OM content nurture crops that are healthier, more tolerant to stress, and produce higher yields of high nutrient content. In addition, the available nutrients are released slowly making virtually the entire amount available to the plants.

Hazardous Waste Management

The issue of industrial wastes poses a more serious problem to developing countries. In their quest to achieve the Newly Industrialized Country (NIC), status most countries in South Asia are overlooking this problem. This is largely due to accelerated and unplanned industrialisation.

The situation with regard to HWM in Sri Lanka is ill defined at this stage. Sri Lanka, like other countries in South Asia does not have the required facilities for HWM. Even if the legislative framework exists, very little progress can be made with no treatment and disposal facilities. Waste minimisation should be the approach to initiate HWN.

Among the many environmental problems these countries are faced with HWM is an emerging issue that needs to be resolved in the short term. Affordable and appropriate measures need to be developed for dealing with hazardous waste. Facilities for temporary storage of waste should be provided until treatment and disposal facilities are available. Options such as adapting cement kilns for incinerating hazardous wastes and safe disposal at sanitary landfills should be pursued where appropriate.

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WATER POLLUTION CONTROL

Dr. Ajith de Alwis

Sri Lanka has a rich heritage in water management. Today, water is a scarce resource in several regions. This is largely due to uncontrolled deforestation and depletion of the water table. The problem is further compounded by many of the ancient small irrigation schemes being abandoned or in disuse.

Water quality is becoming a serious issue even in areas where water quantity is not much of a problem. The poor quality of water prevents direct use and poses special problems for both agriculture and industry. Some of these water quality problems are a direct result of poor planning and unregulated discharge of untreated wastewater.

The answer lies with prevention rather than control alone. The current Sri Lankan regulations are also perhaps the toughest in the region. With enforcement at a very low ebb, the situation is getting worse in many areas.

WATER POLLUTION CONTROL

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Sri Lanka has a rich heritage in water management. King Parakramabahu the Great (1153-86 AD) decreed; *“Not a single drop of rain water should be allowed to escape into the sea without being utilised for human benefit”* According to De Silva, 1981 *“By itself the irrigation network of ancient Sri Lanka was attributed to the ingenuity of her engineers and craftsmen, and the organisational skills of her rulers. Sri Lanka belongs to the super league in regard to irrigation technology and creative achievement in irrigation works.*

Today however, water is a scarce resource in several regions with many of the earlier irrigation schemes abandoned or in disuse. *Water Quality* is becoming a serious issue even in areas where *Water Quantity* is not much of a problem. The poor quality of water prevents direct use and poses special problems for agriculture and industry alike. Some of these problems are a direct result of inadequate planning, and lack of control over wastewater and solid waste disposal.

Sri Lanka is facing a crisis, especially with regard to wastewater, its treatment and safe disposal. The answer definitely lies with prevention rather than control alone. The current Sri Lankan regulations are also quite tough compared with others in the region. With enforcement at a very low ebb, the situation is getting into a crisis stage in many areas. There has been lot of prescription but very little action.

The Problem of Water Pollution

The pollution of Sri Lanka's water bodies has taken place due to improper agricultural practices, industrial discharges and poor land use planning and land management. The widespread and indiscriminate use of agrochemicals and fertilisers has contributed to the pollution of waterways. In addition deforestation and destructive forms of agricultural practices have caused soil erosion and consequent silting of water bodies. The long term consequences are many and may even contribute to micro climatic changes.

There is no proper disposal of solid waste in Sri Lanka and the facilities provided are inadequate. The disposal facilities contribute to significant groundwater pollution. Less than 25% of Sri Lankan households have access to pipe-borne water, while about 7% draw water from streams and rivers for domestic use. The majority of the population is dependent on well water. Perhaps due to their complexity and toxicity, industrial discharges are more critical and may need immediate control.

In Sri Lanka environmental awareness is quite high. There are many organisations and forums for creating awareness among the general populace. The Sri Lankan media too has responded very positively. However, with respect to industrial pollution the correct message is not getting across to the public and they are left with a one sided picture. It is well known that industrial facilities have often severely polluted air, water and soil. What needs to be understood is that a further extension of past trends is not the inevitable consequence of industrialisation. Rather, such problems reflect inefficient technologies or wasteful processes

as well as carelessness and lack of appropriate legal and economic policies. Also through sound planning and management the mistakes of the past can be minimised or eliminated.

These environmental problems illustrate the need for changes in attitudes and policies for the operation and monitoring of industries. Cumulative impacts of small and medium scale industries are major contributory factors to drinking water problems in the Colombo district. About 80% of the all small and medium scale industries are located in the Colombo and Gampaha districts. Because these industries were established long before the enactment of environmental laws, waste water discharges are often made to surrounding streams, drains, or land without any treatment. Some industries generate hazardous wastes that also get discharged with other wastes thus posing major health risks.

The high incidence of water pollution has in recent years resulted in conflicts between industry and community. Some recent instances are as follows:-

- a) **Pulp & Paper Mill at Embilipitiya:** This mill discharges black liquor from the pulping process to Walawe River. The liquor is toxic to fish and other aquatic life, and is also dark in colour. The discharge is also upstream of the Ambalantota drinking water extraction point. The use of straw does not permit the smooth functioning of the chemical recovery process that was designed to recycle chemicals and to control effluent.
- b) **Tanneries in and around Colombo:** At present numerous tanneries are located in areas that are residential, along the banks the of Kelani river. The practice of discharging wastewater containing highly toxic chemicals along with associated odorous and residual substances without any effective control has brought strong protests and objections from nearby residents and downstream water users.
- c) **Alum plant at Ranala:** The facility produces sulphuric acid and alum. The 'acid factory' as it is known locally has brought strong local objections due to the creation of acidified well water, noxious gases, etc. The process used is DCDA (Double Contact Double Absorption) and the air pollution potential is minimal. The residents say that this plant causes acid rain.
- d) **Textile factories at Ratmalana:** Un-regulated industrial development in this area has resulted in multicoloured wastewater in municipal storm water drains, frequently containing strong acids and other toxic chemicals and emitting noxious odorous. Public protests are very strong and numerous.

Even industries that are considered to be comparatively safe have caused problems of water pollution. Examples include;

- a) **Coral and Sand Mining:** This activity has led to significant coastal erosion (Southern coastal belt) and salinity intrusion (Maha Oya) affecting drinking water supplies.
- b) **Brick and Tile Industry:** Raw material extraction has caused numerous environmental problems. Large scale clay mining resulted in hundreds of abandoned clay pits clogged with water weeds and providing ideal breeding grounds for mosquitoes. The deep and gaping abandoned clay pits by the riverside during flood season are becoming part of the river, resulting in riverbank erosion. This is a problem in the Maha Oya basin around Wennappuwa, Katana, Katugampola and Divulapitiya where more than 900 tile factories are located.

The Kelani river is the main source of drinking water for the greater Colombo Region with a draw off of around 80% of the requirements. Numerous industries along the Kelani river and its tributaries discharge directly into this river. It has witnessed major and minor fish kills due to industrial discharges. At present most of the industries are downstream of the Ambatale water intake located 15 km from the river mouth. However, there is a possibility that during the dry season when the water level in the river is low, contaminants could find their way to the water intake through tidal action. This has prompted the government to declare the area as an 'environmentally sensitive zone.

The Ratmalana-Moratuwa area, located south of Colombo emerged as an industrial cum residential suburb in the 1950's. Today there are about 225 industrial establishments spread over an area of 40 square kilometers. In addition, the area also holds about 350,000 residents. Most of the waste water from the industries in the area is discharged untreated into nearby drainage courses. The Lunawa lagoon, which provides the only sea outlet for these discharges, was a source of livelihood for fishermen. Today it is a dead lagoon with accumulated pollutants and solid waste. The other significant water body, the Bolgoda lake is also adversely affected.

The Beira lake in the city which is 67.6 ha in extent is an example of a lake which has become eutrophic from excess nutrients from urban sewage and other industrial and domestic effluents. The murky and greenish lake is not only an eye-sore but also emanates unbearable stench at times. The greening of the Beira has been attributed to algal blooms caused by the blue green algae microcyst. Much planning has been done to clean up this lake to give the city a more pleasant outlook.

Regulatory Framework

Sri Lanka has an impressive legal framework to protect the environment, the most recent being the amendments to National Environmental Act (Protection and Quality) Regulation, No. 1 of 1990; gazetted on 1996.05.23 dealing with hazardous waste handling and management. Compared with other developing countries, Sri Lanka, has a long history of legislation pertaining to natural resource management. The number of individual statutes and laws which deal wholly or in part, with environmental conservation and or natural resource management is said to range from 75 to 100. Some of these are outdated in today's context and need to be amended or removed from statute book. The Environmental Impact Assessment (EIA) process which has been made mandatory for all major development activities and projects results in failure when project proponents carry out development activities disregarding the recommended monitoring plans based on which the initial approval has been granted.

The National Environmental Act No. 47 of 1980 as amended by the Act No 50 of 1988, provides general standards for discharge of domestic and/or industrial effluent into inland surface waters and marine coastal waters. Though ocean outfalls for treated waste have been permitted there is no standard yet for such discharges. It is important to realise that the objective of environmental laws and regulations is to provide a level playing field for industry, so that it can contribute to a better quality of life without depleting natural resources or damaging the environment and jeopardizing the health and economic well-being of the people. The laws enacted and regulations passed will be meaningless unless they are properly implemented and strictly enforced. The ability for compliance should be considered when environmental laws and regulations are framed, as it will be difficult to enforce incomprehensible legislation. Good understanding by the industry is important for ensuring eventual compliance.

Water Quality Standards

A comparison of Sri Lanka discharge standards with that of India and Singapore is given below. The data indicate that Sri Lanka has more stringent standards in comparison with the other two countries.

Table 2: Comparison of Water Quality Standards of Sri Lanka, India and Singapore

Parameter	Sri Lanka	India	Singapore	
			Water course	Controlled Water course
PH	6 - 8.5	5.5 - 9.0	6 - 9	6 - 9
Temperature	not exceed 40°C	not exceed 40°C	45°C	45°C
BOD ₅ at 20°C	30	30	50	20
COD	250	250	100	60
Total suspended solids	50	100	50	30
Oil and Grease	10	10	10	5
Phenolic compounds	1	1	0.2	Nil
Cyanides	0.2	0.2	0.1	0.1
Sulphides	2	2.8	0.2	0.2
Arsenic	0.2	0.2	1	0.05
Cadmium	0.1	1	0.1	0.01
Chromium	0.1 (total)	2	1	0.05
Copper	3	3	0.1	0.1
Lead	0.1	0.1	0.1	0.1
Nickel	3	3	1	0.1
Selenium	0.05	0.05	0.5	0.01
Zinc	5	5	1	0.5

Sri Lanka has proposed industry specific discharge standards as well. An example is desiccated coconut (DC) mill operations (Table 3). This industry is of importance to our economy as Sri Lanka is the second largest producer of desiccated coconut. The standards have been introduced in a staged programme. Currently there is a programme at the Ceylon Institute of Scientific and Industrial Research (CISIR) to set up a pilot scale treatment system to study DC mill wastewater treatment as there is very little knowledge and experience regarding the characteristics and treatability of DC waste.

Table 3: Environmental Discharge Standards for DC industry

Parameter	Intermediate Standard	Ultimate Standard
pH	6.5-8	6.5-8
COD (mg/l)	850	300
BOD (mg/l)	150	30
Oil (mg/l)	50	10
Suspended solids (mg/l)	80	30
Total N (mg/l)	30	20

Similar industry specific standards are available for discharge of wastewater into inland surface waters, from the natural rubber, concentrated latex production and tanning industries.

Handling of Generated Sludge

Existing types of treatment plants for some industries are given in Table 4. Many industries do have some form of physical flocculation/coagulation or neutralisation systems in use. These are not mentioned here as they are not professionally designed nor adequately controlled.

Table 4: Examples of existing wastewater treatment systems in selected industries

Industry	Type of treatment plant (Number of systems)
Ceramic Industry	• Physio-chemical treatment - recovery of glaze and water (1)
Food Processing Industry	• Fat removal, Equalisation, Biological treatment, sludge drying - water recycling (50%) (1)
Beverage Industry	• Equalisation, separate treatment of high and low BOD lines , trickling filter and activated sludge, chlorination, sludge drying (1) • Oxidation ditch system (1) • RBC system (1)
Concentrated latex industry	• Rubber trap, oxidation ditch and sedimentation tank (1)
Paint industry	• Flocculation and sedimentation, Biological treatment, sludge drying (1)
DC industry	no treatment systems
Textile industry	• Neutralisation / equalization tank, activated sludge, polishing lagooning, sludge drying beds (5) • electro-chemical treatment with filter presses for sludge dewatering. (1) • RBC system (1) • Ozone treatment for colour removal (1)
Hotel industry	• RBC system (1) • Fat trap, Equalisation, trickling filter, clari-foculation, sludge digestion, artificial wetland, composting (1)
Service stations / Garages	• limited use of oil-water separators
Petroleum refining and storage	• API separator system (2)
Tanning industry	• Equalisation tank and a sedimentation tank and drying beds (1)
Pharmaceutical Industry	• Flocculation/coagulation and disinfection using chlorine (1)

The above listing along with the number of units, indicates that pollution control technologies are not used extensively in industries. From a treatment perspective no significant and comprehensive treatment facilities exist within industries. Most of the treatment systems are primitive and are not suitable for the task intended. Even some of the more comprehensive systems are poorly managed due to insufficient attention being given to them. Some of the systems in Industrial Estates and Free Trade Zones are receiving closer attention and care. For instance in the Kalutara district there is significant wastewater generation from distilleries. The principal waste from these distilleries is the spent wash known as 'goda' which is discharged from the alcohol stills after distillation of toddy. The spent wash from a distillery has a high temperature and BOD and is acidic. The systems generally used in treatment are of the septic tank type with a number of tanks in a series. Subsequently the wastewater overflows to streams or watercourses. This system is not suitable to treat distillery waste. Anaerobic digestion systems are more appropriate as they can produce biogas in addition to effluent treatment to suitable levels.

One of the drawbacks faced by industries is the lack appropriate technology and their ability to select from offered options. Some companies are offering packaged systems that are low in flexibility and with industries not fully aware of their individual waste profiles such units will not be able to perform efficiently. The sludge generated in these operations are discharged mostly to land, private collectors or municipal collection systems. There is also the practice of collecting sludge generated in containers and selling the containers along with their contents. The responsibility of discharging lies with the purchaser of these containers. The environmental law has now been amended to include the disposal of sludge in this manner. However, the necessary infrastructure to make the law effective is not yet in place.

Water Pollution Control

Water is fast becoming a scarce resource. Hence due care and attention must be given to extraction, consumption as well as the discharge of wastewater. The points made are applicable to pollution prevention and control in all modes (air, water, solid etc.) but predominantly applies to water pollution control as it is in this area that the problems are acute. Sri Lankan industries face problems in the following areas.

- a) It is difficult to obtain satisfactory analytical data quickly and at low cost. There is an on-going laboratory accreditation programme with respect to environmental analysis which will help in the future. Lack of general awareness among the industry personnel is addressed separately.
- b) There are not many organisation/s to carry out environmental system design and fabrication tasks. Ability to provide turnkey solutions is almost non-existent. The construction of wastewater treatment plants tends to be biased towards civil construction with little or no involvement of process considerations.
- c) The construction industry tends to use more cement and concrete and the use of other engineering materials such as plastics is neglected.
- d) No importance is given to waste minimisation. A value is more or less immediately taken in as the design criteria.
- e) In design no simulation and modelling methodologies are used with designs mainly based on conventional scaling criteria.

Prevention rather than Control

The concept of pollution control is now considered to be both uneconomical and illogical. The prevention of pollution is given more weightage. This approach has economic benefits compared with only the penalties that the former had. Preventative approaches can solve both first generation pollution problems (pollution at the production site) as well as second generation problems (pollution generated by the user). However, in implementing prevention strategies an overall appraisal of the process need to be considered and this aspect has deterred many from adopting this approach.

In the preventive approach the emphasis is to minimise the total quantity of wastewater generated. In a process plant one can get wastewater from process use, grey water from personal consumption and stormwater etc. There is also the need for firewater for an emergency. Cascading use of water is not practiced with much of the water being used only once prior to discharge. This is highly uneconomical.

The quantity of water used by industry varies widely. It is important that the facility is aware of its total water usage. This is not true in most facilities. With regulations being imposed there has been a rise in effluent disposal costs. Cost of water for consumption is also on the rise. Today piped water supply is charged for and the groundwater extraction should also be

charged for in the future. This will be an incentive to use water more efficiently and to minimise effluent discharges.

The methodologies for reducing water use and thus reducing the wastewater quantity to be discharged are being developed rapidly. In the developed countries the industries are looking at zero discharge. These range from simple housekeeping rules such as 'do not make it a liquid if it is dry!' to expensive yet very effective 'membrane technologies'. Housekeeping operations as simple as sweeping prior to washing floors, can substantially reduce the volume of waste water.

Rainwater Harvesting

Within the industry rain water is hardly ever utilised. This is unfortunate as rainwater is a very useful resource. Rainwater is one of the least contaminated sources. The mean annual rainfall of Sri Lanka is around 2000 mm which distributed over the surface area of 65610 sq. km, gives an average volume of 131,230 million cubic metres of fresh water. Collections and storage of rainwater runoff from roofs, could serve the dual purpose of reduction in the volume of runoff into sewer networks and the provision of water which could be used for general purposes such as cleaning factory floors, watering of lawns and gardening. Rainwater harvesting has been practiced in the drier areas of Sri Lanka from early days. With modern factory buildings and systems, implementation of rainwater harvesting as a source of water supply is a low cost option which will have high returns. Recently one multinational company has stated that it will fulfill all its water requirements by using rain water harvesting.

Regulatory Aspects

At present there are no pollution levies on effluent discharges in Sri Lanka. However this matter is under consideration as a policy issue. The most important aspect of pollution levies is that they encourage industry to look at pollution in economic terms. This will also facilitate the implementation of waste minimisation procedures. At present the discharge standards are given as a set of values and are based on the dilution principle. The concept can be traced back to the UK's Royal commission report where 20 mg/l BOD, 30 mg/l SS were given as discharge values when a dilution of 8:1 is provided by the receiving water. However, more relaxed standards can be adopted when greater dilution is available. Furthermore these standards were proposed for the UK where the river temperatures seldom rise above 18°C. This is not applicable in Sri Lanka where river temperatures of 25-30°C are common. This means that in our climate the dissolved oxygen availability is lower than in UK. The standards need to address these issues along with emphasis on the dilution factor.

The regulatory framework will influence the ultimate pollution control strategy adopted by industry. Costs, the sources of funding, and the ability and willingness of the individual to pay are all important aspects to be taken into account. It is important to understand the nature of processes available along with Best Economical Options (BEO). In UK the principle of Best Available Technology Not Entailing Excessive Cost (BATNEEC) is adopted in implementing standards. Sri Lanka is currently looking into setting discharge standards based on water quality objectives with respect to receiving bodies and their end uses. When one applies the same set of standards for each and every discharge independent of the size of the discharge and independent of the downstream use of the receiving water the system though simple is not cost effective and less flexible. It is cheaper to tailor the discharge standard to the particular applications.

The proposed water quality standards will cater to a range of constituents which must be met for all receiving waters: i.e., rivers, lakes, estuaries, inshore and off-shore areas. In addition the water quality standards will be set for many forms of water use: i.e; drinking water, freshwater fishing, irrigation, contact recreation, non and recreation.

Management Awareness

In implementing these policies in the developing world a change of attitude is necessary at all levels of management. There is still a wide perception that water is free, or at least very cheap. Often the relatively low cost of production of water is responsible for the high volume of water used. The awareness by the management of the real requirements of water to meet process and other requirements is almost negligible. This factor could be easily avoided by being fully aware of the material balance of the process operations. Knowledge here not only will enable the management to decide on efficient use of water, but on efficient use of all the other raw materials as well. Also, the knowledge gained can significantly influence the requirements of wastewater treatment.

Another obstacle to economical use of water is poor organisational capacity. Often no individual holds clear responsibility for the efficient use of water. Even at present insufficient consideration is given to the efficient use of water when new facilities are being designed. Plant operators and personnel are neither adequately trained in the efficient use of water nor provided with appropriate facilities to monitor and control water usage.

Aeration methods

It is important that the industry is aware of the benefits of advanced aeration methods and techniques. Aerobic treatment systems depend on oxygen transfer and higher oxygen transfer efficiencies mean rapid biodegradation rates with low residence time requirements giving low plant costs.

For sake of simplicity and lower initial capital cost, the industry compromises efficiency and running costs. The surface aerators traditionally employed in activated sludge systems or aerated lagoons are not the best always. For example the VITOX™ system which saves power and civil costs, has virtually unlimited oxygen transfer capability. When unlimited oxygen is available, irrespective of loading, the biomass level will rise to its peak operational point, oxidising more BOD to carbon dioxide and water. New developments such as air diffuser systems (fine bubble and coarse bubble units) display high oxygen transfer efficiencies. These systems are without any moving parts and thus have low maintenance costs.

Phytoremediation

Phytoremediation uses a plant's natural abilities to take in water and nutrients through roots, evaporate water through leaves, and act as a filter to metabolise organic compounds, like oil and pesticides, or to absorb and concentrate toxic trace elements like lead and selenium. This method is cost effective compared to conventional remediation methods. Wastewater can be treated in artificially created wetlands. These wetlands are lined like landfills and have controlled inlets and outlets that allow the flow rates to be regulated. Water hyacinth for example can take up lead, copper, cadmium, iron and mercury. The harvested water hyacinth can be effectively used for anaerobic digestion. Also plants that thrive in brackish

environments are ideal for cleaning up and reducing the volume of wastewater containing high salt content.

New Technologies

There is a need to develop awareness at various levels to be successful in the water pollution control from a technical as well as from an economic point of view. Aeration methods highlight the need to consider concepts such as oxygen transfer efficiency and trade off initial capital costs with lower recurrent costs and higher overall efficiencies. The phytoremediation process shows that these are simple solutions to complex problems. Developments are taking place at a rapid pace in this area and it is not possible to be comprehensive other than stimulate interest. Technologies like membrane operations offer near ultimate solutions in treatment with possibilities of recycling and raw material recovery.

System Selection Methodology

The present system selection of wastewater treatment by the industry is more product related than process related. The industries look at others producing the same type of end products and then try to emulate the treatment process or strategy. Whenever there are no direct examples (as with DC mills) the owners face problems. The scenario was typical before the advent of the chemical engineering profession which introduced the paradigms of unit operations, processes and transport processes thus streamlining and completely restructuring process industries which brought about development in the west. Such analytical methods can be used in wastewater treatment processes as well.

An effective strategy involves initially characterising all of the plant's wastewater streams. A material balance helps to identify the composition along with quantities immediately. In general, wastewater can be characterised based on its bulk organic parameters, physical characteristics and specific contaminants. This knowledge enables all waste minimisation steps to be carried out first before attempting treatment. Consequently, it is possible to evaluate the treatment needs of each stream with respect to the applicable standard. The streams requiring the same type of treatment can then be combined and treated, improving the cost-effectiveness.

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CLIMATE CHANGE AND SEA LEVEL RISE

Hussain Shihab

The world is worried about the weather. The worry has increased in the last decade, partly because of the extreme events which have affected many countries.

These events range from floods in the latter part of eighties in Bangladesh to storms that created havoc in the Maldives and unprecedented droughts in India and Pakistan.

These extreme events are disturbing enough, but political and public concern have been intensified by the findings of scientists which lead us to believe that the underlying pattern of Global Climate Change is being altered by humanity to humanity's detriment. The present patterns of activities which we call development are not sustainable and threaten a breakdown in the environmental equilibrium essential for the support of human and other form of life on our planet.

If the nations of the world wait until the consequences and the victims of climate change are clear, scientists and politicians alike agree that it will be too late to act. Due to these reasons the United Nations Framework Convention on Climate Change was brought into effect. Climate Change caused by Greenhouse Gases is bound to make sustainable development difficult. This will increase pressures on water, soil, food production systems and other natural resources and exacerbate the problem of poverty.

The International Community has entrusted the Inter-Governmental Panel on Climate Change to carry out assessments on climate change at international level. Their latest findings show that Greenhouse Gas concentrations since pre-industrial times have led to positive radiative forcing of climate tending to warm the surface and to produce climate change.

CLIMATE CHANGE AND SEA LEVEL RISE

Mr. Hussain Shihab

The world is worried about the weather. The worry has increased in the last decade, partly because of the extreme events which have affected many countries, including a number of the South Asia Co-operative Environment Programme's (SACEP's) member countries. The many floods in Bangladesh in the latter part of the 80's and in the 90's, the floods in parts of Sri Lanka in the 90's the inundation of the Maldives in 1987 and the storms that created havoc in 1989, 1990, 1991 and the unprecedented floods in parts and droughts in other parts of India in the past decade, and finally the flood damage in the Punjab Province of Pakistan in 1991 are just some examples from South Asia.

Damage to infrastructure by strong winds in the Maldives

Atoll	No. of Structures
Fadhippolhu Atoll	214
Male' Atoll	123
Ari Atoll	48
Mulaku Atoll	139
N. Nilande Atoll	159
S. Nilande Atoll	160
Kulhumandulu Atoll	126
H. Huvadho Atoll	388
N. Huvadho Atoll	123
S. Huvadho Atoll	284
Fuahmulaku Atoll	2
Addu Atoll	1881
Total	4081

Source : MPHRE

Elsewhere on the globe, Hurricane Giblest devastated Jamaica in 1988, Mid-western Canada had a serious drought in 1988, a severe cyclone hit New Zealand and flooding caused damage in Northern Australia, in the same year. In the United States one of the century's worst heat waves gripped the East Coast and desiccated the Midwest, also in 1988.

Stockholm had the warmest winter in 230 years in 1989, and France the hottest May ever recorded. In the same year, Italy sweltered under summer heat waves. Britain basked in the summer and basked in the winter too during an unusually warm, dry year. These events illustrate vividly how climatic variations can affect our lives and economic activities.

These extreme events are disturbing enough in their own right. But political and public concern has been intensified by the findings of scientists which leads us to believe, that the underlying pattern of global Climate Change is being altered by humanity to humanity's detriment. Five of the warmest years have occurred in the decade of the 1980's. Global mean temperatures are increasing, and now there is scientific evidence to show, that there is a link between these changes and the extreme events that affected so many countries. Human

activities are undoubtedly altering the chemical composition of the atmosphere, and the scientists now agree, that this is likely to be a cause of the temperature increases we have experienced.

These changes can be regarded as one consequence of human pressure on the physical environment. The present patterns of activities which we tend to call development, are not sustainable and threaten a breakdown in the environmental systems essential for the support of human and other life on this planet earth. This unsustainable environmental pressure is in turn linked to the increasing expansion of the patterns of consumption of natural resources by humankind and the rapid growth of human population.

The stakes are high. The people of various nations could be asked to decide between environmental catastrophe and enormous costs. But do we really have to make this choice? Many scientists believe the danger is real, but others are much less certain. What is the evidence? Here is what we know.

Global Warming

When sunlight warms the earth, certain gases in the lower atmosphere, acting like the glass in a greenhouse, traps some of the heat as it radiates into space. These greenhouse gases; carbon dioxide, methane and man-made chlorofluorocarbons, warm our planet, making life possible.

If they were more abundant, greenhouse gases might trap too much heat. Venus, for example, has 60,000 times more carbon dioxide in its atmosphere than earth, and its temperature averages above 425 degrees C. But if green house gases were less plentiful or entirely absent, temperatures on Earth would average below freezing. Because the concentrations of greenhouse gases have been steadily rising, many scientists are concerned about global warming. Researchers at the Goddard Institute and the University of East Anglia in the United Kingdom foresee a doubling of greenhouse gas concentrations during the next century, which might raise average global temperatures as much as five degrees centigrade.

From these findings we may take it as a fact that Climate Change is a threat to humankind. But let us examine what is causing the build-up of the greenhouse gases? Nature accounts for most of the greenhouse gases in the atmosphere. For example, carbon dioxide (CO₂), the most plentiful trace gas, is released by volcanoes, oceans, decaying plants and even through our breathing process. But much of the build-up is man-made. CO₂ is given off when we burn wood or such fossil fuels as coal and oil. Infact, the amount in the atmosphere has grown more than 25 per cent since the Industrial Revolution began around 200 years ago-and over 11 per cent since 1958 alone.

Methane, is the next most abundant greenhouse gas. It is released when organic matter decomposes in swamps, rice is grown in the rice fields, from livestock yards, and even in the guts of termites and cud-chewing animals. The amount grows about one per cent per year, partly because of increased cattle raising and the use of natural gas.

Chlorofluorocarbons (CFC'S) are greenhouse gases, released by refrigerators, air-conditioners, plastic foam, solvents and spray cans. The amount in the atmosphere is small compared to CO₂, but CFC's are thousand times more potent in absorbing heat and is the major ozone depleting substance and is responsible for the "ozone hole," over the Antarctic and now also over the Arctic region.

From these findings scientists now agree that global warming is a threat to the future balance of the earth's environment, but no one is certain about its future effects as regard the severity. Responding to the threat will be expensive, complicated, and difficult. There is even some disagreement over whether any problem exists at all. While many people worry that the effects will be extremely serious, others argue that scientists cannot prove that what they suspect will happen, will actually happen. In addition, it is not clear who, in the various regions of the world, will suffer most. Yet if the nations of the world wait until the consequences are clear, it will be too late to act.

Initial Work on the Subject

One of the first international intergovernmental groups to start work on climate change was the British Commonwealth. The British Commonwealth which includes more than 26 Small Island Nations, sounded the siren about Climate Change and Sea Level Rise. An expert group was set-up by them, consisting of representatives from nine of its countries, which included socio-economists, scientists, government representatives, representatives from World Meteorological Organisation (WMO), United Nations Environment Programme (UNEP) and International Union for Conservation of Nature and Natural Resources (IUCN). The group which was set up due to an initiative taken by the President of the Maldives, His Excellency Mr. Maumoon Abdul Gayoom at the Commonwealth Summit in 1987, concluded its work in July 1989. Its report, which contained a number of recommendations, highlighted the Ecological, Economic and Social consequences of Climate Change and Sea Level Rise and strongly recommended that measures be taken to enhance the knowledge, and understanding of the subject.

An Intergovernmental Panel on Climate Change (IPCC) also had been set-up by WMO and UNEP in 1988. This became the major intergovernmental body dealing with Climate Change. The assessments of IPCC and the conclusion of the 2nd World Climate Conference 1990 convinced governments that urgent measures were needed to protect the earth from this threat.

The issue of Climate Change was given a higher profile and in the run up to the Earth Summit. UNEP also came up with the United Nations Framework Convention on Climate Change (UNFCCC), which was signed by more than 50 countries at the Summit itself. The IPCC, after more than 30 months of work by a large international group of scientists and experts, compiled its first assessment in time for the first meeting of the Parties to the Climate Change Convention in Berlin from 28 March - 7 April 1995. The latest of its reports were compiled for the 2nd Meeting of the Parties which was held in Geneva, in July 1996. *(It should be noted that the Scientific findings on Climate Change given in this paper are mainly from the findings of the IPCC, since the writer believes that these are the only findings that can be accepted by most of the developing countries)*

The Scientific Findings

For development to be sustainable, Climate Change too has to be taken into account and all its aspects understood. Considerable progress has been made in the understanding of climate change since 1990. The I.P.C.C has made available new data and new analyses. According to this new data; *greenhouse, gas concentrations have continued to increase.*

Increases in greenhouse gas concentrations since pre-industrial times (i.e. since about 1750) have led to a positive radiative forcing of climate, tending to warm the surface and to produce other changes of climate. The atmospheric concentrations of greenhouse gases, inter alia

carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) have grown significantly: by about 30%, 145%, and 15% respectively (value for 1992). These trends can be attributed largely to human activities, mostly fossil fuel use, land-use change and agriculture. The growth rates of CO₂, CH₄ and N₂O concentrations were low during the early 1990s. While this apparently natural variation is not yet fully explained, recent data indicate that the growth rates are currently comparable to those averaged over the 1980s.

The direct radiative forcing of the long-lived greenhouse gases (2.45 Wm⁻²) is due primarily to increases in the concentrations of CO₂ (1.5 Wm⁻²) CH₄ (0.47 Wm⁻²) and N₂O (0.14 Wm⁻²) (value for 1992). Many greenhouse gases remain in the atmosphere for a long time (for CO₂ and N₂O, many decades to centuries, hence they affect radiative forcing on long time-scales. The direct radiative forcing due to the CFCs, but not HCFCs combined is 0.25 Wm⁻². However, their net radiate forcing is reduced by about 0.1 Wm⁻² because they have caused stratospheric ozone depletion which gives rise to a negative radiative forcing.

Growth in the concentration of CFAs, but not HCFCs, has slowed to about zero. The concentrations of both CFCs and HCFCs, and their consequent ozone depletion, are expected to decrease substantially by 2050 through implementation of the Montreal Protocol and its Adjustments and Amendments. At present some long-lived greenhouse gases (particularly HFCs (a CFC substitute), PFCs and SF₆) contribute little to radiative forcing but their projected growth could contribute several per cent to radiative forcing during the 21st century. If carbon dioxide emissions were maintained at near current (1994) levels, they would lead to a nearly constant rate of increase in atmospheric concentrations for at least two centuries, reaching about 500 ppmv (approaching twice the pre-industrial concentration of 280 ppmv) by the end of the 21st century.

A range of carbon cycle models indicates that stabilisation of atmospheric CO₂ concentrations at 450, 650 or 1000 ppmv could be achieved only if global anthropogenic CO₂ emissions drop to 1990 levels by, approximately 40, 140 or 240 years respectively from now, and drop substantially below 1990 levels subsequently. Any eventual stabilised concentration is governed more by the accumulated anthropogenic CO₂ emissions from now until the time of stabilisation, than by the way those emissions change over the period. This means that, for a given stabilised concentration value, higher emissions in early decades require lower emissions later on. Among the range of stabilisation case studies, for stabilisation at 450, 650 or 1000 ppmv accumulated anthropogenic emissions over the period 1991 to 2100 are 630 GtC, 1030 GtC, and 1410 GtC respectively. For comparison the corresponding accumulated emissions for IPCCIS92 emission scenarios range from 770 to 2190 GtC. Stabilisation of CH₄ and N₂O concentrations at today's levels would involve reductions in anthropogenic emissions of 8% and more than 50% respectively.

There is evidence that tropospheric ozone concentrations in the Northern Hemisphere have increased since pre-industrial times because of human activity and that this has resulted in a positive radiative forcing. The forcing is not yet well characterised, but it is estimated to be about 0.4 Wm⁻² (15% of that from the long-lived greenhouse gases.) However the observations of the most recent decade show that the upward trend has slowed significantly or stopped.

Anthropogenic aerosols tend to produce negative radiative forcings. Tropospheric aerosols (microscopic airborne particles) resulting from combustion of fossil fuels, biomass burning and other sources have led to a negative direct forcing of about 0.5 Wm⁻², as a global average, and possibly also to a negative indirect forcing of a similar magnitude. While the negative forcing is focused in particular regions and subcontinent areas, it can have

continental to hemispheric scale effects on climate patterns. Locally, the aerosol forcing can be large enough to more than offset the positive forcing due to greenhouse gases. In contrast to the long-lived greenhouse gases, anthropogenic aerosols are very short-lived in the atmosphere, hence their radiative forcing adjusts rapidly to increases or decreases in emissions.

Climate has changed over the past century

At any one location year-to-year variations in weather can be large, but analyses of meteorological and other data over large areas and over periods of decades or more have provided evidence for some important systematic changes. Global mean surface air temperature has increased by between about 0.3 C and 0.6 C since the late 19th century; the additional data available since 1990 and the re-analyses since then have not significantly changed this range of estimated increase. Recent years have been among the warmest since 1860, i.e. in the period of instrumental record, despite the cooling effect of the 1991 Mt. Pinatubo volcanic eruption.

Night-time temperatures over land have generally increased more than daytime temperatures. Regional changes are also evident. For example, the recent warming has been greatest over the mid-latitude continents in winter and spring, with a few areas of cooling, such as the North Atlantic ocean. Precipitation has increased over land in high latitudes of the Northern Hemisphere, especially during the cold season.

Global sea level has risen by between 10 and 25 cm over the past 100 years and much of the rise may be related to the increase in global mean temperature. There are inadequate data to determine whether consistent global changes in climate variability or weather extremes have occurred over the 20th Century. On regional scales there is clear evidence of changes in some extremes and climate variability indicators (e.g., fewer frosts in several widespread areas; an increase in the proportion of rainfall from extreme events over the contiguous states of the USA). Some of these changes have been towards greater variability; some have been towards lower variability. The 1990 to mid - 1995 persistent warm-phase of the El Niño-Southern Oscillation (which causes droughts and floods in many areas) was unusual in the context of the last 120 years.

Human Influence on Global Climate

Since the 1990 IPCC Report, considerable progress has been made in attempts to distinguish between natural and anthropogenic influences on climate. This progress has been achieved by including effects of sulphate aerosols in addition to greenhouse gases, thus leading to more realistic estimates of human-induced radiative forcing. These have then been used in climate models to provide more complete simulations of the human-induced climate-change 'signal'. In addition, new simulations with coupled atmosphere-ocean models have provided important information about decade to century time-scale natural internal climate variability. A further major area of progress is the shift of focus from studies of global-mean changes to comparisons of modelled and observed spatial and temporal patterns of climate change.

The limited available evidence from proxy climate indicators suggests that the 20th century global mean temperature is at least as warm as any other century since at least 1400 AD. Data prior to 1400 are too sparse to allow the reliable estimation of global mean temperature. Assessments of the statistical significance of the observed global mean surface air temperature trend over the last century have used a variety of new estimates of natural internal and externally-forced variability. These are derived from instrumental data,

palaeodata, simple and complex climate models, and statistical models fitted to observations. Most of these studies have detected a significant change and show that the observed warming trend is unlikely to be entirely natural in origin.

More convincing recent evidence for the attribution of a human effect on climate is emerging from pattern-based studies, in which the modelled climate response to combined forcing by greenhouse gases and anthropogenic sulphate aerosols is compared with observed geographical, seasonal and correspondences increase with time, as one would expect as an anthropogenic signal increases in strength. Furthermore, the probability is very low that these correspondences could occur by chance as a result of natural internal variability only. The vertical patterns of change are also inconsistent with those expected for solar and volcanic forcing.

The ability of scientists to quantify the human influence on global climate is currently limited because the expected signal is still emerging from the noise of natural variability, and because there are uncertainties in key factors. These include the magnitude and patterns of long term natural variability and the time-evolving pattern of forcing by, and response to, changes in concentrations of greenhouse gases and aerosols, and land surface changes. Nevertheless, the balance of evidence suggests that there is a discernible human influence on global climate.

Climate Changes in the Future

The IPCC has developed a range of scenarios, IS92a-f, of future greenhouse gas and aerosol precursor emissions based on assumptions concerning population and economic growth, land-use, technological changes, energy availability and fuel mix during the period 1990 to 2100. Through understanding of the global carbon cycle and of atmospheric chemistry, these emissions can be used to project atmospheric concentrations of greenhouse gases and aerosols and the perturbation of natural radiative forcing. Climate models can then be used to develop projections of future climate.

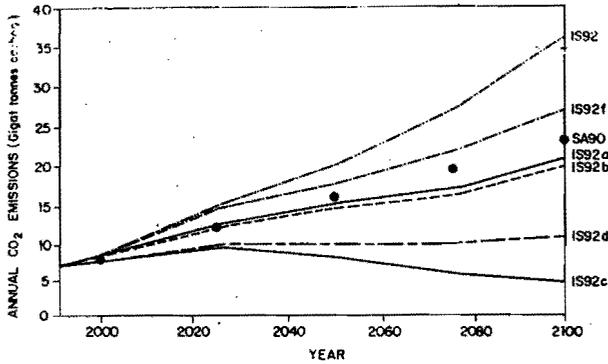
The increasing realism of simulations of current and past climate by coupled atmosphere-ocean climate models has increased the confidence in their use for projection of future climate change. Important uncertainties remain, but these have been taken into account in the full range of projections of global mean temperature and sea level change.

For the mid-range IPCC emission scenario, IS92a, assuming the "best estimate" value of climate sensitivity and including the effects the future increases in aerosol, models project increases in global mean surface air temperature relative to 1990 of about 2 C by 2100. This estimate is approximately one third lower than the "best estimate" in 1990. This is due primarily to lower emission scenarios (particularly for CO₂ and the CFAs), the inclusion of the cooling effect of sulfate aerosol, and improvements in the treatment of the carbon cycle. Combining the lowest IPCC emission scenario (IS92⁰C) with a "low" value of climate sensitivity and including the effects of future changes on aerosol concentration leads to a projected increase of about 1⁰C by 2100. The corresponding projection for the highest IPCC scenario (IS92e) combined with a "high" value of climate sensitivity gives a warming of about 3.5⁰C. In all cases the average rate of warming would probably be greater than any seen in the last 10,000 years, but the actual annual to decadal changes would include considerable natural variability. Regional temperature changes could differ substantially from the global mean value. Because of the thermal inertia of the oceans, only 50-90% of the eventual equilibrium temperature change would have been realised by 2100 and temperature

Climate Change and Sea Level Rise

would continue to increase beyond 2100, even if concentration of greenhouse gases were stabilised by that time.

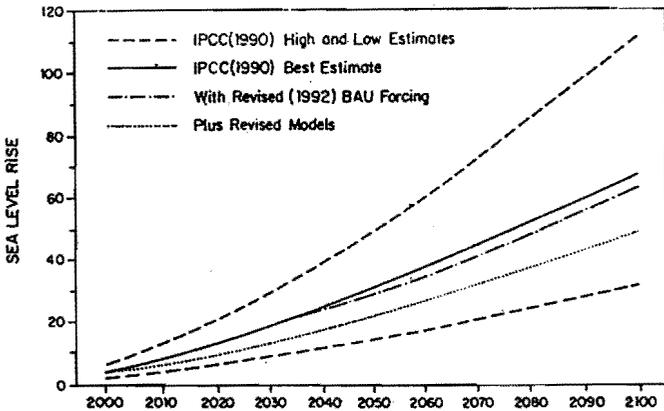
Annual CO₂ Emissions from Energy, Cement Production and Tropical Deforestation for the six IPCC 1992 Scenarios (IS92 I-f) and the 1990 IPCC Scenario A (SA90)



Source: IPCC Climate Change 1992

Average sea level is expected to rise as a result of thermal expansion of the ocean and melting of glaciers and ice-sheets. For the IS92a scenario, assuming the “best climate” values of climate sensitivity and of ice melts sensitivity to warming, and including the effects of future changes in aerosol, models project an increase in sea level of about 50 cm from the present to 2100. This projection, also reflects improvements in the climate and ice melt models. Combining the lowest emission scenario (IS92⁰C) with the “low” climate and ice melt sensitivities and including aerosol effects gives a projected sea level rise of about 15 cm from the present to 2100. The corresponding projection for the highest emission scenario (IS92e) combined with “high” climate and ice-melt sensitivities gives a sea level rise of about 95 cm from the present to 2100. Sea level would continue to rise at a similar rate if future centuries beyond 2100, even if concentrations of greenhouse gases were stabilised by that time, and would continue to do so even beyond the time of stabilisation of global mean temperature. Regional sea level changes may differ from the global mean value owing to land movement and ocean current changes.

Recent Projections of Future Sea-Level Rise



Source: McLean, Roger and Nobuo Minuira, Vulnerability Assessment to Sea Level Rise and Coastal Zone Management Proceedings of the IPECAC Eastern Hemisphere Workshop, Tsukuba, Japan. 3 – 6 August 1993

A general warming is expected to lead to an increase in the occurrence of extremely hot days and a decrease in the occurrence of extremely cold days. Warmer temperatures will lead to a more vigorous hydrologic cycle. This translates into prospects for more severe droughts and/or floods in some places and less severe droughts and/or floods in other places. Several models indicate an increase in precipitation intensity, suggesting the possibility of more extreme rainfall events. Knowledge is currently insufficient to say whether there will be any changes in the occurrence of geographical distribution of severe storms. e.g., tropical cyclones.

Sustained rapid climate change could shift the competitive balance among species and even lead to forest dieback, altering the terrestrial uptake and release of carbon. The magnitude is uncertain, but could be between zero and 200 GtC over the next one to two centuries, depending on the rate of climate change. A set of impact scenarios specific to the entire Asia Pacific region was prepared by ADB in 1994. This study has given country specific scenarios for economic and population growth, and for some other parameters, which may make the impact analysis more useful for preparing national response strategies.

Regional Impacts of Climate Change and Sea Level Rise

1. Physical and Biological Impact of Climate Change

Assessment studies have shown that climate changes and sea level rise to many biological and physical impacts. Particular examples of estimated regional impacts include:

- Changes in temperatures of annual average temperature increases for inland South Asia and the Indo-China Peninsula of 0.3°C to 0.7°C by 2010, and 1.2°C to 4.5°C (degrees) by 2070 (Ghosh 1995).
- Changes in the amount of precipitation - in some areas of the Asian and Pacific region may receive more rain than at present, and some less. The various climate models do not necessarily agree on the pattern that these changes will take place.
- Changes in the timing of precipitation-such as the shifting of monsoon patterns and changes in the severity of monsoons. It is not yet clear, from model results, whether the annual monsoons in the Asian and Pacific region will become stronger or weaker as a result of climate change.
- Changes in plant growth rates - both positive and negative rates are predicted. Increases could occur, induced by higher concentrations of CO₂ and, (particularly in the more northerly countries of the regions such as Japan), through longer growing seasons due to higher temperatures. Decreases could occur as a result of intolerance of high temperatures, or from changes in the amount or timing of precipitation (Topping 1990).
- The very survival of some countries such as small island developing states could be at stake due to climate change. Altered severity of storms and floods and accompanying erosion, exacerbated by storms and floods, as well as by the timing and amount water discharged by rivers. For island nations, climate change may include an increase in the frequency of hurricanes and typhoons to areas that already experience them. A widening or shift in the belts of such storms could also occur, so that additional island and mainland areas are adversely affected. Rising seas will exacerbate the damage caused by these weather phenomena.
- Changes in forests due to changes in Asian and Pacific region is home to large tracts of both ecologically and economically. These ecosystems are sensitive to climate change, but due to the long lives and long maturation periods probably required for large trees in

forests, they will probably be less able than other ecosystems to adapt to changes in the susceptibility of plants and animals to these pressures.

- Changes in biodiversity and species distribution - all of the changes above have the potential to alter the distribution and range of plant and animal species, including both domesticated crops and livestock, and native flora and fauna. (Qureshi 1993.) Difficulties in adapting to new climatic conditions could mean the disappearance of certain species and the arrival of others.
- Changes on ocean temperatures and their effects on ocean productivity, including the productivity of and growth rates of reefs are especially sensitive to temperature: a temperature increase (not related to global warming) of 1.5(degrees) C experienced in Indian Ocean waters in 1987 resulted in widespread bleaching of corals in that region.

2. *Physical and Biological Impacts of Sea level Rise.*

The most obvious regional (as well as global) impact of SLR brought on by climate change is inundation of coastal lands by the higher water level of the oceans. Estimates of the extent of inundation by a one-metre SLR in the region includes 23,000 Km² of significant losses of land in many other nations (Topping et al 1990). Shoreline inundation by hundreds of metres to many kilometres may result from tens of centimetres of SLR. Table 6.4 shows additional estimates of land loss for countries in the region, along with the associated displacements of human populations.

Studies of several areas in the Asian and Pacific region show that coastal wetlands are especially at risk and estimate wetland losses of 35 to cover 90 cent (Nicholls 1994)

The impacts of climate change-induced SLR could be particularly severe for small island nations of the region. Nations that do not have much land more than a few metres above sea level, and often depend to a very large extent on the biological and physical resources of the coastal zone. A number of case countries could be severely effected by a range of extreme climatic events including tropical cyclones, sea surges, floods and droughts.

All of the generic regional impacts listed above will apply to many of the countries in the region, although to varying degrees in each case, for example inundation of coastal areas through rising seas will effect many countries, (e.g. Bangladesh, small island states), And flash flooding and tidal waves will particularly affect the Maldives, Pakistan, and the areas through salt intrusion will affect for example China. Disruption of flooding processes will affect the maintenance of soil fertility (e.g. Sri Lanka), will impact on the biodiversity (e.g. coral ecosystems in Tonga) and on the availability and timing of water resources (e.g. Viet Nam) (Topping et al 1990).

3. *Socio-economic Impacts of Climate Change and SLR*

(a) Generic socio-economic impacts.

The Asian and Pacific region has a high percentage of the world's most densely populated coastline, as well as eight of the world's largest coastal cities (IPCC Working Group 1990). For Example, 70 per cent of the population in South-east Asia lives in Coastal areas, approximately 13 per cent of the population of China lives in the coastal zone, as does 22 per cent of the population of Indonesia. i).The first cluster of social and economic impacts of climate change, particularly SLR, concerns the dislocation of populations. Particular issues include:

- The need for resettlement of those whose lands will be flooded and the socio-economic consequences of resettlement. This can include people the costs of transport, the presence of more people to be fed and housed in less space (exacerbated by population growth), and the potential for crowded and resource-scarce conditions to spark ethnic and other conflicts.
- The dislocation of populations due to changes in regional weather risks being worsened by global climate change and SLR, through the decline in coastal and marine productivity, which could be accompanied by food shortages. The end result could be a widespread decline on people's agricultural production in inland areas.
- Increased unemployment/underemployment for dislocated population. Recent reductions in fish catches around the world, for example, have already resulted in significant unemployment and under-employment among the 15 million people in the region that are currently employed in the fishing industry (Weber 1993). Small islands' populations and coastal-living people will be severely affected in their subsistence activities (small scale fish farming and fishing).
- Physical population displacement and decreased employment opportunities in rural coastal and inland areas toward cities, where migrants may join the urban poor, putting additional strain on social services in cities.

Land Loss and Population Displacement in Various Sea-level Rise (SLR) Scenarios

Country	SLR scenario (cm)	Land loss		People displaced	
		km ²	Per cent	Millions	Per cent
Bangladesh (1)	45	15,668	10.9	5.5	5.0
Bangladesh (2)	100	29,846	20.7	14.8	13.5
India	100	5,763	0.4	7.1	0.8
Pakistan	200	1,700	0.2	n.a.	n.a.

*Source: National study team reports, ADB, 1993.
n.a. = not available; (1), (2) = Different scenarios*

- Increased exposure of populations to natural catastrophes such as flooding, storms, and tidal waves (Environmental Agency 1991). Whole communities on low-lying coastal areas face potential disasters of complete destruction.
- **iii) A third cluster of potential social and economic impacts, concerns other economic sectors, capital assets, and capital markets. Examples here include:**
 - The need for new capital investments to maintain water supplies (for example, for pumping, treatment (to the extent that natural waste treatment resources are damaged), for coastal and inland flood containment facilities and sea walls, for other physical infrastructure needed to protect or repair port facilities and other coastal structures, to generate electricity for increased air conditioning, for flood containment facilities, and for other climate-related needs.
 - Loss of property through inundation, including commercial properties, farmland, residential properties, fishing and aquaculture areas. There may also be the need for additional investments in energy, pumping equipment, and/or agrochemicals in order to maintain productivity on, or obtain production from marginal and degraded lands, *i.e.* those affected by inundation of seawater.
 - Impacts on tourism. Physical, biological, and social changes caused or exacerbated by changes in sea level and climate may result in some locations becoming less desirable

tourist destinations, thus reducing tourist income. These impacts may be particularly important for smaller island nations that are proportionately more Impacts on tourism for income.

- Impacts on storage, transport, treatment and disposal of toxic, municipal, and other wastes, change-related flooding and SLR. As home to a surprising that coastal areas are also home to a large number of facilities that store and/or treat industrial facilities (for example, chemical plants, refineries), toxic and hazardous waste landfills, sewage treatment facilities, incurring great costs to governments.

(b) Country specific socio-economic impacts

A number of country-specific studies conducted to date also show that the potential social and economic impacts of climate change are significant in relative and absolute terms.

In Sri Lanka, study of socio-economic effects SLR-related impacts noted salinity intrusion into drinking water wells in coastal regions, erosion of beaches and other economically important shoreline areas, increased salinity of estuaries, increased coastal deterioration of agricultural drainage, and loss of much of the Muthurajawela Marsh. Impacts from other ramifications of climate change include: severe fluctuations of crop output grains, legumes, potatoes, rice, and export crops; though water supply on the whole will probably remain unchanged during conditions of climate change, the timing of precipitation will be affected; increased evaporation from water holding tanks; changes in forest ecology, with resulting changes in commercial wood production, biological diversity, and recreational opportunities; and increasingly congenial (that is, wet and humid) habits for human parasites and vectors, including malaria, filaria, dengue. More frequent flooding and storms would cause increasing damage, via inundation and landslides in hill areas, to roads, railways, and communications infrastructure. Based on the economic assessment of a limited number of subsectors, this study estimated an annual income loss due to SLR US \$ 28 million (at Rs 46/US\$), and capital costs of about US \$ 34 million. Income losses from changes in agricultural production were estimated at an additional US \$ 65 to 87 million. Similar potential impacts have been documented in the recent ADB-funded studies that cover many Asian Countries (ADB 1994a).

Uncertainties and Gaps in Knowledge

Many factors currently limit our ability to project and detect future climate change. In particular, to reduce uncertainties further work is needed. It is necessary to estimate future emissions and biogeochemical cycling (including sources and sinks) of greenhouse gases, aerosols and aerosol precursors and projections of future concentrations and radiative properties. Representation of climate processes in models, especially feedbacks associated with clouds, oceans, sea ice and vegetation will be required, in order to improve projections of rates and regional patterns of climate change. Systematic collection of long-term instrumental and proxy observations of climate system variables (e.g., solar output, atmospheric energy balance components, hydrological cycles, ocean characteristics and ecosystem changes) should be undertaken for the purpose of model testing, assessment of temporal and regional variability and for detection and attribution studies.

Future unexpected, large and rapid climate system changes (as have occurred in the past) are, by their nature difficult to predict. This implies that future climate changes may also involve "surprises". In particular these arise from the non-linear nature of the climate system. When rapidly forced, non-linear systems are especially subject to unexpected behavior. Progress can be made by investigating non-linear processes and sub-components of the climatic

system. Examples of such non-linear behaviour include rapid circulation changes in the North Atlantic and feedbacks associated with terrestrial ecosystem changes.

Human Health

Climate change is likely to have wide ranging and mostly adverse impacts on human health, with significant loss of life. These impacts would arise both directly and indirectly and it is likely that indirectly impacts would, in the longer term, predominate. Direct health effects include increases in mortality and illness due to an anticipated increase in the intensity and duration of heat waves. Temperature increases in colder regions should result in fewer cold-related deaths. An increase in extreme weather would cause a higher incidence of death, injury, psychological disorders, and exposure to contaminated water supplies.

Additional indirect effects include respiratory and allergic disorders due to climate enhanced increases in some air pollutants, pollens, and mold spores. Exposure to air pollution and stressful weather events combine to increase the likelihood of morbidity and mortality.

Options to Reduce Emissions

Sinks of Greenhouse Gases

Human activities are directly increasing the atmospheric concentrations of several greenhouse gases, especially CO₂, CH₄, halocarbons, sulfur hexafluoride (SF₆), and nitrous oxide (N₂O). CO₂ is the most important of these gases, followed by C₄. Human activities also indirectly affect concentration of water vapor and ozone. Significant reductions in net greenhouse gas emissions are technically possible and can be economically feasible. These reductions can be achieved by utilising an extensive array of technologies, and policy measures that accelerate technology development, diffusion, and transfer in all sectors including the energy, industry, transportation, residential/commercial, and agricultural/forestry sectors.

Energy, Industrial Process, and Human Settlement Emissions

Global energy demand has grown at an average annual rate of approximately 2% for almost 2 centuries, although energy demand growth varies considerably over time and between different regions. In the published literature, different methods and conventions are used to characterise energy consumption. These conventions differ, for example, according to their definition of sectors and their treatment of energy forms. based on aggregated national energy balances, 385 EJ of primary energy was consumed in the world in 1990, resulting in the release of 6 Gt C as CO₂. Of this, 279 RJ was delivered to end users, accounting for 3.7 Gt C emissions as CO₂ at the point of consumption. The remaining 106 EJ was used in energy conversion and distribution, accounting for 2.3 Gt C emissions as CO₂. In 1990, the three largest sectors of energy consumption were industry (45% of total CO₂ releases), residential/commercial sector (29%) , and transport (21%). Of these, transport sector energy use and related CO₂ emissions have been the most rapidly growing over the past 2 decades. For the detailed sectoral mitigation option assessment in this report, 1990 energy consumption estimates are based on a range of literature sources; a variety of conventions are used to define these sectors and their energy use, which is estimated to amount to a total of 259-282 EJ.

Organisation for Economic Co-operation and Development (OECD) nations have been and remain major energy users and fossil fuel CO₂ emitters, although their share of global fossil

fuel carbon emissions has been declining. Developing nations, taken as a group, still account for a smaller portion of total global CO₂ emissions than industrialised nation.

Energy Demand

Numerous studies have indicated that 10-30% energy efficiency gains above present levels are feasible at little or no net cost in many parts of the world through technical conservation measures and improved management practices over the next 2 to 3 decades. Using technologies that presently yield the highest output of energy services for a given input of energy, efficiency gains of 50 - 60% would be technically feasible in many countries over the same time period. Achieving these potentials will depend on future cost reductions, financing, and technology transfer, as well as measures to overcome a variety of non technical barriers. The potential for greenhouse gas emission reductions exceeds the potential for energy use efficiency because of the possibility of switching fuels and energy sources. Because energy use is growing worldwide, even replacing current technology with more efficient technology could still lead to an absolute increase in CO₂ emissions in the future.

In 1992, the IPCC produced six scenarios (IS92af) of future energy use and associated greenhouse gas emissions (IPCC, 1992, 1995). These scenarios provide a wide range of possible future greenhouse gas emission levels, without mitigation measures. In the Second Assessment Report, future energy use has been reexamined on a more detailed sectoral basis, both with and without new mitigation measures, based on existing studies. Despite different assessment approaches, the resulting ranges of energy consumption increases to 2025 without new measures are broadly consistent with those of IS92. If past trends continue, greenhouse gas emissions will grow more slowly than energy use, except in the transport sector.

Industry

Energy use in 1990 was estimated to be 98-117 EJ, and is projected to grow to 140-242 EJ in 2025 without new measures. Countries differ widely in their current industrial energy use and energy related greenhouse gas emission trends. Industrial sector energy related greenhouse gas emissions in most industrialised countries are expected to be stable or decreasing as a result of industrial restructuring and technological innovations, whereas industrial emissions in developing countries are projected to increase mainly as a result to industrial growth. The short term potential for energy efficiency improvements in the manufacturing sector of major industrial countries is estimated to be 25%. The potential for greenhouse gas emission reductions is larger. Technologies and measures for reducing energy related emissions from this sector include improving efficiency (e.g., energy and materials savings, co-generation, energy cascading, stream recovery, and use of more efficient motors and other electrical devices); recycling materials and switching to those with lower greenhouse gas emissions; and developing processes that use less energy and materials.

Transportation

Energy use in 1990 was estimated to be 61-65 EJ, and is projected to grow to 90-140 EJ in 2025 without new measures. Projected energy use in 2025 could be reduced by about a third to 60-100 EJ through vehicles using very efficient drive trains, lightweight construction, and low air resistance design, without compromising comfort and performances. Further energy use reductions are possible through the use of smaller vehicles; altered land use patterns, transport systems, mobility patterns, and lifestyles; and shifting to less energy intensive transport modes. Greenhouse gas emission per unit of energy used could be reduced throughout the use of alternative fuels and electricity from renewable sources. These

measures, taken together, provide the opportunity for reducing global transport energy related greenhouse gas emissions by as much as 40% of projected emission by 2025. Actions to reduce energy related greenhouse gas emissions from transport can simultaneously address other problems such as local air pollution.

Commercial and Residential energy use in 1990 was estimated to be about 100 EJ, and is projected to grow to 90-140 EJ in 2025 without new measures. Projected energy use could be reduced by about a quarter to 126-170 EJ by 2025 without diminishing services through the use of energy efficient technology. The potential for greenhouse gas emission reductions is larger. Technical changes might include reduced heat transfers through building structures and more efficient space conditioning and water supply systems, lighting, and appliances. Ambient temperatures in urban areas can be reduced through increased vegetation and greater reflectivity of building surfaces, reducing the energy required for space conditioning. Energy related greenhouse gas emission reductions beyond those obtained through reduced energy use could be achieved through changes in energy sources.

Mitigating Industrial Process and Human Settlement Emissions

Process related greenhouse gases including CO₂, CH₄, N₂O, halocarbons, and SF₆ are released during manufacturing and industrial processes, such as the precaution of iron, steel, aluminum, ammonia, cement, and other materials. Large reductions are possible in some cases. Measures include modifying production processes, eliminating solvents, replacing feedstocks, materials substitution, increased recycling, and reduced consumption of greenhouse gas intensive materials. Capturing and utilising CH₄ from landfills and sewage treatment facilities and lowering the leakage rate of halocarbon on refrigerants from mobile and stationary sources also can lead to significant greenhouse gas emission reductions.

Energy Supply

This assessment focuses on new technologies for capital investment and not on potential retrofitting of existing capital stock to use less carbon intensive forms of primary energy. It is technically possible to realise deep emission reductions in the energy supply sector in step with the normal timing of investments to replace infrastructure and equipment as it wears out or becomes obsolete. Many options for achieving these deep reductions will also decrease the emissions of sulfur dioxide, nitrogen oxides, and volatile organic compounds. promising approaches, not ordered according to priority, are described below.

Greenhouse gas reductions in the use of fossil fuels

New technology offers considerably increased conversion efficiencies. For example, the efficiency of power production can be increased from the present world average of about 30% to more than 60% in the longer term. Also, the use of combined heat and power production replacing separate production of power and heat - whether for process heat or space heating - offers a significant rise in fuel conversion efficiency.

Switching from coal to oil or natural gas, and from oil to natural gas can reduce emissions. Natural gas has the lowest CO₂ emission per unit of energy of all fossil fuels at about 14 kg C/GJ, compared to oil with about 20 kg with higher efficiency than coal. Large resources of natural gas exist in many areas. New, low capital cost, highly efficient combined cycle technology has reduced electricity costs considerably in some areas. Natural gas could potentially replace oil in the transportation sector. Approaches exist to reduce emissions of

CH₄ from natural gas pipelines and emissions of CH₄ and/or CO₂ from oil and gas wells and coal mines.

The removal storage of CO₂ from fossil fuel power station stack gases is feasible, but reduces the conversion efficiency and significantly increases the production cost of electricity. Another approach to decarbonisation uses fossil fuel feedstocks to make hydrogen-rich fuels. Both approaches generate a byproduct stream of CO₂ that could be stored, for example, in depleted natural gas field. The future availability of conversion technologies such as fuel cells that can efficiently use hydrogen would increase the relative attractiveness of the latter approach. However, longer term CO₂ storage options, the costs, environmental effects, and efficacy of such options remain largely unknown.

Switching to non fossil fuel sources of energy

Nuclear energy could replace busload fossil fuel electricity generation in many parts of the world if generally acceptable responses can be found to concerns such as reactor safety, radio active waste transport and disposal, and nuclear proliferation.

Solar, biomass, wind, hydro, and geothermal technologies already are being used. In 1990, renewable sources of energy contributed about 20% of the world's primary energy consumption, most of it fuelwood and hydropower. Technological advances offer new opportunities and declining costs of energy form these sources. In the longer term, renewable sources of energy could meet a major part of the world's demand for energy. Power systems can easily accommodate limited fractions intermittent generations, and with the addition of fast-responding backup and storage units, also higher fractions.

Possible actions which can be considered by Policymakers

A portfolio of possible actions that Policymakers could consider, in accordance with applicable international agreements, to implement low-cost and/or cost-effective measures to reduce emissions of greenhouse gases and adapt to climate change can include:

- implementing energy efficiency measures, including the removal of institutional barriers to energy efficiency improvements;
- phasing out existing distortionary policies and practices that increase greenhouse gas emissions, such as some subsidies and regulations, non-internalisation of environmental costs, and distortions in transport pricing;
- implementing cost-effective fuel switching measures from more to less carbon-intensive fuels and to carbon-free fuels such as renewable;
- implementing measures to enhance sinks or reservoirs of greenhouse gases, such as improving forest management and land use practices;
- implementing measures and developing new techniques for reducing methane, nitrous oxide, and other greenhouse gas emissions;
- encouraging forms of international cooperation to limit greenhouse gas emissions, such as implementing coordinated carbon/energy taxes, activities implemented jointly and tradable quotas;

- promoting voluntary actions to reduce greenhouse gas emissions;
- promoting education and training, implementing information and advisory measures for sustainable development and consumption patterns that will facilitate climate change mitigation and adaptation;
- planning and implementing measures to adapt to the consequences of climate change ;
- undertaking research aimed at better understanding of the causes and impacts of climate change and facilitating more effective adaptation to it;
- conducting technological research aimed at minimising emissions of greenhouse-gases from continued use of fossil fuels and developing commercial non fossil energy sources;
- developing improved institutional mechanisms, such as improved insurance arrangements, to share the risks of damages due to climate change.

Decision Making Frameworks for Addressing Climate

Since climate change is a global issue, comprehensive analyses of mitigation, adaptation, and research measures are needed to identify the most efficient and appropriate strategy to address climate change. International decision making related to climate change, as established by the FCCC is a collective process in which a variety of concerns, such as equity, ecological protection, economics, ethics and poverty-related issues, are of special significance for present and future generations. Treatments of decision making under uncertainty, risk aversion, technology development and diffusion processes, and distributional considerations are at present relatively poorly developed in international environmental economic ,and especially in the climate change literature.

Decision making related to climate change must take into account the unique characteristics of the “problem”: large uncertainties (scientific and economic), possible non-linearities and irreversibilities, asymmetric distribution of impacts geographically and temporally, the very long time horizon, and the global nature of climate change with the associated potential for free riding. Beyond scientific uncertainties and impact uncertainties, socioeconomic uncertainties relate to estimates of how these changes will affect human society (including direct economic and broader welfare impacts) and to the socioeconomic implications of emission abatement.

The other dimension that magnifies uncertainties and complicates decision making is geographical: climate change is a global problem encompassing an incredibly diverse mix of human societies, with differing histories, circumstances and capabilities. Many developing countries are in relatively hot climates, depend more heavily on agriculture, and have less well developed infrastructure and social structures; thus, they may suffer more than average, perhaps much more. In developed countries, there may also be large climate change impacts.

The literature also emphasises that delaying responses can be costly. Some studies suggest that the cost of delay is small; other emphasise that the cost could include imposition of risks on all parties (particularly the most vulnerable), greater utilisation of limited atmospheric capacity, and potential deferral of desirable technical development. No consensus is reflected in the literature.

The global nature of the problem - necessitating collective action by sovereign states - and the large differences in the circumstances of different parties raise consequential as well as procedural issues. Consequential issues relate to outcomes while procedural issues relate to how decisions are made. In relation to climate change, the existence of an agreed legal framework involves a collective process within a negotiated framework (FCCC). Accordingly decision making can be considered within three different categories of frameworks, each with different implications and with distinct foci: global optimisation (trying to find the globally optimal result), procedural decision making (establishing and refining rules of procedure), and collective decision making (dealing with distributional issues and processes involving the interaction of numerous independent decision makers. The most important thing of all is for the decision maker to remember that, "*Sustainable development must meet the needs of the present generation without compromising the ability of future generations to meet their own needs.*"

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WATER QUALITY STANDARDS

W. A. D. D. Wijesooriya

Following review of use classes distinguished in other countries and discussions with officials and experts of relevant agencies, seven use classes for inland surface waters and four use classes for coastal waters have been distinguished for Sri Lanka. In this classification all surface waters should meet the requirements for minimum water quality criteria.

A simple procedure has been formulated for an initial designation of use of the main inland surface waters and coastal waters, avoiding costly and time-consuming inventories. This procedure has been applied as an example for an initial designation of the uses of the Kelani, Kalu and the Mahaweli rivers and the South West coast of Sri Lanka.

Designation of uses is a cyclical process. When the observed actual quality does not meet the requirement for the designated uses then certain corrective steps have to be taken. The measures may include modification of the uses, a reduction of emission of pollutants, augmented dilution or increased flushing.

WATER QUALITY STANDARDS

W. A. D. D. Wijesooriya

The goal of the Central Environmental Authority (CEA) with regard to Sri Lanka's inland waters is to maintain and restore the wholesomeness of water resources. According to the National Environmental Act No 47 of 1980 of Sri Lanka *"no person shall pollute any inland waters of Sri Lanka or cause or permit to cause pollution in the inland waters of Sri Lanka so that the physical, chemical or biological condition of the waters is so changed as to make or reasonably expected to make those waters or any part of those waters unclean, noxious, poisonous, impure, detrimental to the health, welfare, safety or property of human beings, poisonous or harmful to animals, birds, wildlife, fish, plants or other forms of life or detrimental to any beneficial use made of those waters"*.

But it is obvious that maintaining all natural water bodies at every point at pristine quality is not possible technically and economically. Planning pollution control activities to attain such a goal is bound to retard development activities and at the same time cost prohibitive. Natural water bodies have got to be used for various competing as well as conflicting demands. Therefore, the objective is aimed at restoring and/or maintaining natural water bodies at various reaches to such quality as are needed for their best use.

The objective of this study, which was carried out during the period 1991-1992 is to propose ambient surface water quality standards (inland and coastal) related to various uses. Guidelines for designation of surface water use were also proposed under this programme.

Environmental Quality Standards for Inland Surface Waters

Only a limited amount of data is available on present quality of inland surface waters of Sri Lanka. Data available in articles in scientific journals and reports and unpublished data obtained from government agencies have been reviewed.

This data indicated that the following water quality problems do exist:

- a. Excess of biodegradable matter and nutrients in waters receiving discharges of urban areas (Kelani River, Beira Lake, Kandy Lake, canals in the Colombo area).
- b. Heavy metals are most likely a problem in some areas (Kelani River and downstream of tanneries).
- c. Some observed pesticide concentrations exceed levels that are safe for aquatic ecosystems.

After review of use classes that are distinguished in other countries and discussions with officials and experts of the relevant governmental agencies, the following use classes have been distinguished for Sri Lanka:

- i. Ecosystem conservation
- ii. Drinking water source without conventional treatment but with disinfection.
- iii. Bathing and water recreation.
- iv. Fisheries and protection of aquatic life.

- v. Drinking water source with conventional treatment.
- vi. Irrigation and other agricultural uses.
- vii. Other uses, including: cooling water and process water supply for non-food industries; hydropower; fish survival; navigation; controlled waste water disposal.

All inland surface waters should meet the requirements for use class vii. As such class vii is proposed as a minimum water quality requirement.

The proposed water quality standards have been based on a comparison of the standards of other countries, including the standards of countries in the region. Also the Sri Lanka standard for potable water has been taken into account. For most uses these standards agreed fairly well. In case of significant differences, preference was given to the standard with the strongest scientific basis. In the formulation of the minimum quality requirement, i.e. use class vii, more weight was given to comparable standards of countries in the region, when these standards appeared acceptable, taking into account the criterion that acute fish kills should be avoided. The proposed standard is given in annex 1 (tables S.1 and S.2). This standard covers physical characteristics, dissolved oxygen content, macro-pollutants, heavy metals and organic micro-pollutants.

Designation of uses is a cyclic process. If the observed actual quality does not meet the requirement for the designated uses then measures have to be taken for modification of the uses, reduction of emission of pollutants, augmented dilution or increased flushing.

A simple procedure has been formulated for an initial designation of uses of the main inland surface waters, avoiding costly and time consuming inventories. This procedure has been applied as an example for an initial designation of the uses of the Kelani, Kalu and the Mahaweli rivers.

Example 1 : Initial use designation of Kelani River

Use	Branch (see figure 3.3)					
	.10	.11	.12	.13	.15	.151
1. Nature conservation	-	-	-	-	-	-
2. Drinking water, disinf. only	-	-	-	-	-	-
3. Bathing	O-M	O-Con	O-Con	O-Con	O-Con	O-Con
4. Fishing	O-CR	O-MR	-	-	¹⁾	¹⁾
5. Drinking water, conv. tr.	O-Amb	O-Con	O-Con	O-Con	O-KR	O-LR
6. Irrigation	O-M	O-Con	O-Con	O-Con	O-Con	O-Con
7. Other	O-M	O-Con	O-Con	O-Con	O-Con	O-Con

Abbreviations and notes:

- Con - confluence M-mouth O-origin
- CR - Castlereagh Reservoir KR-Kaltuwawa Reservoir
- LR - Labugama Reservoir MR-Maussakelle Reservoir Amb-Ambatale

¹⁾ fishing is not permitted on the reservoir

Example 2 :Initial use designation of Kalu River

Use	Branch (see figure 3.3)
	All
1. Conservation	-
2. Drinking water, disinf. only	-
3. Bathing	O-M
4. Fishing	-
5. Drinking water, conv. treat.	O-M
6. Irrigation	O-M
7. Other	O-M

Abbreviations:
O - Origin
M - Mouth

Environmental Quality Standards for Coastal waters

Coastal water is used for many purposes, some of which require good water quality, like nature conservation and fishery or aquaculture of shell fish. From the data available on coastal water quality it is clear that at least in some areas an unacceptable high level of pollution exists, which threatens the current use. The source of this pollution is mostly disposal of domestic and industrial wastewater.

To protect the coastal waters it is necessary that water quality standards are established related to different uses. On the basis of the present use of coastal water, the requirements for water quality, and the use classification of Thailand and India, the following classification for water use was proposed for Sri Lanka.

Proposed classification of use for coastal water in Sri Lanka

Class	Description	Use
a	Nature conservation	Ecosystem conservation, Science and education, Aesthetic enjoyment
b	Fishery of shell fish	Fishery of shell fish, Aquaculture of shell fish, Salt pans, Water contact recreation, Ornamental production
c	Fishery of fin fish	Fishery of fin fish, Aquaculture of fin fish, Fishery of invertebrates, Aquaculture of invertebrates
d	Non-consumption use	Non water contact recreation, Navigation (water not used for Harbour, Waste disposal, Sand mining, production of any Coral reef mining consumption goods)

To each of the four proposed use classes water quality standards were assigned. These proposed standards are based on quality requirements, present water quality, Sri Lanka tolerance limits, and quality requirements (guidelines, criteria) from Thailand, USA, and EC.

To prevent pollution in sensitive parts of the coastal system it is necessary to divide it into different zones, each with its own designated use and related quality standards. This way polluting activities can take place at locations where they are least harmful to nature as well as to human health.

For the designation of use to certain zones guidelines were defined. With these guidelines in mind a preliminary use designation map was devised for the south west coast of Sri Lanka.

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Annex 1 Table S.1 Proposed inland water quality standards for different uses

Parameter	Unit, Type of limit	Nature conservation	Drinking water, only disinfection	Bathing	Fish and aquatic life	Drinking water, convent. treatment	Irrigation and agriculture	Other
Colour	H.u., max.	n	10 av 30 max	-	-	300	-	-
Odour		n	unobj.	unobj.	-	-	-	-
Dissolved oxygen	mg/l, min.	n	6	5 4 min. daly	6 mean 4	-	3	-
BOD (5 days, 20°C)	mg/l, max.	n	2	-	-	3	-	4
pH		n	6.5-8.5	6-8.5	6-8.5	5.0-8.5	-	5.0-8.5
Nitrates (NO ₃ -N)	mg/l, max.	n	-	-	-	-	-	5
Total ammonia (NH ₃ -N)	mg/l, max.							
- pH < 7.5		n	-	-	10.3	-	-	10.3
- pH = 8.0		-	-	4.9	-	-	4.9	-
- pH = 8.5		-	-	1.8	-	-	1.8	-
Chlorides (Cl)	mg/l, max		200 des. 1200 max.	-	-	200 des. 1200 max.	-	-
Cyanides (CN)	mg/l, max.	n	-	-	0.005	-	-	0.005
Fluorides (F)	mg/l, max.	n	1.5	-	-	1.5	-	-
Sulphates (SO ₄)	mg/l, max.	n	400	-	-	400	-	-
Total coliform	MPN/100 ml (P=80%)	n	50	5000	20,000	5000	-	-
Total arsenic (As)	µg/l, max.	n	50	-	50	50	-	50
Total cadmium (Cd)	µg/l, max.		5	-	H Cd	5	-	5
						< 60 0.2		
						60-120 0.8		
						120-180 1.3		
						>180 1.8		

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S.1 Proposed inland water quality standards for different uses - continued

Parameter	Unit, Type of limit	Nature conser- vation	Drinking water, only disinfection	Bathing	Fish and aquatic life	Drinking water, convent.	Irrigation and agriculture treatment	Other
Total chromium (Cr)	µg/l, max.	n	50	-	2	50		50
Total copper (Cu)	µg/l, max.	n	-	-	H___Cu	-	-	100
< 60	2							
60-120	2							
120-180	3							
> 180	4							
Iron (Fe)	µg/l, max.	n	-	-	300	2	-	-
Lead (Pb)	µg/l, max.	n	50	-	H___Pb	50	-	50
< 60	1							
60-120	2							
120-180	4							
> 180	7							
Manganese (Mn)	µg/l, max.	n	-	-	-	-	-	1000
Mercury (Hg)	µg/l, max.	n	1	-	0.1	1	-	2
Nickel (Ni)	µg/l, max.	n	-	-	H___Ni	-	-	100
< 60	25							
60-120	65							
120-180	110							
> 180	150							
Selenium (Se)	µg/l, max.	n	10	-	1	10	-	-
Zinc (Zn)	µg/l, max.	n	-	-	30	-	-	1000

S.1

Proposed inland water quality standards for different uses - continued

Parameter	Unit, Type of limit	Nature conser- vation	Drinking water, only disinfection	Bathing	Fish and aquatic life	Drinking water, convent. treatment	Irrigation and agriculture	Other
Gross alpha radioact.	pCi/l, max.	n	3	3	-	3	-	3
Gross betha radioact.	pCi/l, max.	n	30	30	-	30	-	30
Phenolic comp. (C ₆ H ₅ OH)	µg/l, max.	n	2	5	1	5	-	5
Anionic deterg. as MBAS	µg/l, max.	n	200 des. 1000 max.	1000		200 des. 1000 max.	-	-
Total pesticides	µg/l, max.	n	-	-	-	-	-	50
Aldrin	µg/l, max.	n	-	-	-	-	-	0.1
DDT	µg/l, max.	n	-	-	0.001	-	-	1
Dieldrin	µg/l, max.	n	-	-	0.004	-	-	0.1
Endrin	µg/l, max.	n	-	-	0.0023	-	-	-
Heptachlor & heptachlorepoxyde	µg/l, max.	n	-	-	0.01	-	-	0.2
α-Hexachlorocyclohexane	µg/l, max.	n	-	-	-	-	0.02	-
Other organic micro-pollutants		n	-	-	see table 3.12	-	-	-
Conductivity	dS/m, max.	n	-	-	-	-	0.7	-
Boron	mg/l, max	n	-	-	-	-	-	0.5

Abbreviations:

H = Hardness (CaCO₃), mg/l

des. = desirable

max. = maximum

P=80% = 80% of the samples give a value that is equal to or less than the indicated limit

S.2 Proposed maximum acceptable levels of organic micro-pollutants in inland surface waters where fisheries and aquatic life are to be protected

Parameter	Unit	Limit ¹
Benzene ²	mg/l	0.3
Chlordane	ng/l	6
<i>Chlorinated benzenes²</i>		
Monochlorobenzene	µg/l	15
Dichlorobenzene 1,2- and 1,3-	µg/l	2.5
Dichlorobenzene 1,4-	µg/l	4.0
Trichlorobenzene 1,2,3-	µg/l	0.9
Trichlorobenzene 1,2,4-	µg/l	0.5
Trichlorobenzene 1,3,5-	µg/l	0.65
Tetrachlorobenzene 1,2,3,4-	µg/l	0.10
Tetrachlorobenzene 1,2,3,5-	µg/l	0.10
Tetrachlorobenzene 1,2,4,5-	µg/l	0.15
Pentachlorobenzene	µg/l	
0.030		
Hexachlorobenzene	µg/l	
0.0065		
<i>Chlorinated ethylenes²</i>		
Tetrachloroethylene	µg/l	260
<i>Chlorinated phenols</i>		
Monochlorophenols	µg/l	7
Dichlorophenols	µg/l	0.2
Trichlorophenols	µg/l	18
Tetrachlorophenols	µg/l	1
Pentachlorophenol	µg/l	0.5
DDT	ng/l	1
Endosulfan	µg/l	0.02
Endrin	ng/l	2.3
Ethylbenzene ²	mg/l	0.7
Heptachlor + Heptachlorepoxyde	µg/l	0.01
Hexachlorobutadiene	µg/l	0.1
Hexachlorocyclohexane isomers	µg/l	0.01
Phenols (total)	µg/l	1
Phenoxy herbicides (2,4-D)	µg/l	4.0
<i>Phthalate esters:</i>		
DBP	µg/l	4
DEHP	µg/l	0.6
Other phthalate esters	µg/l	0.2
Polychlorinated biphenyls (total)	ng/l	1
Toluene	mg/l	0.3
Toxaphene	ng/l	8

¹ Total concentration in unfiltered sample

² Tentative standard

Annex 2 :

Table S.3 Proposed quality standards for different use classes of coastal water in Sri Lanka

Parameter	Unit	Value for different use classes			
		1 Nature conser- vation	2 Fishery of shell fish	3 Fishery of fin fish	4 Non consump- tion use
Floatable solids		N	N	N	NO
Floatable oil/grease		N	N	N	NO
Suspended solids		N	N	N	NO
Transparency ¹		N	<10%	<10%	<50%
Color		N	NV	NV	NO
Odor		N	N	N	NO
Temperature	°C	<32	<32	<32	<32
Coliform (total)	MPN/ml	N	N	<10	<20
Coliform (fecal)	MPN/ml	N	N	<3	<6
pH		N	7.0-8.5	7.0-8.5	6.5-9.0
Salinity ¹	g/l	N	29-35	<10%	<20%
Dissolved oxygen	satur.	N	>80%	>70%	>60%
BOD	mg O ₂ /ml	N	<5	<5	<10
Phosphate (total)	mg P/ml	N	NA	NA	NA
Nitrogen (total)	mg N/ml	N	NA	NA	NA
Ammonia (free)	mg N/ml	N	<0.4	<0.4	<1.2
Cyanide	µg/l	N	<10	<10	<20
Sulfide	µg/l	N	<5	<5	<10
Mercury	µg/l	N	<0.1	<0.1	<0.2
Cadmium	µg/l	N	<5	<5	<10
Chrome (hex.)	µg/l	N	<25	<25	<50
Lead	µg/l	N	<25	<25	<50
Copper	µg/l	N	<25	<25	<50
Manganese	µg/l	N	<100	<100	<200
Zinc	µg/l	N	<50	<50	<100
Iron	µg/l	N	<300	<300	<600
Arsenic	µg/l	N	<50	<50	<100
Fluoride	mg/l	N	<1.5	<1.5	<3
Phenols	µg/l	N	<30	<30	<60
PCB (total)	µg/l	N	<0.03	<0.03	<0.06
Chlor. pestic. (total)	µg/l	N	<0.05	<0.05	<0.1

- ¹ % = change from natural condition
- N Natural condition
- NO Not objectionable
- NV Not visible
- NA Below level causing algae bloom (to be established)
- < smaller than
- > higher than

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TRANSBOUNDARY MOVEMENT OF TOXIC AND HAZARDOUS SUBSTANCES

Muhammad Rajab

Pakistan is an agricultural country and her natural resources are under severe stress. Indiscriminate use of highly toxic and hazardous substances is causing severe ecological damage and also contributing to development of chemical resistant pests.

Some leather tanneries in the past, were using Potassium Dichromate; a carcinogenic compound, but due to strict regulation and control by the Government no import of the chemical was made during 1994 - 95. Similarly the soda-ash plants on mercury based technology are switching over to membrane technology in view of the environmental implications.

The Pakistan Environmental Protection Agency, a regulating body at the federal level, is in the process of developing a National Federal Register of Chemicals which will provide information on registered hazardous chemicals /wastes being imported or locally produced and indicate procedure for handling and reporting. The Agency is also responsible for enforcement of National Environmental Quality Standards.

TRANSBOUNDARY MOVEMENT OF TOXIC AND HAZARDOUS SUBSTANCES

Muhammad Rajab

Industries all over the world need millions of tons of toxic and hazardous substances for their processes which after use generate thousands of tons of hazardous waste. Due to improper disposal they find their way to the environment. According to the International Register of Potentially Toxic Chemicals (IRPTC), UNEP's data bank of centralized computer files of information on hazardous chemicals reveals that 8 million known chemicals exist, out of which 70,000 are commonly used in industries. About 1,000 new chemicals are added to the world market every year.

Present Situation

Pakistan is an agricultural country with a population of 130 million. Its natural resources are under severe stress due to increasing population. To get maximum crop yield, farmers have to use fertilizers and pesticides. Indiscriminate use of highly toxic substances is causing severe ecological damage and also contributing to the development of chemical resistant pests. Over use is contaminating food and fiber products.

To meet the increasing demand of pesticides, the local manufacturers of pesticides are not only importing highly toxic chemicals as raw material but also 18,000 metric tons of insecticides worth U.S. \$ 90 million each year. The major sources of imports are European countries while imports from Asian countries are not very significant. In Pakistan, the pesticides are mostly produced by multi-national companies who are very much aware of the impacts of toxic substances on the environment.

Pesticides are regulated by the Ministry of Food and Agriculture through the Agricultural Pesticides Ordinance of 1971, and the rules framed thereunder. Under the domestic legislation, manufacturing, import and use of pesticides containing DDT is banned.

Pakistan's chemical production is very small which is mostly in the unorganized sector. These units produce acids and alkalis such as sulfuric acid (100,000 tons), soda ash (18600 tons) caustic soda (814000 tones) and chlorine gas (5900 tons). The raw materials for other chemicals are imported from different sources.

Pakistani industry imported chemicals to the value of US \$ 1494 million during 1993-94 and US \$ 1586 million in 1994-94 showing an increase of 6.1%. The import of chemicals constitutes about 17% of Pakistan's total imports. Some of the toxic chemicals imported by Pakistan during the last two years are given below.

Items	Import (Tons)	
	1993-94	1994-95
Formic Acid	4,356	5,026
Phenol	3,000	2,123
Mercury	27	34
Toulene	2,725	2,067
Cyanide	358	408
Printing Ink	1,798	2,546
Potassium dichromate	83	-
Chromates	6	18
Acid/Basic	2,816	2,212
Dyes		

In the past, some leather tanneries in the unorganized sector were using Potassium Dichromate- a carcinogenic compound but due to strict regulation and control by the Government, no import of this hazardous chemical was possible during 1994-95. This was done through an awareness programme for the tanners. With the assistance of UNDP and UNIDO, centralized chrome recovery plants are being installed in two areas where a cluster of tanneries exist.

Out of four soda ash plants in the country three are on Mercury based technology and importing significant quantity of Mercury each year. The industry is aware of the environmental implications and will be switching over to membrane technology shortly.

Response of the Government

The Ministry of Environment in Pakistan has given priority to address the issue of Transboundary Movement of Hazardous Substances. The Pakistan Environmental Protection Agency, a regulating body for the purpose has been organised to effectively deal with the issue. This department now is in the process of developing a National Federal Register of Chemicals which would provide information on registered hazardous chemicals/wastes being imported or locally produced and indicate established procedures for handling and reporting. In addition, a mechanism of Prior Informed Consent (PIC) is being strengthened to monitor inflow of toxic and hazardous substances/wastes into Pakistan in accordance with the UNEP/London Guidelines. Efforts are being made to set up an information system within Pak-EPA which would provide data on the kind of hazardous substances, quantity of hazardous substances imported or locally produced, during the last five years. An information link is also being developed between Custom House, Federal EPA and Provincial EPAs to update import data on regular basis. Under the program, user industries of toxic chemicals will be identified and be declared as priority industry for regular monitoring.

The Government has established the National Environmental Quality Standards which prescribe maximum limits of pollutants in discharges. Violation of these standards is an offence under the Pakistan Environmental Protection Ordinance, 1983, and is liable to be penalized under Section 12. After promulgation of the environmental standards, the industrial associations have taken initiatives to control their wastes by inhouse management and end of pipe treatments. The Government is encouraging tanneries, textile and chemical industry to put waste treatment plants. Duties on anti-pollution equipment have been reduced and a line of credit for the industry to procure environmental control technology has been established in the private sector.

Legislation

Under the new Pakistan Environmental Protection Act, 1996, the hazardous substances have been defined for the first time. According by, they are, "a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (ii of 1971), which, by reason of its chemical reactivity or toxic, explosive, flammable, corrosive, radioactive or other characteristics, causes, or is likely to cause directly or in combination with other matters, an adverse environmental effect; and any other substance as may be prescribed as hazardous substance." Under the prohibitory and regulatory provision of the Act, no person is allowed to generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except under license issued by the Federal Environmental Protection Agency.

International obligations

Though Pakistan is neither a big exporter nor importer of hazardous substances in the region it is very much aware of its international obligations and commitments. Pakistan like other countries has always supported efforts of UNEP in controlling transboundary movement of hazardous substances and wastes. Basel Convention on Transboundary Movement of Hazardous Wastes and its Disposal has already been ratified by the Government. As has been earlier indicated PIC system is being strengthened in the country and institutions are being organized.

Case study

An industrial unit in Pakistan tried to import a second hand soda ash plant based on mercury technology which was installed in Copenhagen, Denmark owned by M/S DS Industries. This plant was built in 1968-75. According to M/S DS industries this plant was shutdown in January, 1991 due to unsatisfactory economic conditions. The plant was expected to be imported in November, 1994 and upon reinstallation in an Industrial Area in Pakistan was to produce 26,000 tones caustic soda and 23,000 tonnes of liquid chlorine per year.

Besides Greenpeace, a number of local NGOs including SDPI and WWF criticised intended import of mercury cells as part of the Chlor-Alkali plant. According to them the mercury cells contain a hazardous substance which would add risk to human health. A number of news items were also published in the national newspapers demanding a ban on import of the plant. The issue was also brought under discussion in the Senate and later was referred to the Standing Committee of the Senate. The Committee held several meetings and decided to hear the proponent's viewpoint. Meanwhile import of Mercury cells were stopped by the Government of Pakistan till decision of the case. Later on due to public pressure, the proponent of the project voluntarily announced its decision not to import the mercury cells. This case created a high level of awareness among people on transboundary movement of hazardous substances.

Basel Convention

In accordance with the provisions of the Basel Convention on the Transboundary Movement of Hazardous Waste and Their Disposal, of which Pakistan is a party, the Ministry of Environment, Urban Affairs, Forestry and Wildlife has been declared as focal point at the federal level. Other Federal/Provincial Government Organisations declared as competent authorities are as follows:

NAME OF THE COMPETENT AUTHORITY	RESPONSIBILITY
1. Ministry of Commerce	To regulate imports/exports
2. Ministry of Industries	To monitor the Industries using hazardous waste and their safe disposal.
3. Central Board of Revenue	To regulate entry into Pakistan, its shipment and re-shipment.
4. Ministry of Communication	To prevent marine pollution and dumping the hazardous wastes in the exclusive Economic Zone of Pakistan.
5. Environmental Protection Agency Punjab/Sind/NWFP	To ensure that hazardous wastes are used for the bonafide industry and their safe disposal.

Recommendations

- (a) International Classification of hazardous and toxic substances is not compatible with Brussels Nomenclature. Consequently, countries are facing problems in collecting data directly from customs authorities. SACEP may assist the countries of the region in this respect.
- (b) Regulatory and administrative measures can be effective only if the institutions dealing with the subject are adequately equipped and strengthened. Pakistan would highly appreciate assistance for the strengthening of its regulatory institutions.
- (c) Presently, there is lack of exchange of information among developing countries on hazardous and toxic substances. There is a need to enhance the information system.
- (d) The developed countries are major manufacturers and suppliers of hazardous substances. A large number of hazardous items are also supplied to the developing countries as secondary raw materials. The developed countries may therefore, provide environmentally friendly substitutes ensuring that products are price wise competitive and are acceptable to users.

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CLEANER PRODUCTION PRACTICES

Ir. Tien N Pham

The concept of Cleaner Production (CP) is rather simple. Its objective is to minimise or eliminate wastes and emissions at their source, rather than treat them after they have been generated. CP on the one hand, conserves raw materials and energy, eliminates toxic raw materials and reduces the quantity of toxicity of all emissions and wastes before they leave the production process. On the other hand, it reduces environmental impacts throughout the entire product life cycle, from raw material extraction to waste disposal.

The approach offers an effective way to achieve a lower level of pollution and environmental risk, more efficient use of raw materials and process optimisation, which in turn results in economic savings. It also improves health and safety standards and worker productivity. It is based on the continuous application of an integrated environmental strategy to processes and products so as to reduce risks to humans and the environment.

A systematic working method, which facilitates the execution of a CP assessment, generally consists of three separate, interrelated options namely; method; procedure; and guidance and supervision. Despite its promise, the introduction of CP is sometimes hampered by a number of barriers due to lack of knowledge, outdated government policies and managerial resistance to change.

CLEANER PRODUCTION PRACTICES

Ir. Tien N. Pham

The concept of Cleaner Production (CP) is evolving from earlier concepts of clean technology and low and non-waste technology. The old concept of clean technology was seen in 1979 by the Commission of the European Communities as having three distinct but complementary purposes namely; less pollution discharges into the natural environment; less waste (low waste and non-waste technology); and less demand on natural resources.

Over the past decades, industries have responded to environmental degradation in four typical ways: ignoring the problem; diluting the pollution, controlling or treating the pollution and preventing pollution & waste generation at the source of production. The last named activity has become the ultimate goal of CP and combines maximum positive effects on the environment with substantial economic savings for industry and society. The term pollution prevention, source reduction and waste minimisation are often used to mean the same thing as CP.

CP avoids industrial pollution by reducing waste generation at every stage of the production process in order to eliminate waste before any potential pollutants are created. As such CP can be defined as *the continuous use of industrial processes and products to prevent the pollution of air, water and land, to reduce waste at source and to minimise risks to human population and the environment*. For processes, this means conserving materials and energy, eliminating the use of toxic raw materials and reducing the quantity and toxicity of all emissions and waste before they leave a process.

For products, CP means to reduce environmental impacts along the entire life cycle, from raw materials extraction to disposal. One essential feature is that *CP is a problem-solving strategy rather than a solution*; CP puts the waste generating process ('the root cause) in the first place and employs a preventive mind-set to develop alternative solutions ('CP options'). A variety of technical, operational, educational and managerial practices can be used to identify the related CP options.

CP involves applying know-how, improving technologies, and above all, changing attitudes in very many places. The essential elements of the CP definition are summarised in Figure 1.

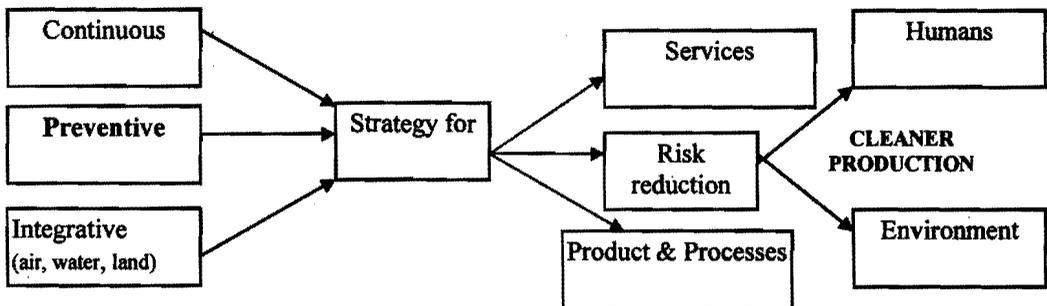


Figure 1. Essential elements of a Cleaner Production definition

It is important to note that CP is not the same as external recycling or effluent treatment CP principles can be applied to both of these activities, but none of them is CP as they do not stress the preventive philosophy that characterises CP.

Benefits of Cleaner Production

CP is a good business and environmental proposition to achieve a lower level of pollution and environmental risk. More efficient use of materials and process optimisation result in less wastes and emissions, which in turn results in lower operating costs. Its focus on occupational health and safety also has positive effects on the worker productivity and decrease in accidents. For new processes, such benefits are usually built into the equipment. For older plants, economic incentives can be achieved from process changes or modifications.

The costs of wastes and emissions treatment can be avoided or minimised by applying the CP concept right from the beginning. Products that are designed and produced with CP concepts in mind are often less harmful for consumers to use, and are normally less of a burden in the waste stream after disposal.

CP is especially important to developing countries, as it provides industries in these countries, for the first time, with an opportunity to “leap frog” over older, more established industries which are still saddled with costly pollution control techniques.

Cleaner Production in Practice

Implementation of CP at the company level takes place via the execution of ‘CP assessments’, which are often characterised as a systematic planned procedure with the objective of identifying ways to reduce or eliminate the generation of waste and emissions. Such a CP assessment should contribute to the initiation of an on-going CP program, catalysing the corporate effort in achieving continuous environmental improvements in its operations. In order to emphasise the ongoing improvement process, CP assessments are sometimes also referred to as ‘environmental improvement’ cycles. Such cycles serve three functions:

- a) *analysis* of the environmental burden of the production processes and its causes;
- b) inventory and evaluation of *improvement* options for the production processes;
- c) *integration* of the feasible improvement options into the production processes and into the daily operation of the company.

Consecutive environmental improvement cycles enable the company to achieve environmental improvement in key areas such as the following.

- a) *resource conservation*: improvement of the material and energy efficiency of the production in order to reduce the input of natural resources (materials, energy and auxiliaries) per unit of production;
- b) *toxics use reduction*: reduction - and to the extent feasible - elimination of the use of ‘hazardous’ materials. In this respect, all materials exerting a highly negative environmental impact could be considered as ‘hazardous’ (including toxic substances, ozone depletion chemical, global warming chemicals etc.).
- c) *Waste minimisation*: reduction - and to the extent feasible - elimination of the generation of ‘waste’ materials (including by products, solid waste, hazardous waste, air emissions and/or waste water discharges).

The environmental improvement process is visualised in figure 2.

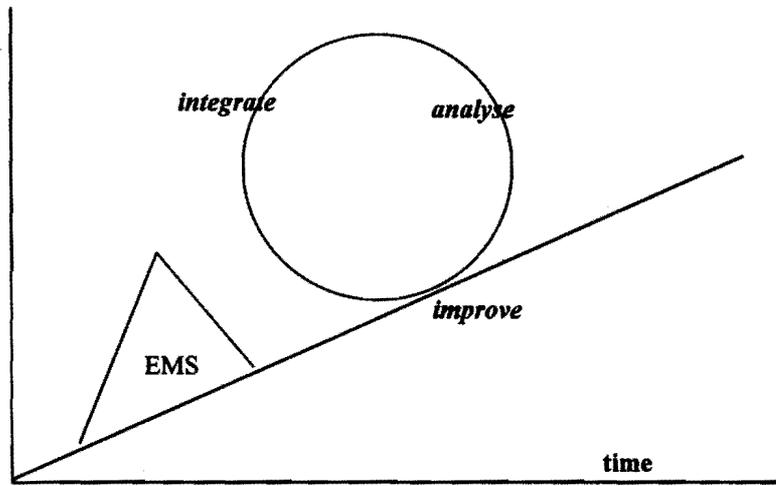


Figure 2: A CP assessment as 'vehicle' for ongoing environmental improvement

A systematic working method for the execution of a CP assessment normally consists of a "method", a "procedure" and (external) "guidance and supervision". The *method* serves as the tool for the identification of CP options. The *procedure* organises the necessary activities and thus fosters the development and implementation of CP opportunities. The (external) *guidance and supervision* guides, informs and stimulates the responsible assessment team at the plant level. Figure 3 shows the consecutive steps of the CP assessment working method.

The discussion below will elaborate on the generation of options for reducing wastes and emissions at their source. It should be noted that the same methodology is applicable for the generation of options for reducing risk and reducing energy consumption.

A CP assessment is initiated after a conscious decision has been made by the management to take some action. The first phase is to form the project team, discuss the programme with workers and supervisors (who will provide much of the data), and identify the main processes to be studied (audit focus). It is important to pay attention to psychological aspects of the study, as workers will be reluctant to provide information if they believe they will be punished for process inefficiencies.

From the data provided by plant records and other information, the project team prepares a material balance of raw materials, auxiliaries, waste, energy, products, by-products, and wastes and emissions. When this material balance is of sufficient quality, it will be possible to determine where the main sources of wastes and emissions are. While simple in concept, the necessary information for a good material balance is often very difficult to obtain. Many companies do not keep good records of chemicals or discharges.

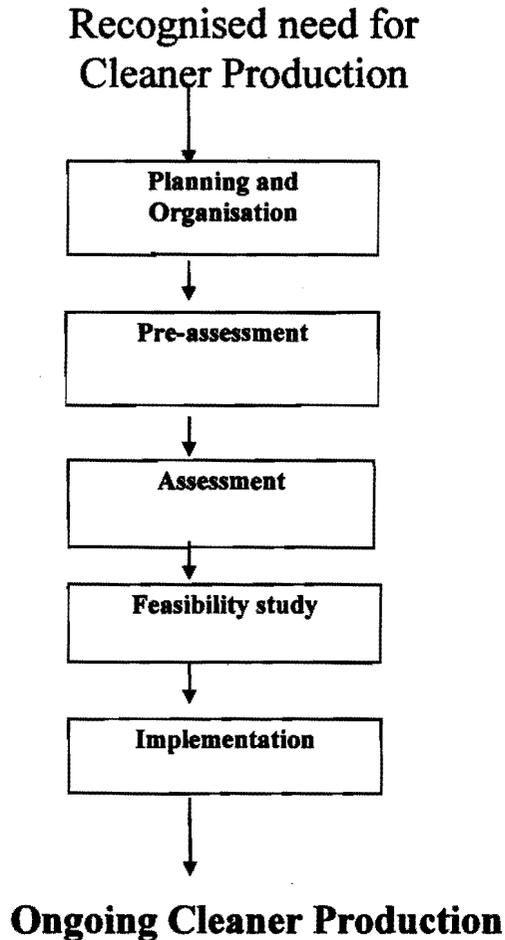


Figure 3. Cleaner Production Assessment

During the Assessment Phase the material balance is studied, and appropriate measures are proposed to reduce or prevent loss of materials. It is here that the project team uses all means possible to identify CP options. The ideas for options may come from literature search, personal knowledge, discussion with suppliers, examples in other companies, specialised data bases, or some further R&D. As a creative intellectual environment to think of all possibilities, based on the widest possible experience, is often needed, brainstorming and group sessions are regularly used at this stage. The brainstorming session is a combination of creativity and 'common sense'. One should focus on all influences of the process that could lead to the generation of wastes and emissions.

During the CP assessment a number of obvious possibilities for immediate improvements may be identified. In order to go further, it is often helpful to conceptually divide the process into several essential elements, as shown by figure 4. The option generating process then considers each element in turn.

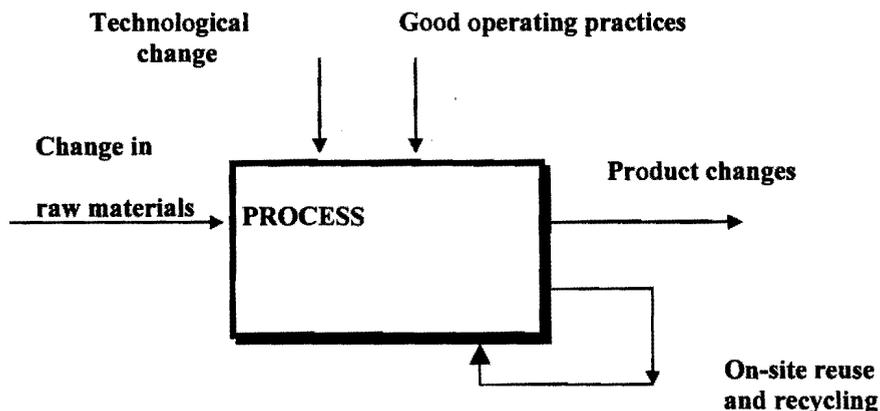


Figure 4. Process element for Cleaner Production options

Essential Elements in the Process

Changes in raw materials accomplish CP by reducing or eliminating the hazardous materials that enter the production process. Also, changes in input materials can be made to avoid the generation of hazardous wastes within the production process. Examples of raw material changes are material purification, and material substitution.

Technology changes are oriented towards process and equipment modification to reduce waste and emissions, primarily in a production setting. Technology changes can range from minor retoolings that can be made in a matter of hours at low cost, to the replacement of processing equipment, such as; changes in the production process; modification of equipment, layout, or piping; use of automation; and changes in process conditions, such as flow rates, temperatures, pressures, and residence times.

Product changes are performed by the manufacturer of a product with the intention of reducing waste and emissions resulting from a product's use. Product changes include; changes in quality standards; changes in product composition; product durability; and product substitution.

Good operating practices also referred to as good housekeeping practices, can often be implemented with little cost. These practices can be implemented in all areas of the plant, including production, maintenance operations, and in raw material and product storage. Good operating practices include the following:

- a) management and personnel practices include employee training, incentives and bonuses, and encourage employees to conscientiously strive to reduce waste and emissions;
- b) material handling and inventory practices include programmes to reduce loss of input materials due to mishandling and proper storage conditions
- c) loss prevention minimises wastes and emissions by avoiding leaks from equipment and spills;
- d) waste segregation practices reduce the volume of hazardous wastes by preventing the mixing of hazardous and non-hazardous wastes;

- e) cost accounting practices include programmes to allocate waste treatment and disposal costs directly to the department or group that generate wastes and emissions, rather than charging these cost to general company overhead account.
- f) production scheduling to reduce shutdown losses or clean out wastes.

On-site reuse means returning a waste material either to the originating process as a substitute for an input material, or to another process as an input material. After the options have been generated, an initial selection should be made, considering availability, suitability, environmental effect and the economic feasibility. The implementation phase of the options has to be followed by monitoring of the changes, and followed by a new assessment which will be used to identify new options for CP. This last step closes the chain of continuous improvement.

Barriers to Introducing Cleaner Production

The introduction of Cleaner Production is sometimes hampered by the following barriers:

- a) Resistance to new ideas and approaches in which staff have no formal training. Demonstration projects are essential to show that Cleaner Production can work in "our country" or in "my company".
- b) Lack of financial resources, awareness and training, expertise and know-how, information and access to existing knowledge.
- c) Uncertainty about the right information, technology or regulations.
- d) Government policies/ regulations that focus on single medium pollutant reductions that discourage innovative solutions to pollution reduction and that offer tax incentives for investment in end-of-pipe technologies.
- e) Lack of familiarity with Cleaner Production practices and techniques on the part of engineers and consultants. Often they do not pay enough attention to improvements in housekeeping, small modifications of existing equipment and other less technical matters that can be very cost-effective.
- f) Fear of being put at competitive disadvantage as a result of perceived high costs.

Adopting the CP approach requires attitudinal changes at all levels of a company, from top management to shop floor. CP is a corporate 'cultural shift', from the 'pollution control culture' to the 'pollution prevention culture'. It thus presents a challenge to managers.

Industry can make CP happen through a commitment to action within the company. Many corporations in industrialised countries have already introduced CP without waiting for government action.

Without a clear, written commitment from top management to CP, other personnel will not contribute effectively. Key to success is the involvement of all workers at all organisational levels in a plant. Motivation, incentives and a workplace culture where suggestions from the shop floor are acted upon, are needed to achieve such universal involvement.

Because CP often involves a change in attitudes, people need incentives to work towards an integrated, systematic approach to environmental protection.

The internal training of workers, supervisors and managers is necessary to identify opportunities for CP and to implement it. The following conditions proved to be necessary for a CP programme to take off:

Cleaner Production Practices

- a) Develop and implement a comprehensive corporate environment policy that focuses on prevention;
- b) Set corporate goals for the CP programme, with specific percentages and timetables;
- c) Allocate responsibility, time and financial support for the entire CP programme;
- d) Involve employees at all levels;
- e) Develop waste reduction audit procedure within the company and use them on a regular basis to identify, evaluate and eliminate waste at each stage in the production process. This gives the information on which in-plant CP options can be based.
- f) Obtain and use the best possible technical and other information, from both inside and outside the company. Waste reduction criteria can cover technical environmental factors, regulatory compliance, public acceptance and economic viability;
- g) Monitor and evaluate progress of the company's CP programme;
- h) Regularly inform all employees on the CP progress made by the company in the last month, six months, year and five year;
- i) Encourage and reward successful individual and group efforts to implement CP; and
- j) Update the CP goals and timetable on a regular basis. Bear in mind that success in CP is a journey not a destination.

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APPLICATION OF CLEANER PRODUCTION TECHNOLOGIES

Ramani Ellepola

The objectives of Cleaner Production Technologies (CPT) application are; less pollution, low waste and less use of raw materials. The application of CPT is a preventive approach whereby the focus is more on waste prevention than waste treatment.

Governmental agencies charged with pollution control functions in many South Asian countries face a dilemma. Pollution control programmes have to be effective, while not slowing down industrial development. Therefore they have to necessarily combine a regulatory approach along with appropriate incentive schemes for adoption of cleaner technology by industry.

The application of Cleaner Production Technologies (CPT) is being increasingly recognised as the most effective method of achieving environmental goals of industries. In the past, the focus was largely on command and control measures whereby regulatory agencies would set the environmental standards including effluent and air emission standards which were expected to be met by industries in discharging their waste.

The control of pollution arising from new industry in Sri Lanka is very much easier as compared to that of existing industry. The older industries established twenty or thirty years ago, very often use outdated technology and have not adopted waste minimisation measures or end of pipe treatment systems. Some of these industries also face financial problems in the installation of the required pollution abatement facilities.

APPLICATION OF CLEANER PRODUCTION TECHNOLOGIES

Ramani Ellepola

Cleaner Production Technologies

World-wide, there is a growing realisation that environmental considerations should play a vital role in the development process. The ultimate goal of development, is to provide a better standard of living for the people. Unfortunately, the adverse environmental impacts of such development projects more often than not endanger their ultimate results. Hence the need to take timely and adequate action to minimise such adverse impacts.

Invariably, industrial operations have adverse environmental impacts, unless adequate mitigatory measures are taken to minimise them. The possible environmental problems arising from industrial operations include surface and ground water pollution, air pollution, soil and noise pollution. The treatment and disposal of hazardous industrial waste arising from certain industries also poses a serious problem in many South Asian countries due to the inadequacy of the necessary treatment and disposal facilities.

Cleaner Production Technologies (CPT) is being increasingly recognised as the most effective method of achieving environmental goals of industries. In the past, the focus was largely on 'command and control' measures whereby regulatory agencies would set the environmental standards including effluent and air emission standards which were expected to be met by industries in discharging their waste. Cleaner Production on the other hand is a preventive approach whereby the focus is more on waste prevention or waste minimisation.

Many of the developed countries have gone through a rapid phase of industrial development during which not much emphasis was placed on pollution prevention. These countries have in turn paid a heavy price for such short sighted policies. The Minamata incident in Japan where thousands of persons were affected by the severe effects of mercury poisoning and the hundreds of persons affected by the Itai - Itai disease through the consumption of rice contaminated with cadmium, are just two examples from Japan.

Similarly, in the United States several thousands of hazardous waste dump sites have been discovered, where chemical companies have disposed of highly hazardous waste in the past. These sites have been found to be so heavily contaminated, that the land on which these sites are situated cannot be used for any purpose till such time they are sufficiently cleaned up. The clean up costs for these sites have been found to be so high that a special fund had to be set up for the specific task of cleaning up these sites.

Why Adopt Cleaner Production Technology?

The developing countries of South-Asia; many of which are undergoing a transformation from essentially agricultural economies into industrialised economies cannot and should not make the same mistakes made by some of the industrialised countries, by not paying sufficient attention to environmental protection during the industrialisation process itself. On the other hand, it is also not possible to retard industrial growth by the imposition of environmental regulations which are

too stringent. A balance has to be achieved whereby industrialisation is allowed to take place with the necessary safeguards so that unacceptable damage to the environment is prevented.

The adoption of CPT by industry is one method by which the twin goals of rapid industrialisation, and environmental protection could be achieved, without sacrificing one for the other. Adoption of CPT by industry would result in a direct reduction of the quantity of waste material that requires to be treated and disposed of by such industries. In addition, industries adopting CPT also stand to gain, through considerable profits made on savings in energy and raw material usage. CPT in itself would not completely do away with the need for the so called 'end-of-pipe' treatment technologies, such as waste treatment plants. Consequently, the quantity, toxicity as well as the pollution load of the waste requiring further treatment could be drastically reduced by the adoption of CPT.

In interacting with industry in the promotion of cleaner technology concepts, environmental agencies in the developing countries have to identify the barriers and the obstacles that are often encountered in the process. These can be classified under different headings such as policy, legal, economic, infrastructure and others..

Policy Barriers

Certain policies adopted by some South Asian Countries, could discourage industries adopting CPT. An example in this regard is that of resource pricing. Resources such as water are either provided at heavily subsidised rates or are completely free of charge. The same can be said of energy prices. This factor in itself can discourage industries from adopting cleaner technology concepts as the savings made through the adoption of such technology may not be substantial. If on the other hand, a more rational resource pricing structure is adopted, industries would be forced into adopting ways and means of bringing down costs, through savings made on inputs such as energy and water use.

Impediments

The legal framework in most Asian countries does not encourage industries to reduce the waste load arising from industries. In most of these countries, the effluent standards specified for industries are usually concentration based. This means essentially that as long as an industry complies with the standards specified, there is no further legal requirement for the industry to keep on reducing its pollution load. This indirectly encourages industry to strive to meet the stated objective or standard; merely to comply. However, if pollutant load based standards are adopted and if industries are charged on the basis of the waste load that is finally disposed of, there would be a definite incentive for the industry to reduce its waste load. Similarly, incentives could be offered to industries which treat their waste water beyond what is required by law, in order to encourage cleaner production.

Economic Incentives

The provision of economic incentives is being increasingly recognised as an important instrument in dealing with industries. Many of the countries in South Asia have enacted environmental legislation in the late seventies or eighties. However, there are many industries in these countries which commenced operations long before such regulations came into force. In most instances, industries which were established two or three decades ago have not paid much attention to environmental safeguards. Many of these industries still use outdated technology and do not pay much attention to waste minimisation concepts. In most cases industries are not

aware of such concepts or lack the financial and technical resources necessary to adopt such technology. A financial mechanism whereby industries could obtain low interest loans for the implementation of cleaner, technology, end of pipe treatment facilities or process modification would go a long way. Similarly, other types of economic incentives could be provided such as tax exemptions on the import of pollution control equipment, treatment plants or pollution free technology.

Infrastructure Development

A common scenario in the developing countries of South Asia is the lack of infrastructure facilities required for environmentally sound industrial development. The provision of industrial estates or parks with the necessary facilities such as power roads, telecommunication facilities, electricity as well as waste treatment and disposal facilities is considered important in this respect. The provision of industrial estates by either the government or private sector is a boon to industry as it relieves the industrialist of the need to identify suitable sites and go through approval procedures as well as ensure that infrastructure facilities are put in place at enormous capital cost. Treatment and disposal of industrial waste can also pose a problem to industry; particularly to small and medium scale industries. Treatment of waste water and hazardous industrial waste can often prove far too expensive for such industries, if done on an individual basis. The treatment of industrial waste in a common waste water treatment system or hazardous waste treatment facility on a payment basis can be of great assistance to such small and medium scale industry.

Research and Development

The availability of appropriate technology at low cost for treatment of industrial waste is an important factor which would determine the number of industries adopting such technology. Waste treatment technology found in many South Asian countries has been invariably imported from the developed countries. Such technology could be both inappropriate as well as costly for local industries in the developing countries of South Asia. It is important therefore that local research institutes develop simpler technology or adapt imported technology in a manner that is more suitable to the particular situation in developing countries.

Demonstrations

Environmental agencies which seek to promote CPT or waste minimisation concepts among industries often face an initial resistance by industries. The reasons are easily explained. Most industrialists are reluctant to adopt technology which is often new and untested and not proven to be effective within the country. It is extremely important therefore that waste minimisation demonstration projects for selected industrial sectors are established within the country. Successful waste minimisation projects which demonstrate how specific industry sectors could effectively reduce their waste load thereby cutting down waste treatment costs and also resulting in savings on water and energy usage would encourage other industries to adopt these measures. The state sector can also establish demonstrations of end of pipe waste treatment systems where suitable technology may not be available. Such waste treatment systems which demonstrate effective waste treatment of particular waste streams would instil confidence in the industries.

Problems of Small and Medium Industries

It is relatively easy to control the pollution arising from large scale industrial enterprises. Some of these large scale industries are multinational companies whose principals abroad are able to provide the technology as well as the funds necessary for pollution control purposes. Some others are state owned or controlled. The managements of such bigger industrial enterprises are also much more aware of environmental regulations and the need to comply with them. One of the major problems relates to the control of pollution arising from the small and medium scale industry sector. In almost all South Asian countries the large majority of the industries are small and medium scale industries. Even though the pollution arising from individual small and medium scale industries may not be substantial, the collective effect of a large number of such industries could have a major environmental impact. It is therefore important to focus attention on the more visible large scale polluters, as well as small medium scale polluting industries. However, the strategy adopted for pollution control from small and medium scale industry will necessarily have to be different from that adopted for large scale industry.

Industrial Pollution Control in Sri Lanka

The first legislative enactment focusing primarily on Environmental Protection and Management was enacted in Sri Lanka in the form of the National Environmental Act No 47 of 1980. The Central Environmental Authority (CEA) was set up subsequently in 1981, as the main agency for the purpose of implementation of this Act. At its inception, the CEA functioned mainly as a co-ordinating and policy making body. In 1988, the National Environmental Act was amended in order to bring in additional regulatory provisions on environmental protection and management. There are two main regulatory provisions in the National Environmental Act which are being implemented by the CEA. These are; the environmental impact assessment procedure for major development projects; and the environmental protection license procedure for the control of industrial discharges.

EIA Procedure

Since June 1993, all major development projects are required by law to undergo environmental impact assessments prior to implementation. The prescribed projects' which require environmental impact assessments include infrastructure development projects such as highways, power generation, construction of airports and harbours, solid and hazardous waste treatment and disposal sites as well as development of large scale industrial estates. In addition to this, large scale, individual industries with a high pollution potential are also required to undergo full scale environmental impact assessments. The environmental impact assessment procedure ensures that all the impacts that a major project may have on the environment are identified and mitigatory action planned at an early stage. This makes it easier for project proponents to plan mitigation measures and have them incorporated into the project at an early stage of the project planning cycle.

Environmental Protection Licence Scheme for Industries

Since July 1990, all industries which discharge or deposit waste effluents or emissions into the environment are required to obtain an Environmental Protection Licence (EPL) from the Central Environmental Authority. The licence so issued to an industry will stipulate the standards and criteria under which the industry is allowed to discharge its waste.

There are several legally binding standards which are gazetted and are required to be adhered to by industries, depending on the final discharge point of their waste. Different standards are required to be complied with, depending on whether the final effluents are discharged into an inland surface water body such as a river or lake, or into the ocean or used for irrigation purposes. Several highly polluting industrial sectors such as textiles, natural rubber processing and leather tanning are required to meet standards which are more stringent than those mentioned above. Standards have also been developed for the control of air emissions from industries. The Environmental Protection Licence issued to an industry is legally binding on the industry and the violation of the conditions in the licence is an offence punishable under the National Environmental Act.

A licence issued is annually renewable and if an industry is found not complying with the conditions in the licence, action is usually taken to cancel the licence and proceed with legal action.

Siting of New Industry

The siting of all new industries now requires the prior approval of the Central Environmental Authority. The CEA screens all proposed new industrial sites before the relevant Local authority grants the final Authority for the establishment of the new industry. Although the screening of new industrial sites by the CEA commenced only recently, it has several benefits and ensures that new industries are not located in unsuitable locations. There have been instances in the past, when industries have been located in totally unsuitable locations, resulting in many problems both for the industry as well as to neighbouring residents.

There are several areas in and around Colombo, where haphazard siting of industry in the past has created major problems. One example in this regard is the Moratuwa-Ratmalana area where many industries were established in the past when planning regulations were non-existent. With increasing urbanisation and population pressure, residential areas have developed alongside with these industries. The discharge of effluents and air emissions from these industries as well as excessive noise and vibration arising from the operations cause pollution problems as well as a nuisance to neighbouring residents.

The situation regarding siting and control of pollution from new industries has improved immensely since the promulgation of regulations under the National Environmental Act, in 1990. Most new industrialists are now aware of the need to plan their pollution control strategy at an early stage of the planning process unlike in the older industries when not much attention was paid to plan pollution abatement measures in the early stages of the planning process, thereby making it more difficult and costly to incorporate pollution control measures.

The necessary legislative provisions are already in place for taking legal action against errant industrialists who are violating the norms and standards stipulated by the CEA. However, the authorities have been fairly flexible in this regard particularly in relation to existing industries. These industries have been allowed sufficient time to meet the stipulated standards. It is only in extreme cases where the industry concerned does not make any attempt at all to abate the pollution that the CEA proceeds with legal action.

Assistance to Industrialists

The government adopts a mix of regulatory and incentive based strategies in order to control pollution arising from industries. There are many programmes which have been initiated in recent times with a view to providing assistance to industries, with special emphasis on the older industries.

A 'Pollution Control and Abatement Fund' (PCAF) has been set up with donor funding in order to provide interest free loans as well as free technical assistance to industries which have been established in the past and which have pollution problems at present.

In order to assist older industries in special areas such as the Moratuwa-Ratmalana area, where industries face problems of not having the necessary space for the installation of treatment systems, the Government, with World Bank assistance, is to set up common waste treatment systems for joint waste treatment. Industries in such areas will be expected to discharge into the common waste treatment system or install waste treatment systems of their own.

There are several specific industrial sectors where the required pollution control technology is not available in the country at present. Demonstration waste treatment systems have been set up for such industrial sectors in order to assist industrialists to set up their own treatment systems.

Waste Minimisation Project

Another programme which is being implemented in order to assist industries is a demonstration waste minimisation project in selected industrial sectors. Waste minimisation programmes essentially adopt process changes and/or good housekeeping practices which result in a direct reduction of waste thereby reducing end of pipe treatment costs for the industry. A UNIDO assisted waste minimisation project is being implemented by the CEA covering three selected industries namely distillery, textile and metal finishing. Demonstration waste minimisation projects such as these help industries in meeting the required environmental standards while at the same time reducing end-of-pipe treatment costs.

Future Siting of Industry

In order to avoid the problems arising from inappropriate siting of industry as in the Moratuwa-Ratmalana area, the Government has made a policy decision that in future, all effluent generating high polluting industries should be sited in industrial estates with treatment facilities. However, at present a sufficient number of such estates are not available for this purpose. The Ministry of Industries is in the process of identifying and developing several industrial estates countrywide, in order to cater to this need. The plan is to develop these industrial estates on a Build Own and Operate or (Boo) or Build Own and Transfer (BOT) basis.

Other programmes which are ongoing is the relocation of polluting industries employ a similar production process to one central location in order to facilitate sharing of costs of waste treatment and disposal. One example in this regard, is the relocation of tanneries situated in and around Colombo to a suitable location outside Colombo. The main reason for the relocation of these tanneries is that these tanneries which were established several decades ago were carrying out their operations in highly residential areas. The operation of these tanneries is causing a major nuisance to the nearby residents. In addition, although these tanneries many of which are involved in chrome tanning generate substantial quantities of waste water containing chromium, The available space is insufficient for the installation of the necessary treatment systems. The

Application of Cleaner Production Technologies

relocation of the tanneries will give an opportunity to the industry to share the cost of waste treatment while to minimising pollution.

Although the quantities of hazardous waste arising from industrial operations is not very substantial at the present time, it is envisaged that the problem is bound to become serious with increased industrialisation. There are a few selected industrial sectors which are already facing problems in relation to the disposal of hazardous waste. With an increasing number of industries installing treatment systems for the treatment of their waste water, a serious problem with regard to the disposal of sludge from such waste treatment systems has arisen. In view of this, the government is in the process of identifying a suitable site to be developed as a hazardous waste landfill site. In addition, regulations governing the storage, transport and disposal of hazardous waste are also being developed and will come into force very early.

The CEA is in the process of developing an appropriate control system for the import, use and disposal of chemicals. A complete inventory of the chemicals in use within the country has been compiled. Relevant data on nearly one thousand chemicals is now available in the CEA as a computerised data base. Chemical and trade names, acute and chronic toxicity data, environmental effects, disposal methods, and the legal status of these chemicals in other countries are available in this data base. In addition, international data bases such as the Geneva based International Register of Potentially Toxic Chemicals (IRPTC) has made available their data bases to the CEA. The CEA has identified several highly hazardous chemicals which are presently being imported into Sri Lanka with no restrictions at all. It is proposed to make legal provision to regulate the import and use of these chemicals in the near future.

VI

REGIONAL CO-OPERATION

South Asia Co-operative Environment Programme

South Asian Regional Seas Programme

UNEP's Contribution to Sustainable Development

Network for Environmental Training at Tertiary Level in Asia and the Pacific

Global Environmental Facility

29

SOUTH ASIA CO-OPERATIVE ENVIRONMENT PROGRAMME

Hussain Shihab

The 1972 Stockholm Conference had drawn the attention of the world to the environmental issues that would change the lifestyles of the people and in many ways threaten their future well being if the wasteful patterns of resource consumption were not changed to more sustainable patterns.

The warning echoed by the Stockholm Conference resulted in the establishment of the United Nations Environment Programme. Soon, the Environmental Crusade swept across the developed and the developing world including the South Asian nations.

The initiative to establish an organisation for the protection, preservation and management of the South Asian environment was taken on by UNEP in the late seventies and the result was the establishment of the South Asia Co-operative Environment Programme (SACEP). It should be borne in mind that this was the first regional organisation to be established in the South Asian sub region even before the coming into being of the South Asian Association for Regional Co-operation.

All countries of SACEP are developing countries and five of them are categorised as “least developed countries”. The decision of the leaders of the SACEP member countries to commit funds from their tight national budgets to an organisation to protect and preserve the environment just 9 years after the Stockholm Conference shows their commitment to conserve natural resources and protect the environment for the benefit of present and future generations.

SOUTH ASIA CO-OPERATIVE ENVIRONMENT PROGRAMME

Hussain Shihab

The 1972 Stockholm Conference had drawn the attention of the world to the environmental issues that would change the lifestyles of the people and in many ways would threaten the future well being of the world if the continuing patterns of resource consumption was not changed to a more sustainable pattern. The warning echoed by the Stockholm Conference and the establishment of the United Nations Environment programme was taken seriously by the developing world and in particular by the leaders of South Asia.

The initiative to establish an organisation for the protection, preservation and management of the South Asian environment was taken by the United Nations Environment Programme; Regional Office for Asia and the Pacific in the late seventies and the result was the establishment of the South Asia Co-operative Environment Programme in Sri Lanka. It should be noted that, this was the first regional organisation to be established in the sub region even before the coming into being of the South Asian Association for Regional Co-operation (SAARC) a couple of years later. Due credit should be given to the leaders of South Asia for their far sightedness in establishing this specialised agency.

It should be noted also that all countries of SACEP are developing countries with 5 of them in the category of "least developed countries". The decision of the leaders of the SACEP member countries to commit funds from their tight national budgets to an organisation to protect and preserve the environment just 9 years after the Stockholm Conference shows their commitment to preserve our natural resources for the benefit of present and future generations.

SACEP is the brainchild of the High Level Meeting of Ministers of the South Asian Countries held in February 1981. SACEP became a legal entity on the 7th of January 1982 when the required number of countries ratified the Articles of Association. To date, 8 countries; Afghanistan, Bangladesh, Bhutan, Maldives, India, Nepal, Pakistan and Sri Lanka have ratified the Articles of Association of SACEP.

Aims and Functions of SACEP

As set forth in the Colombo Declaration, the aims of SACEP are:

- (a) To promote and support the protection, management and enhancement of the environment, both natural and human, of the countries of South Asia, individually, collectively, and co-operatively;
- (b) To make judicious use of the resources of the environment towards removal of poverty, reduction of socio-economic disparity, improve the quality of life, and prosperity on a continuing basis;
- (c) For these purposes, to make the fullest use of the organisational arrangements and facilities for co-operation under SACEP.

The functions of SACEP are:

- (a) To promote co-operative activities in priority areas of environment of mutual interest;
- (b) To ensure that these activities result in benefit individually or collectively to the member states;
- (c) To extend support as needed through exchange of knowledge and expertise available among the member countries;
- (d) To provide local resources towards implementation of projects and activities; and
- (e) To encourage maximum constructive and complementary support from interested donor countries and other sources.

The Principal organs of SACEP are:

- a) The Governing Council
- b) The Consultative Committee
- c) The Secretariat

The Governing Council is the “principal review and deliberative body of SACEP” where the member states are represented at ministerial level. The Governing Council is responsible for determining the policy and programmes of SACEP and meets regularly using host facilities provided by a member country according to mutual agreement.

The Consultative Committee consists of representatives of the respective missions of the Member States of SACEP in Colombo. It meets quarterly at the SACEP Secretariat and its responsibilities are to facilitate the implementation of the programmes and policies as determined by the Governing Council through close informal co-operation and to promote the dissemination of information on the concepts and operations of SACEP in general.

The Secretariat which is based in Colombo, consists of a Director, who is appointed for a period of three years. The Director is appointed from the member states on a rotational basis and is Chief Executive Officer and acts as the Secretary to the meetings of the Governing Council and the Consultative Committee. The Secretariat also has a number of International Officers depending on the projects that are ongoing at a particular time, from nominees of the member countries and also has supporting staff who are recruited from time to time according to the regulations laid down by the Consultative Committee.

There are 14 Subject Area Focal points; with member states or organisations assuming responsibility for co-ordination as follows;

1. Environmental Impact Assessment and Cost/Benefit Analysis: Environment and Development - Sri Lanka
2. Environmental Quality Standards – To be designated

The South Asia Co-operative Environment Programme

3. Technology for Development of Renewable and Reusable Resources - UNIDO
4. Environmental Legislation - India
5. Conservation of Montane Ecosystems and Watersheds - Pakistan
6. Social Forestry - Afghanistan with Assistance of India
7. Conservation of Coral, Mangroves, Deltas, Coastal Areas – Bangladesh
8. Island Ecosystems - Bangladesh
9. Tourism and Environment - Nepal
10. Desertification - UNEP
11. Regional Seas Programme - SACEP
12. Energy and Environment - India and Pakistan
13. Education and Training - India
14. Training in Wildlife Management - India

In consultation with member governments the following areas have been selected for priority attention.

- (a) Capacity Building and Awareness Raising
- (b) Systematic Information Exchange and Intra-Regional Technology Transfers
- (c) Environmental Management for Training and Institutional Development for Training
- (d) Regional Co-operation in Management Plans for Montane Ecosystems / Watersheds and Coastal Resources
- (e) Wildlife and Wildlife Habitat Conservation in the Region

A number of projects and programmes have been implemented since 1982. In 1992 SACEP with the assistance of UNEP reviewed progress and came up with a Strategy and Programme for the next 4 years titled: SACEP's Strategy and Programme 1 - (SSP - 1) 1992 - 1996. It was formulated keeping in mind the conclusions of the 1992 Earth Summit in Rio de Janeiro and in particular, Agenda 21, the Rio Declaration and the Biodiversity and Climate Change Conventions and other relevant Environmental Conventions. The criteria for the formulation of this programme were as follows; collective regional priorities and interests; consistency with Agenda 21; current programmes of international, other regional and national organisations agencies and prospective availability of donor funding for various programmes and projects.

Under SACEP's Strategy and Programme 1 - (1992 - 1996) the following major programmes are currently under implementation with assistance from UN and Bilateral donor agencies:

- a) Assessment of Faunal Biodiversity in the SACEP Region
- b) Co-operation in Environmental Training in the SACEP Region
- c) Framework Legislation for Environmental Management
- d) SACEP Environmental & Natural Resources Information Centre (SENRIC)

SACEP also regularly publishes a Programme Update and a Quarterly Newsletter. SACEP is also preparing "The State of Environment Report for South Asia 1995" with assistance of the UNEP's Environment Assessment Programme (UNEP/EAP).

Coastal and Marine Environmental Management was one of the fifteen priority subject areas identified by experts of the region and SACEP since its formation has been actively involved in various programme activities in this subject area.

The Stockholm Conference of 1972 on the Human Environment was the spiritual father of the United Nations Environment Programme. The Conference underlined the vital importance for humanity of the seas and all the living organisms which the oceans support. UNEP, at its very First Governing Council in 1973 set the "Health of the Oceans" as one of its priority concerns. Even today this remains as one of its major concerns. For a variety of historical reasons, a Regional Seas Programme for the South Asian Seas could not be initiated until the inception of SACEP. The quest for the launching of a Regional Seas Programme for the South Asian Seas, initiated by the SACEP Member States at UNEP's Governing Council in 1982, led a year later to the designation of the South Asian Seas Region as a part of UNEP's Regional Seas Programme.

Before the South Asian Regional Seas Programme, was formalised there were four Meetings of National Focal Points, a Meeting of Experts and a Meeting of Legal and Technical Experts. At the meeting of Plenipotentiaries of the Member States concerned which was held in New Delhi on 24th March 1995, SACEP was designated as the Secretariat for the implementation of the South Asian Seas Programme. Since that date, SACEP has been involved in revising the Action Plan and getting the necessary documentation from the member states to implement the programme. However the delay in acquiring the credentials of one member country has resulted in the Secretariat being unable to work to its potential in the implementation. This is also causing delays in obtaining the country contributions for running of the Secretariat and also recruitment of personnel who are required specifically for the implementation for the South Asian Regional Seas Programme.

The other important programme that is being implemented by SACEP is SACEP Environmental and Natural Resources Information Centre (SENRIC). The NORAD assisted Project Co-operation on Environmental Training in South Asia was successfully completed in February 1996.

The second NORAD assisted Project under implementation is the Assessment of Faunal Biodiversity in South Asia. Under this project, a Manual for use in the field for identification of species has already been developed and will be published after completion of the meeting. The final meeting would review and revise the regional report and approve the action plan for the assessment of Faunal Biodiversity in the South Asian Region.

SACEP with UNEP-EAP has also carried out the initial work for the UNEP Global Outlook which will be published by the United Nations Environment Programme. SACEP with UNEP has successfully conducted a Workshop on Framework Legislation for Environment Management in the South Asian Region.

Based on the 14 Priority Subject Matter Areas; activities have been prioritised for implementation in 1996-1997 by the Secretariat. Under the area of Capacity Building & Awareness Raising, a Project was formulated in Capacity Building of Officials in charge of Managing the Coastal and Marine Environment. This was done in consultation with the Subject Area Focal Point and in line with the recommendation given by the Ahmedabad Workshop on Regional Training in Environmental Capacity Building. The project also falls into the parameters of the Regional Seas Programme. This project is titled "Regional Training for Management of Protected Areas and Coral island Ecosystems in the Indian Ocean." First phase of this Project will concentrate on drawing up of a 4 week syllabus and modules for the training course. This will be done through a meeting of the member country Official Experts and 4 International Consultants.

With regard to the South Asian Regional Seas Programme, immediately after the Meeting of Plenipotentiaries, IMO was requested by SACEP Secretariat to give an estimate for a Final Review of the Oil Pollution Contingency Plan for the region. IMO estimated that the updating and a final meeting at ministerial level to adopt the Action Plan would cost US \$ 35,000. An immediate request was sent to UNEP Nairobi and it is envisaged that this meeting can be held towards the end of the year. .

In the project that was concluded in New Delhi on Framework Legislation for Environmental Management in South Asia, one of the recommendations was the setting up of a national task force for the review of the framework environmental; legislation. Based on this recommendation and in close consultation with the Legal Section of UNEP/ROAP, a project was developed to carry out this task in the member countries

After the Earth Summit in Rio, UNEP was given the task of assisting national Governments through sub-regional bodies to build up capabilities within the national governments to annually prepare their own State of the Environment reports and co-operate with subregional organisations to prepare the Sub- Regional State of the Environment Reports. Under this mandate, UNEP in co-operation with sub regional organisations have to fulfil this task by the next earth summit which will be held in 2002. The objectives are:

- a) Increase awareness and understanding of environmental trends and conditions;
- b) Provide the foundation for decision making at all levels and
- c) Facilitate the measurement of progress towards sustainability.

Under this task, UNEP/EAP has in co-operation with the sub regional organisations initiated activities for the realisation of these objectives. Under the 1st phase of the programme being implemented by SACEP, India and Pakistan has been allocated US \$ 20 - 25,000 each for activities to implement the programme and work has already commenced. In this regard, the data for State of Environment Reporting has been collected by the Indian Government's designated Agency; The Tata Energy Research Institute. A Workshop for the Officials of the Indian Ministry of Environment & Forests concerned with the subject has already been held in AIT, Bangkok in July 1996. With regard to Pakistan, the National Focal Point for the activity has

been identified at the Ministry of Environment, Forests and Urban Affairs and computer equipment for the purpose has been supplied by SENRIC to the Pakistani Focal Point. The Workshop for Pakistani Officials is proposed to be held in November 1996. Initial discussions with the Bangladesh Government is in progress to designate the Focal Point and to establish a Work Schedule under this activity.

The State of the Environment Report for South Asia has been finalised and is awaiting the approval of the ministers of member countries for some time. However, many of the ministers were unable to attend the meeting last year. This meeting is now being planned by UNEP/EAP/AP and SACEP for late 1996 or early 1997.

Finally, I should make reference to the role of Subject Area Focal Points in the implementation of SACEP Programmes. These Focal Points were identified in consultation with the Governments and they were to play a crucial and active role in formulating projects on the subject matter of which they were in charge. Only few Subject Area Focal Points have been active as a result of which activities in certain Subject Areas have been minimal. May I take this opportunity to request the delegates present here to make every endeavour to encourage Subject Area Focal Points which have not been active to assist the SACEP Secretariat in the formulation of projects of a regional nature and submit to the SACEP Secretariat for seeking of funds.

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SOUTH ASIAN REGIONAL SEAS PROGRAMME

Prasantha Dias Abeyegunawardene

The various aspects of Coastal and Marine Environmental Management are presently being covered in three of SACEP's fifteen Priority Subject Matter Areas, namely Conservation of Corals, Mangroves, Deltas, and Coastal Areas and Conservation of Island Ecosystems, which were identified by experts of the region at its formative stages. SACEP since then has actively been involved in various programme activities in these subject areas.

For a variety of historical reasons, a Regional Seas Programme for the South Asian Seas was not initiated. The emergence of SACEP saw the revival of interest of the concerned member states towards the establishment of a Regional Seas Programme for the South Asian Seas. The quest for the launching of a Regional Seas Programme for the South Asian Seas, initiated by the SACEP member states at UNEP's Governing Council in 1982, led a year later to the designation of the region as a part of UNEP's Programme.

In connection with the South Asian Regional Seas Programme, there has been four Meetings of National Focal Points, a Meeting of Experts and a Meeting of Legal and Technical Experts. There has also been an IMO/UNEP Workshop on South Asia Marine Pollution Emergency Action Plan. The Action Plan for the South Asian Regional Seas Programme was formally adopted at a Meeting of Plenipotentiaries of the concerned countries held in New Delhi, on March 24th 1995.

The Action Plan in addition to specifying the needs under the main components of Environmental Assessment, Environmental Management, Environmental Legislation & Institution and Financial Arrangements, identified the areas where priority activities need to be developed for implementation. These priority activities are in four specific areas; namely; Integrated Coastal Zone Management; Development and Implementation of National and Regional Oil Spill Contingency Planning; Human Resources Development Through Strengthening Regional Centres of Excellence; and Land Based Sources of Marine Pollution

SOUTH ASIAN REGIONAL SEAS PROGRAMME

Prasanthia Dias Abeyegunawardene

The Stockholm Conference in 1972 on the Human Environment was the spiritual father of the **United Nations Environment Programme**. The Conference underlined the "vital importance" for humanity of the seas and all the living organisms which the oceans support. UNEP in its very **First Governing Council Sessions in 1973** agreed on "**Health of the Oceans**" as one of its priority concerns. Even today this remains as one of its major concerns.

In the light of deteriorating environmental conditions, the countries of the South Asian Region, thoughtfully came together, and signed a Declaration in Colombo, now known as the "**Colombo Declaration**". The countries concerned were **Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka**. Through this association, they formulated the **South Asia Co-operative Environment Programme (SACEP)** to be the nerve centre of environmental activities of regional concern. SACEP, since it became a '**legal entity**' in **1982**, has been implementing the policies and programmes approved by its Governing Council which consists of ministerial level representatives of the member countries.

The various aspects of **Coastal and Marine Environmental Management** is presently being covered under three of SACEP's **fifteen Priority Subject Matter Areas**, namely **Conservation of Corals, Mangroves, Deltas, and Coastal Areas, Conservation of Island Ecosystems and Regional Seas Programme**. From its inception, SACEP has been actively involved in various programme activities in these subject areas.

For a variety of historical reasons, a **Regional Seas Programme for the South Asian Seas** was not initiated in the 1970's. The emergence of SACEP saw the revival of interest of the concerned member states towards the establishment of a **Regional Seas Programme for the South Asian Seas**. The quest for the launching of a **Regional Seas Programme for the South Asian Seas**, initiated by the SACEP Member States at UNEP's Governing Council in **1982**, led a year later to the designation of the region as a part of UNEP's Programme.

The **South Asian Seas Region** can be categorised into two distinct geographical groups. While Maldives and Sri Lanka are island nations, Bangladesh, India and Pakistan are situated on the Asian mainland. India has two groups of islands in the Arabian Sea and Bay of Bengal, whose problems are similar to that of Maldives and Sri Lanka. The northern Indian Ocean with its adjoining seas, Bay of Bengal and Arabian Sea form the common marine boundary for the five South Asian nations. The total land area covered by these countries is about 4.5 million sq. km. having a population of about 1.1 billion. The population density varies from 270 per sq. km. in Sri Lanka to 591 per sq.km. in the Maldives. The region except Sri Lanka has a high rate of population growth of around 2.5%. Nearly 10 to 15% population of these countries is directly or indirectly dependent on the sea for living.

The region is characterised by the location of some of the largest population concentrations in the world in the five megacities of Karachi, Bombay, Madras, Calcutta and Dhaka and a large number of medium-sized towns and cities along the Indian and Bangladesh coasts. It is expected that each of these five cities would have a population of over 10 million by the year 2000.

In connection with the South Asian Regional Seas Programme, there has been four Meetings of National Focal Points, a Meeting of Experts and a Meeting of Legal and Technical Experts. There has also been a IMO/UNEP Workshop on South Asia Marine Pollution Emergency Action Plan. **Six Priority Projects** were identified by the experts in the region and Project Proposals were formulated even prior to the formal adoption of the Action Plan.

These projects are as follows:

	PROJECT TITLE	IMPLEMENTING AGENCY
1.	Coastal Environmental Management Plan (CEMP) for Pakistan	ESCAP and Govt of Pakistan
2.	Development of a System of Protected Areas in the South Asian Seas Region	IUCN
3.	Assessment of Levels and Effects of Marine Pollution in the South Asian Seas Region	Intergovernmental Oceanographic Commission (IOC)
4.	Development of an Operational Regional Contingency Plan for Responding to Marine Pollution	International Maritime Organisation (IMO)
5.	Survey of Land Based Sources of Marine Pollution and Formulation of Guidelines and Proposals for Environmentally Sound Waste Management Technologies and Policies	SACEP
6.	Promotion of Public Awareness for South Asian Countries in connection with the South Asian Seas Programme	SACEP

Projects 1, 2, 4 & 6 have been completed whilst the other two Projects, are due to be implemented shortly.

Under the project "**Promotion of Public Awareness for South Asian Countries in connection with the South Asian Seas Programme**", SACEP has produced a 15 minute video programme titled "*The Sea a Heritage to Share*" which has been shown over national television in the member countries of SACEP. It is possibly the first time that a programme of this nature has been produced under any of the existing UNEP Regional Seas Programmes. There has been many publications as an output of the **South Asian Regional Seas Programme**.

While in South Asian Seas Action Plan was being finalised SACEP had under implementation a project titled "**Capacity Building in the Field of Planning and Management of the Coastal Areas in the South Asian Seas Region Phase I**" in collaboration with the **Economic and Social Commission for Asia and the Pacific (ESCAP)** and in co-operation with the **United Nations Environment Programme (UNEP)**. Within the framework of the Project, ESCAP in co-operation with the UNEP and SACEP conducted a **Workshop on Management Strategies for the Protection of the Coastal and Marine Environment in the South Asian Seas Region**, which was held in Colombo in December 1993.

The main objective of the Workshop was to **Assess the Potential and Modalities of Promoting Co-operation for Capacity Building among the Maritime Member Countries of SACEP** on the basis of Country Studies on Coastal Zone Management prepared by National Experts from Bangladesh, India, Maldives, Pakistan and Sri Lanka.

The Workshop also reviewed **Management Strategies for the Protection of the Coastal and Marine Environment**, assessed the **Requirements for Capacity Building in the Management of Coastal and Marine Environment** and identified **Priorities for Action and the Nature of Assistance** that will be required to address the issues on the Protection of Coastal and Marine Environment.

The Workshop also carried out a thorough **Assessment of Capacity-Building Requirements** in the Countries of the Region and Formulated Recommendations for addressing needs. These included the fields of **Integrated Coastal Zone Management, Ocean Resource Assessment, Data and Information Systems, Marine Pollution, Ocean Technology Development, Disaster Mitigation, Coastal Erosion, Sea Level Monitoring, Education and Awareness and Human Resources Development.**

Based on the **Overall Assessment of Capacity-Building Requirements**, the Workshop agreed on the following Areas for **Priority Action** to support **Capacity-Building Activities in the South Asian Seas Region.**

- i) An Umbrella Project for Regional Co-operation and Pilot Projects in Integrated Coastal Zone Management;
- ii) Development and Implementation of National and Regional Oil Spill Contingency Planning;
- iii) Human Resources Development through Strengthening of National Centres of Excellence;

Based on the findings of the Studies and the Recommendations of the Workshop, ESCAP in collaboration with SACEP developed a Set of Proposals to address the above three areas for Capacity Building. The Secretariat presented the outlines of Project Proposals addressing the above areas, as well as a Strategy for Project Development and Implementation to an Intergovernmental Meeting which was held in May 1994 in New Delhi.

The Meeting approved the following **Priority Project Proposals**

Component A: Integrated Coastal Zone Management

- * Umbrella Project for Regional Co-operation in Integrated Coastal Zone Management
- * Pilot Project in Integrated Coastal Zone Management in Bangladesh
- * Pilot Project in Integrated Coastal Zone Management in India
- * Pilot Project in Integrated Coastal Zone Management in Maldives
- * Pilot Project in Integrated Coastal Zone Management in Pakistan
- * Pilot Project in Integrated Coastal Zone Management in Sri Lanka

Component B: Development and Implementation of National and Regional Oil Spill Contingency Planning

- * Umbrella Project for Regional Co-operation in Capacity Building for Oil Pollution Response

Component C: Human Resources Development Through Strengthening Regional Centres of Excellence

- * Umbrella Project on Regional Co-operation for Development of Centres of Excellence

The Meeting also spelt out the Strategy for Project Development and Implementation of these projects and also recommended that steps should be taken for the early adoption of the Action Plan for the South Asian Regional Seas Programme.

The Action Plan for the South Asian Regional Seas Programme was formally adopted at a Meeting of Plenipotentiaries of the concerned countries held in New Delhi, on March 24th 1995. The Action Plan of the South Asian Seas Programme approved at the Meeting of Plenipotentiaries has certain important elements which will assist the member countries in protecting the marine environment of the region.

The Action Plan in addition to specifying the needs under the main components of Environmental Assessment, Environmental Management, Environmental Legislation & Institutional and Financial Arrangements identified the four priority areas where action is needed for implementation under the Action Plan. These priority activities are in four specific areas. Under these Priority Areas activities that have been selected for staged implementation by the South Asian Member States.

The First of the Priority Area is Integrated Coastal Zone Management. Details of this area as spelt out in the Action Plan are as follows:

- a) The ESCAP/UNEP/SACEP Intergovernmental Meeting on Capacity Building in Coastal Environmental Management in the South Asian Seas Region, 17 - 19 May 1994, New Delhi, endorsed Integrated Coastal Zone Management (ICZM) as a priority element for environmentally sound and sustainable development of marine and coastal areas in the region (ENR/CBCEM/REP). This is in harmony with worldwide acknowledgement of the urgent need for Integrated Coastal Resources Management as expressed in Agenda 21, Chapter 17.
- b) The region as a whole has important assets in terms of human and institutional capacity in relevant scientific, economic, social and technological fields and planning experiences. Therefore, specifically targeted regional co-operation activities could boost the exchange of experiences, information, data and expertise in relevant sectors; promote co-operative research programmes and technology transfer; and support the development of suitable planning guidelines, awareness-raising initiatives, scientific and technological means and capacity -building activities.
- c) Activities should be carried out through the implementation of pilot projects in ICZM in each country of the region. Guidelines for the development of pilot project activities are presented in document ENR/CBCEM/2/REV.2 - Capacity-building requirements: Priority

Projects and Strategy for their Implementation - of the ESCAP/UNEP/SACEP Intergovernmental Meeting on Capacity Building in Coastal Environmental Management in the South Asian Seas Region.

The following activities have been selected for staged implementation by each of the South Asian Member States:

- (a) Preparation of Coastal Profiles, including; project scope, i.e. definitions, geographic boundary;-identification of issues and priorities; preparation of development outlooks and strategies for their achievement, and analysis of the social and economic implications of the proposed strategies; identification of information gaps; proposal for the preparation of a comprehensive and integrated management plan; analysis of the legal and financial requirements posed by the ICZM Project Proposal; and proposal for the institutional arrangements needed to support the co-ordination and implementation of the pilot project.
- (b) Analysis and Forecasting, including: surveys and research on selected issues within sectors of human and economic activities in the coastal area; analysis of natural systems, and human and economic activities in the coastal area; assessment of exposure to risks, e.g. sea-level rise, natural hazards; and preparation of resource atlas. The purpose of this phase is to provide an analytical basis for the establishment of precise goals and objectives. and definition of management strategies for sustainable development in the coastal area.
- (c) Definition of Goals and Strategies, including; refinement and adoption of goals and objectives; preparation of strategies; and evaluation of and decision on the most suitable strategy. Decision-making bodies at the highest level must approve of the goals and strategies of environmentally sustainable development in the coastal area concerned.
- (d) Integration of detailed Plans and Management Policies, including; establishment of procedures for the approval and periodic revision of the plan; identification of those authorities which will adopt the planning policies and introduce the planning controls into their operations; definition of expenditure priorities and the technical personnel required to implement the plan; and specify the instruments to be used in the plan implementation.
- (e) Implementation of Plans

The Second Priority Area is Development and Implementation of National and Regional Oil Spill Contingency Planning. The details of this Priority Area are as follows.

- a) The ESCAP/UNEP/SACEP Intergovernmental Meeting on Capacity Building in Coastal Environmental Management in the South Asian Seas Region, 17 - 19 May 1994, New Delhi, endorsed the Development and Implementation of National and Regional Oil and Chemical Spill Contingency Planning as a priority element for environmentally sound and sustainable development of marine and coastal areas in the region (ENR/CBCEM/REP). This is in harmony with world-wide acknowledgement of the urgent need for Integrated Coastal Resources Management as expressed in Agenda 21, Chapter 17.

- b) The risk associated with oil transportation along the routes of the region is high due to the intensity of oil tanker movements. Therefore, this component builds on earlier studies and regional initiatives in the field and aims at enhancing consultation and technical co-operation among the states of the region. The proposed strategy involves capacity building activities in marine environmental monitoring; marine pollution modelling and impact assessment; information storage and exchange; planning and operational capabilities required for marine pollution emergencies; and development of adequate policies and management practices and appropriate legislation in the field.
- c) Activities should be carried out through the guidelines for the development of project activities that are presented in document ENR/CBCEM/2/REV.2 - Capacity-building requirements: Priority Projects and Strategy for their Implementation - of the ESCAP/UNEP/SACEP Intergovernmental Meeting on Capacity Building in Coastal Environmental Management in the South Asian Seas Region.

The following activities have been selected for the implementation by the South Asian Seas member States.

- (a) Updating the South Asian Marine Pollution Emergency Plan;
- (b) Assessment of infrastructure requirements for pollution emergencies and development of mechanisms for implementation of the Plan;
- (c) Assistance in developing National Marine Pollution Contingency Plans where they do not exist;
- (d) Preparation of national training and manpower development plans for marine environmental monitoring, response and combat including surveillance of oil spills and information collection and management;
- (e) Collection, storage and dissemination of data through RENRIC of SACEP;
- (f) Assistance in the development of national legislation where necessary; and
- (g) Preparation of technical guidelines and dissemination to member states.

The Third of the Priority Area is Human Resources Development Through Strengthening Regional Centres of Excellence. The details of this Priority Area are given below.

- a) The ESCAP/UNEP/SACEP Intergovernmental Meeting on Capacity Building in Coastal Environmental Management in the South Asian Seas region, 17 - 19 May 1994, New Delhi, endorsed Human Resources Development through Strengthening Regional Centres of Excellence as a priority element for environmentally sound and sustainable development of marine and coastal areas in the region (ENR/CBCEM/REP). This is in harmony with world-wide acknowledgement of the urgent need for marine environmental protection as expressed in Agenda 21, Chapter 17.
- b) The region as a whole has important assets in terms of human and institutional capacity in relevant scientific, economic, social and technological fields and planning experiences. The centres of excellence should address the requirements of human resource development in a regional perspective, through training programmes targeted to personnel from the countries

of the region, fellowship schemes for enhancing the inter regional sharing of expertise and experiences, and joint research programmes in relevant fields. The centres should serve the main purpose of strengthening the development of human resources within the region.

- c) Activities should be carried out through the guidelines for the development of project activities that are presented in document ENR/CBCEM/2/REV.2 - Capacity-building requirements: Priority Projects and Strategy for their Implementation - of the ESCAP/UNEP/SACEP Intergovernmental Meeting on Capacity Building in Coastal Environmental Management in the South Asian Seas Region.

The following activities have been selected for the implementation by South Asian member States:

- (a) Development of research programmes and projects and sharing of experience in the empowerment of local communities;
- (b) Development of guidelines for multidisciplinary research in Integrated Coastal Zone Management (based on the implementation of the pilot projects) and for the replication of pilot experiences;
- (c) Training of personnel involved in pilot projects on ICZM in all aspects of ICZM and for future ICZM projects and preparation of training manual; and
- (d) Refinement and testing of methodologies and techniques for participatory research and for eliciting community participation that would facilitate plan implementation.

The Fourth of the Priority Area is Land Based Sources of Marine Pollution The details of this Priority Area is given below.

- a) The United Nations Convention on the Law of the Sea 1982 came into force on November 16, 1994. Its universality has been assured by means of an implementing Agreement relating to Part XI of the Convention which was opened for signature in July 1994. All the countries of the South Asian region are signatories to this umbrella Convention which regulates the activities of nations in the ocean sector both within and outside national jurisdiction. The Convention has specific provisions relating to the prevention, reduction and control of marine pollution from land-based activities.
- b) The South Asian Seas region is characterised by the location of some of the largest population concentrations in the world. The cities and urban conglomerations situated on the coast are the single largest polluters of the marine environment. Untreated sewage and industrial effluent, solid waste and agricultural activities are identified as amongst the most significant causes of pollution of coastal waters. Other causes of degradation to coastal ecosystems include the mining of sand and coral, and exploitation of fishery stocks. Coral reefs and mangroves are identified as among the most important ecosystems that are threatened from land-based activities.
- c) In this context, it should be noted that a Regional Programme of Action for the Protection of the Marine Environment of the South Asian Seas from Land-based Activities was prepared by SACEP for the Meeting of Government-designated Experts to Review and Revise a Global Programme of Action to Protect the Marine Environment

from Land-based Activities, Reykjavik, 6-10 March 1995 This document will be reviewed and adopted at a later date.

The following activities have been selected for implementation by South Asian Seas Member States:

- (a) Development of strategy, including refinement of the Programme of Action, for the Protection of the Marine Environment of the South Asian Seas from Land-based Activities;
- (b) Development of a regional programme for monitoring of marine pollution in the coastal waters of the South Asian Seas and the regular exchange of relevant data and information;
- (c) Development of pilot activities in countries of the South Asian Seas to control the degradation of the marine coastal environment from land-based activities;
- (d) Training of personnel involved in these pilot projects to control the degradation of the marine and coastal environment from land-based activities, including preparation of a training manual;
- (e) Development of a regional programme to identify the special problems of the largest coastal cities, each having a population of more than 10 million by the year 2000, and of the island States in the areas of: (i) disposal of domestic effluents; and (ii) collection and disposal of solid wastes

The Meeting of Plenipotentiaries also adopted a resolution in respect of Implementation of the South Asian Seas Action Plan. This resolution is given below.

RESOLUTION 1: IMPLEMENTATION OF THE SOUTH ASIAN SEAS ACTION PLAN

The Meeting of Plenipotentiaries

Noting that the overall authority for the Action Plan is vested in the Governments of the region and having adopted, on 24 March 1995, the Action Plan for the Protection and Management of the Marine and Coastal Environment of the South Asian Seas Region,

1. **Decides** that, for the period 1995-1996, program activities should be undertaken in the following areas, subject to the availability of resources:

Annex 1 - Integrated Coastal Zone Management;

Annex 2 - Development and implementation of National and Regional Oil and Chemical Spill Contingency Planning;

Annex 3 - Human Resource Development through Strengthening Regional Centres of Excellence;

Annex 4 - Protection of the Marine and Coastal Environment from Land Based Activities.

2 **Invites** the Director of the South Asia Co-operative Environment Programme (SACEP),

- (a) To act as the Secretariat for the South Asian Seas Action Plan and to enhance its capacities for this purpose.
- (b) To prepare, with the support of the UNEP's Regional Seas Programme and in co-operation with the other competent international and regional organisations, including ADB, ESCAP, IOC of UNESCO, IMO, UNDP, and Governments of the region, detailed documents describing the operational details of projects to be developed on the basis of priorities identified in 1. above.
- (c) To convene, quarterly at the SACEP Secretariat, meetings of the Consultative Committee to review the progress achieved in implementing the Action Plan and to deliberate on activities which require immediate attention. The Consultative Committee will also advise on financial implications of project implementation and if necessary advise the secretariat on their revision.
- (d) To co-ordinate the implementation of the projects agreed at the Meeting of Plenipotentiaries, subject to the availability of funds.

Under the **Institutional and Financial Arrangements** for the Implementation of the Action Plan, the **overall authority** is vested in the Governments and regular periodic meetings of the Governments. **Intergovernmental Meetings** will be sole authority in determining the content, review, progress and approval of the workplan of the regional programme. Their purview will also include the financial implications of the regional programme. The periodicity of the Intergovernmental Meetings will be once in 2 years.

There will also be a **Consultative Committee** comprising of the diplomatic representatives of the Member States of the South Asian Seas in Sri Lanka which will meet quarterly at the SACEP Secretariat and their function would mainly be to deliberate on the activities which require immediate action and to review the progress achieved in the implementation of the Action Plan.

Each Member State would identify and designate a **National Focal Point** to co-ordinate the national activities of the Action Plan. Each member state would also establish a **National Co-ordination Committee**, designate **National Project Co-ordinators** for specific activities of the Action Plan and select **National Institutions** for carrying out the technical work of the programme activities.

There would also be a "**System of Networking**" established among **SACEP, National Focal Points and National Project Co-ordinators** for smooth implementation of project activities.

South Asia Co-operative Environment Programme was designated to function as the **Secretariat for the South Asian Regional Seas Programme**.

The Meeting of Plenipotentiaries also adopted a resolution in respect of “**Institutional Arrangements for the Implementation of the South Asian Seas Action Plan**”, the text of which is given below.

RESOLUTION 2: INSTITUTIONAL ARRANGEMENTS FOR THE IMPLEMENTATION OF THE SOUTH ASIAN SEAS ACTION PLAN

The Meeting of Plenipotentiaries

Having adopted the Action Plan for the Protection and Management of the Marine and Coastal Environment of the South Asian Seas Region

Noting the willingness of SACEP to accept the designation as the organisation responsible for the secretariat functions of the South Asian Seas Action Plan (SASAP),

1. **Calls upon the Director of SACEP**, in consultation with the Governments of the South Asian Seas region, with the support of UNEP and in close co-operation with the relevant United Nations bodies and intergovernmental and non-governmental organisations, to make such arrangements as required to achieve the objectives of the SASAP,
2. **Also calls upon the Director of SACEP**, to convene every two years an intergovernmental meeting of the states of the South Asian Seas region in order to keep under review the implementation and execution of the Action Plan and make policy decisions concerning all substantive and financial matters relating to the SASAP. Specifically, the intergovernmental meetings should:
 - (a) review the progress achieved in implementing the programmes since the previous meeting;
 - (b) carefully evaluate the results achieved;
 - (c) adopt a workplan for the implementation of the programme in the subsequent two year period;
 - (d) provide the policy guidance for the procedures to be followed in the implementation of the programme;
 - (e) approve the budgetary resources required to support the workplan and their allocation for a two year period; and
 - (f) agree on the means of financing activities of the programme, including firm pledges for contributions to be made by Governments.
3. **Requests the Director of SACEP**, to convene in 1997 an Intergovernmental Meeting in order to review the progress achieved in the implementation of the Action Plan and to further consider the institutional and financial arrangements.
4. **Also requests the Director of SACEP**, to convene, quarterly at the SACEP Secretariat, a meeting of the Consultative Committee to provide the secretariat with

policy guidance on the implementation of the decisions taken at the Meeting of Plenipotentiaries and subsequent Intergovernmental Meetings.

A South Asian Seas Action Plan Trust Fund has also been established to service the Secretariat. Contributions to the Trust Fund by the member states will be on an agreed scale of contribution. Funding for projects will be on a project to project basis.

A Resolution in respect to the "Financial Arrangements for the Implementation of the South Asian Seas Action Plan" was adopted at the Meeting of Plenipotentiaries, the text of which is given below.

RESOLUTION 3: FINANCIAL ARRANGEMENTS FOR THE IMPLEMENTATION OF THE SOUTH ASIAN SEAS ACTION PLAN

The Meeting of Plenipotentiaries

Having adopted the Action Plan for the Protection and Management of the Marine and Coastal Environment of the South Asian Seas Region

Noting the willingness of SACEP to be entrusted with the management of the proposed South Asian Seas Action Plan (SASAP) Trust Fund,

Also noting the readiness of the States of the region to contribute to the costs for the implementation of the Action Plan through a SASAP Trust Fund,

1. **Decides** that the SASAP Trust Fund be financed, at least for the initial two year period, by annual contribution according to the ratios in the SAARC Scale of Assessment agreed upon by SAARC Member States, where the maximum contribution from a Member State is 35% whilst the minimum contribution is 5%. The actual contributions from the states are to be assessed as follows:

COUNTRY	%	1995 US \$	1996 US \$
Bangladesh	14.5	10,367.50	11,020.00
India	35.0	25,025.00	26,600.00
Maldives	6.5	4,647.50	4,940.00
Pakistan	29.5	21,092.50	22,420.00
Sri Lanka	14.5	10,367.50	11,020.00
TOTAL	100.0	71,500.00	76,000.00

2. **Requests** the Director of SACEP to assume responsibility for administering the SASAP Trust Fund.
3. **Urges** the States to pay their contributions in equal yearly installments, starting from April 1995.
4. **Calls upon** the Director of SACEP, with support from UNEP's Regional Seas Programme, UNDP, ESCAP, IMO, IOC of UNESCO, Asian Development Bank and other relevant organisations to search additional financial resources which may be

available for the implementation of the SASAP, in particular to approach the Global Environment Facility on behalf of the participating States to seek funds for the implementation of the components of the South Asian Seas Action Plan.

5. **Undertakes** to explore potential international sources of additional financial support for the implementation of the South Asian Seas Action Plan.

The Meeting of Plenipotentiaries also adopted a Resolution establishing the South Asian Seas Programme. The text in respect of Final Act establishing the South Asian Regional Seas Programme is as follows:

Meeting of Plenipotentiaries on the Action Plan for the Protection and Management of the Marine and Coastal Environment of the South Asian Seas Region

New Delhi, 24 March 1995

FINAL ACT

1. The Meeting of Plenipotentiaries on the Action Plan for the Protection and Management of the Marine and Coastal Environment of the South Asian Seas Region was convened, at the request of the Governments of the region, by the Executive Director of the United Nations Environment Programme pursuant to decision 11/7 of the General Council, adopted 24 May 1983, which requested *...the Executive Director to designate the South Asian Seas as a region to be included in the regional seas programme, in close co-operation with the South Asia Co-operative Environment Programme and the Governments of the Region, and to assist in the formulation of a plan of action for the environmental protection of the South Asian Seas.*"
2. The Meeting was held in New Delhi at the invitation of the Government of India on 24 March 1995.
3. The States invited to participate at the Meeting of Plenipotentiaries were the: People's Republic of Bangladesh, Republic of India, Republic of Maldives, Islamic Republic of Pakistan and Democratic Socialist Republic of Sri Lanka.
4. All of the afore mentioned states accepted the invitation and participated in the Meeting.
5. Representatives of the following Intergovernmental organisations also attended the Meeting: Economic and Social Commission for Asia and the Pacific (ESCAP); International Maritime Organisation (IMO); Intergovernmental Oceanographic Commission (IOC) of UNESCO; South Asia Co-operative Environment Programme (SACEP); and United Nations Environment Programme (UNEP).
6. The Meeting was inaugurated on behalf of the Government of India by Hon. Mr. Pranab Mukherjee, Minister for External Affairs. The meeting was opened, on behalf of the Executive Director of the United Nations Environment Programme, by Mr. Peter Schroder, director, Oceans and Coastal Areas Programme Activity Centre. An

opening statement was also made by Mr. Eduardo Faleiro, Minister for Ocean Development, Government of India.

7. The Meeting elected Mr. Eduardo Faleiro (India) as President of the Meeting, Mr. M Abul Quasem (Bangladesh), Mr. Asif Shuja Khan (Pakistan) and Ms. S. Athulathmudali (Sri Lanka) as Vice Presidents, and Mr. Hussain Shihab (Maldives) as Rapporteur.
8. The Meeting considered the Report of the Fourth Meeting of National Focal Points, presented as UNEP(OCA)SAS WG3/REP. This document contained the proposed final drafts of the Action Plan with Annexes, Institutional and Financial Arrangements, Resolutions and the Final Act to be adopted by the Meeting of Plenipotentiaries.
9. As a result of the deliberations at the Meeting, the Action Plan for the Protection and Management of the South Asian Seas Region, with Annexes, and the Institutional and Financial Arrangements for the Implementation of the Action Plan were adopted.
10. The Meeting considered and adopted the Resolutions, the texts of which are appended to this Final Act.

The Action Plan for the Protection and Management for the Marine and Coastal Environment of the South Asian Seas was signed by the representatives of People's Republic of Bangladesh; Republic of India; Republic of Maldives; Islamic Republic of Pakistan; and Democratic Socialist Republic of Sri Lanka.

In witness whereof the representatives have signed this Final Act. Done at New Delhi, this 24th day of March, 1995, in a single original copy, to be deposited in the archive of Department of Ocean Development, Government of India, New Delhi.

People's Republic of Bangladesh

Republic of India

Republic of Maldives

Islamic Republic of Pakistan

Democratic Socialist Republic of Sri Lanka

Current Status

The present status of the South Asian Regional Seas Programme in respect of the institutional, financial and programme activities is as follows.

In respect of the INSTITUTIONAL ARRANGEMENTS, SACEP with its present staff members serves as the Secretariat for the South Asian Seas Programme including project formulation and approaching donor agencies. The reason for the delay in the recruitment of personnel for the South Asian Seas Programme is due to the fact that one member state has yet to submit

the Letter of Credential of the delegate who participated in the Meeting of Plenipotentiaries. Once this is received, steps will be taken as per provisions in the Action Plan to recruit the necessary personnel to service the South Asian Seas Secretariat.

With respect to the **FINANCIAL ARRANGEMENTS**, A South Asian Seas Trust Fund has been established. This fund was established in Sri Lanka on 7th August 1995 as per resolution adopted at the Meeting of Plenipotentiaries and contributions for 1995 has been received from the Governments of Maldives and Sri Lanka. The contributions from the other member states is expected once all the Letters of Credential have been submitted.

Programme Activities

In spite of the delay in receiving the Letters of Credentials, many programme activities have already been initiated. In respect of this, the following detailed projects have been formulated and funding for some have already been negotiated.

First of these, is the project on **Regional Training for Management of Protected Areas & Coral Island Ecosystems in the Indian Ocean**.

This project will be implemented by **South Asia Co-operative Environment Programme** in close co-operation with the National Focal Points & Institutions and relevant UN and International Organisations. **Funding to be provided by Norwegian Agency for Development Co-operation (NORAD).**

The duration of this project will be **12 months** and the **Objectives** are as follows:

Short Term

- a) Assessment of the present status with respect to the management of the coral reef eco-system and the identification of appropriate institutional mechanisms available & the current needs in the region.
- b) Based on the assessment made to train personnel of South Asia and neighbouring countries to:
 - (i) assess the needs for the conservation and protection of coastal and marine species and ecosystems;
 - (ii) define and classify the coastal and marine biogeography of the region using widely acceptable and compatible approaches, concepts and methodology;
 - (iii) make recommendations for actions needed to conserve and protect threatened coastal and marine species and ecosystems with special emphasis on coral reefs; and
 - (iv) define priorities for to formulate and implement actions to plan, establish and manage coastal and marine protected areas in the Indian Ocean region.

Long Term

To ensure the long term conservation and protection of coastal and marine species and ecosystems of South Asia and the neighbouring countries by implementing activities that contribute to the fulfillment of conservation requirements of the Action Plan for the Protection of the marine and Related Coastal Environment of the South Asian Seas Region. Institutional, Social and Economic Factors.

The expected outputs from this project is as follows:

- a) Present status report on management of the coral reef eco-system and the identification of the institutional mechanisms available & the current needs in the region.
- b) Training of personnel in management methodologies of conservation and protection of coastal and marine species and ecosystems.
- c) Classification of the coastal and marine biogeography of the region using widely acceptable and compatible approaches, concepts and methodology.
- d) Formulation of a set of recommendations for actions needed to conserve and protect threatened coastal and marine species and ecosystems with special emphasis on coral reefs.

The activities planned for this project are as follows:

Initially a **Consultative Meeting** will be convened at the SACEP Secretariat whereby a minimum of 3 Experts on Coastal Zone Management with special emphasis on Coral Reef Management will be invited to participate and assess of the present status with respect to the management of the coral reef eco-system and the identification of the institutional mechanisms available & the current needs in the region.

Based on the assessment made, this Consultative Committee would draw up 2 appropriate medium term **"Training Courses on Coral Reef Management"** for the Maldives and Sri Lanka taking into account the training facilities available in the region and also the appropriate institutional mechanisms currently available in the region to utilise the trained manpower. These Training Courses would include among other subjects Management Methodologies for Coastal Zone Management and Coral Reefs, Tourism, Fisheries, Coastal Construction, Environmental Protection etc.

The Consultative Committee would also determine the number of personnel that initially need to be trained based on the national requirements and would also determine the course content and duration. They would also identify suitable Resource People and suggest suitable Institutions within the region which could conduct these courses. This project will be implemented with the active participation of SACEP's Focal Point for this Subject Matter Area, namely, the Marine Research Section, Ministry of Agriculture & Fisheries, Maldives.

The funding approved for the first phase of this project is US \$ 47,250.

The Second Project which will be implemented will be with the International Maritime Organisation (IMO). They have agreed to assist SACEP in the updating and finalisation of the Regional Oil Spill Contingency Plan for the South Asian Seas Region. The total cost of this activity is US \$ 35,000 and UNEP has agreed to fund this project. It is expected that this activity will be completed before the end of 1996.

The third Programme Activity which the Secretariat has undertaken is the submission to United Nations Environment Programme Global Environment Facility, a Proposal for a PDF Block B Grant, under the Focal Area of International Waters / Biological Diversity titled Development of a Strategy, including the Refinement of the Programme of Action for the Protection of the Marine, Coastal and Associated Freshwater Environment from Land-based Sources Pollution in the South Asian Seas.

The funding requested from GEF is US \$ 350,000 with in kind contributions from the concerned Governments (US \$ 50,000) and SACEP (US \$ 20,000)

The background to this proposal is that an Intergovernmental Conference convened in Washington D.C., from 23 October - 3 November 1995, adopted the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA) and the Washington Declaration. The GPA adopted calls for the strengthening of regional co-operative arrangement, strategies and programmes for, amongst others:

- (a) identification and assessment of problems and causes; and
- (b) establishment of targets and priorities for action.

This document clearly recognised and established that Regional and Subregional co-operation is crucial for development and implementation of successful actions in any activity, more so in the protection of both freshwater and marine environment from land-based activities. Such co-operation ensures more accurate identification and assessment of problems in particular geographic areas and more appropriate establishment of priorities for action in these same areas. It has been proven that such co-operation also strengthens regional and national capacity-building and offers an important avenue for harmonising and adjusting measures to fit the particular environmental, institutional and socio-economic circumstances.

The Washington Conference designated UNEP as the Secretariat of the Global Programme of Action, with the task of promoting and facilitating implementation at the national, regional and global levels.

Article 207 of the United Nations Convention on the Law of the Sea requires States to adopt laws and regulations to prevent, reduce and control pollution of the marine environment from land-based sources; to take measures as may be necessary to prevent, reduce and control such pollution and to endeavour to harmonise their policies in this connection at the appropriate regional level

Decision 11/10 of the Convention on Biological Diversity also encourages the use of integrated marine and coastal area management as the most suitable framework for addressing human impact on the marine and coastal biological diversity. There is specific reference to land-based activities in Annex 1 to this decision.

In Agenda 21, Chapter 17 identifies prevention, reduction and control of degradation of the marine environment from land-based activities as the main management-related activity contributing to this goal.

The Call to Action of the International Coral Reef Initiative (ICRI) concluded that coral reefs are in serious decline globally, especially those near shallow shelves and dense human population areas, and that the primary agent of this degradation is human activity (e.g. population growth, increasing pollution and use of the fragile resource), and, therefore, the need is urgent to manage those human activities.

GEF's Strategy for International Waters, Paragraph 4.10 indicates that priority will be given to comprehensive approaches to management that emphasises imminent environmental needs. Within this overall priority, GEF will place priority on addressing control of land-based sources and ground water pollution; prevention of physical or ecological degradation of critical habitats that sustain biodiversity, provide shelter and nursery areas for the production of fish protein sources, and otherwise are important for restoring and maintaining ecosystems associated with international waters; control unsustainable exploitation of marine living resources as well as nonliving resources.

Against this backdrop, SACEP prepared a proposal and submitted to UNEP for assistance. **The Main Objective** of the project is initially to review the already prepared **Draft Regional Review of Land-based Sources for the South Asian Seas Region** and activities affecting the quality and uses of the marine, coastal and associated freshwater environment, including the identification of "hot spots" and impacts of land-based activities requiring priority actions, as well as activities undertaken to achieve them as a basis for **Development of a Regional Strategic Action Plan** to address these problems.

The Review will be conducted within the overall framework of the Global Programme of Action, the Action Plan for the Protection and Management of the South Asian Seas Region, in close co-operation with its associated projects.

The regional review will be undertaken under the overall co-ordination of the SACEP which is the designated Secretariat for the implementation of the all activities coming under the Action Plan for the South Asian Seas Programme, with guidance from the Water Branch, UNEP, Nairobi, and in close co-operation with UNDP and the World Bank.

The use of national experts and institutions ensures a multi-disciplinary approach within the countries, and that they acquire the necessary expertise to ensure continuity in the follow-up of the project activities.

The PDF funds will be used for the following specific activities:

To comprehensively update the Draft Regional Review to include:

- (a) identification and assessment of problems and their causes;
- (b) quantification of pollution loads with a view to defining priorities for action; and
- (c) establishment of targets and priorities for action

The reviews will be prepared on the basis of the work done in the countries by nationals assisted by consultants, critical analyses and evaluation of available data and information provided by governments, as well as databases of relevant regional programmes, agencies of the United Nations System, Intergovernmental and Non-Governmental Organisations.

The **Consultants** will be engaged from the region to liaise with institutions in the countries and assist them and their experts to identify sources, quantify loads, and determine priorities for action as required and in close co-operation with Governments, Secretariat for SAS (SACEP), UNEP, UNDP and the World Bank. The Terms of Reference of these Consultants and the selection of them will be responsibility of the Secretariat for SAS (SACEP) in close collaboration with UNEP, UNDP and the World Bank. The review will be submitted to a Regional Workshop as a basis for discussion, and will be finalised taking into consideration inputs from the Workshop participants and the National Reports.

The **Regional Consultant** will visit each of the five countries, make institutional arrangements for collection of raw data from which quantitative estimates of pollution loads will be made, and return after specified periods to work relevant institutions to prepare a document containing quantitative estimates, the major sources of entry into the coastal and marine environment (lagoons, estuaries, rivers, creeks), the danger they constitute to the coastal development of resources, and recommendation for action based on the priorities defined.

PDF Outputs will be a comprehensive regional review on assessing land-based sources and activities affecting the marine, coastal and associated freshwater environment & the preparation of a Project proposal for the development of a Regional GPA Strategic Action Plan.

This proposal was submitted in July 1996 and a response should be forthcoming shortly.

At the recently concluded **International Coral Reef Initiative (ICRI) Workshop for the South Asian Region**, SACEP as the Secretariat for the South Asian Regional Seas Programme was designated to act as the Secretariat for ICRI. A **Junior Programme Officer**, funded by British ODA and UNEP will be assigned to SACEP to implement programme activities in this important area of activity.

Conclusion

Twelve years was indeed a long time to wait to see a fulfillment of a dream. However this wait was worth the while, and today the marine member states of SACEP see the fruits of realisation of the dream of bringing to South Asia, what is considered by many as the "**Crown Jewel of UNEP**" - **THE REGIONAL SEAS PROGRAMME**.

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UNEP'S CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

Dr. Wimala Ponniah

Ever since it was created, as an outcome of the United Nations Conference on the Human Environment convened in Stockholm in 1972, UNEP has recognised that environment and development are closely linked. UNEP actively promotes environmentally-sound and sustainable development; development which maintains and improves economic progress without damaging the environment and the natural resource base upon which future development depends.

UNEP was set up to catalyse, co-ordinate and stimulate action within the UN system, not to execute or to finance environmental programmes and projects. When the Governing Council first met in 1973, it outlined UNEP's goals which are actively pursued with a multitude of different partners. Although its central task lies within the UN system, it also works with and through intergovernmental and non-governmental organisations and with the scientific community, through research centres and institutes in many countries.

The environmental threats facing the world are so great and so universal that no country, or group of countries, can hope to tackle them alone. They compel us to act together as a world community. They require us to forge a global partnership. The achievements have been heartening in almost all of UNEP's subprogramme elements such as Climate Change, Industry and Environment, Capacity Building and the Regional Seas Programme to name a few.

UNEP'S CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

Dr. Wimala Ponniah

Ever since it was created, as an outcome of the United Nations Conference on the Human Environment convened in Stockholm in 1972, UNEP has recognized that environment and economic development are closely linked. Sound environmental management for sustainable development has long been the guiding philosophy of UNEP. Thus UNEP actively promotes Environmentally Sound and Sustainable Development (ESSD) or development which maintains and improves economic progress without damaging the environment and the natural resource base upon which future development depends.

The United Nations Environment Programme is not an institution, but a programme which comprises all the activities undertaken within the United Nations system that relate to the environment. The Secretariat in Nairobi services and co-ordinates that programme. As the General Assembly resolution did not name it, it became known simply as "UNEP".

Unlike other specialized agencies such as the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), UNEP does not bear the prime responsibility within the UN System for executing projects in its area of concern. Nor like the United Nations Development Programme (UNDP), does it exist to fund them. Although UNEP runs some projects of its own and uses some of the Environment Fund to support the environmental activities of others, its primary role lies elsewhere.

Unique among United Nations bodies, it exists as a catalyst, spurring others to act and working through and with other organizations, including UN agencies and governments, and only sometimes sharing the credit for the achievements.

The achievements are heartening. The following pages are not intended to give an encyclopedic list of UNEP activities over the last 24 years of its history, but to highlight most of the major subprogramme elements and activities, some well entrenched in the environment programme and others fairly new and successful, all of which aim at promoting environmentally sound and sustainable development.

Caring for Land Resources

Desertification is a major global concern which puts at risk the livelihoods of a billion people dependent on the drylands for their survival. UNEP alerted the international community to this issue and coordinated the United Nations Plan of Action to Combat Desertification, now succeeded by the Convention to Combat Desertification. After strongly supporting the Interim Secretariat for the Convention, UNEP's activities in Desertification control now focus on achieving strong support and effective implementation of the Convention. UNEP is also Task Manager on Desertification for the Commission on Sustainable Development.

The Land Sub-programme covers other global issues such as food security and sustainable agricultural practices. The programme is closely related to the Water, Atmosphere and Biodiversity Sub-programmes coordinated within UNEP's integrated Natural Resources Programme. The drylands cover 40 per cent of the world's land surface and their interactions with climate and water are becoming more widely appreciated; so also is the specialised biology

on which the productivity of the soil depends. UNEP's intention is to achieve heightened global awareness of the crucial importance of the drylands - the cradle and breadbasket of mankind.

To achieve these ends UNEP has four main activity areas namely; awareness-raising on dryland problems; the assessment of the phenomena of Desertification; promoting action to combat Desertification; the social dimensions of land degradation and the promotion of sustainable practices.

UNEP believes in action through partnership at all levels and is actively seeking to strengthen existing partnerships (UNDP, FAO) and to form new ones involving the United Nations (IFAD, World Bank), governments, NGOs, community organisations, scientific institutions and the private sector. A UNEP priority is to emphasize and popularize positive aspects in environmentally sound land management and community action, including adoption and use of commercially useful species and dryland products.

UNEP, together with other United Nations organisations and NGOs, works towards identifying the social and economic linkages to land degradation and provides an up-to-date analysis of, and information on, the major issues involved. Another important activity is to increase people-oriented approaches to sustainable land-use through recognition and dissemination of successful practices in land degradation control.

Climate Change

Throughout time, the earth's climate has experienced many changes oscillating between the ice age and the interglacial periods. Such changes are natural and probably occur as a consequence of orbital changes in the planetary system or other cosmic events. Climate change brings about significant alterations in the biosphere with species burgeoning, migrating and even disappearing depending on how they are able to adapt to the changing conditions. Glaciers retreat in warm periods with ice melt and expanding seas, lifting sea levels by tens of metres. In cold times seas fall to uncover new islands and expand shorelines.

Presently climate is again changing, more rapidly than in any other historical period. The cause is not natural but instead responds to increasing concentrations of carbon dioxide and other radiatively active gases in the atmosphere, primarily through emissions of these gases from industrial development, mostly from countries of the North but more recently also from the newly industrialising countries.

As happened during previous fluctuations, the environment is likely to be severely impacted. However, people and their increasingly sophisticated social and economic systems continue to be vulnerable to rising temperatures and oceans, changing rainfall patterns and unfamiliar weather extremes.

People are, largely unwittingly, the cause of climate change but they can also prevent the changes reaching levels dangerous for the environment. To do so needs an extraordinary partnership of effort, immense will and possibly sacrifice.

Regional decision-making for responding to climate change needs reliable assessments of the underlying causes and impact. The authoritative assessment of climate change, its potential consequences and the range of response options represent the collective opinion of the participants in the Intergovernmental Panel on Climate Change (IPCC) established by UNEP

and WMO in 1988. A second assessment report has just been adopted (1995) and a third assessment will be made towards the end of the century. UNEP shares the IPCC Secretariat with WMO, makes scientific contributions to the assessment process, assists developing countries to take part in the Panel's work and through its Information Unit on Climate Change ensures wide dissemination of the IPCC results.

The United Nations Framework Convention on Climate Change (UNFCCC) is the umbrella treaty under which governments are deciding and implementing actions to mitigate climate change. UNEP supports the UNFCCC Secretariat through the secondment of expert staff and contributes to information exchange among parties through the CC:INFO system operated through the Secretariat.

UNEP provides a forum for discussion and consensus building between developed and developing countries and, in this capacity, is exploring some of the issues of concern, particularly contentious issues among UNFCCC Parties. UNEP is presently looking at the issues of activities implemented jointly and of technology transfer. Reviews of these and future issues, examined in a series of targeted workshops, may help Parties to obtain a clearer picture and ways of avoiding the difficulties of approaches towards managing climate change.

Environmental Citizenship

UNEP's mission is: *"To provide leadership and encourage partnership in caring for the environment by inspiring, informing and enabling nations and people to improve their quality of life without compromising that of future generations."* The concept of Environmental Citizenship lies at the heart of this mission and encapsulates many strands of how UNEP and other information outlets have been engaging in environmental work.

The essence of environmental citizenship is an informed and mobilised civil society, through education in the broadest sense of the word. Public education and information activities are an important instrument for improving general environmental literacy and a means to unleashing the energy and creativity of people in their communities around the world.

One of the fundamental prerequisites for the achievement of sustainable development is broad public participation in decision-making. The 'commitment and genuine involvement of all social groups' advocated in Agenda 21 can only be assured with the careful targeting of different stakeholders in society so that they consciously try to live sustainably in their daily, normal existence. In this regard, therefore, environmental citizenship is simply the idea that people and their organizations have a responsibility to conserve the environment.

The global environmental citizenship programme seeks to assert the ethical obligations of different sectors of society needed to protect life on Earth. The tools for inculcating environmental citizenship include special information packages, features, news releases, exhibits, publications and regular contact with the media and governments. Special campaigns such as the Clean Up the World Campaign, special events such as World Environment Day, awards such as the Global 500 Prize, audio-visual productions and photographic competitions, conferences and workshops, manuals, booklets and magazines aim at alerting people to environmental issues and to stimulate community and non-governmental action.

The cornerstone of UNEP's environmental citizenship programme is partnerships with international, regional, national, local and community-based organisations. The work of these organisations - non-governmental organisations, women's, youth, religious and consumer groups and service clubs, to name a few have a great multiplier effect as they communicate with their

memberships and constituencies on a regular basis. The role of these partners is, in addition to serving as effective channels of communication with their constituencies, to shape UNEP's output and to make it relevant and responsive to the real needs and requirements of users.

Behavioural change is the ultimate goal of UNEP's global environmental citizenship programme, UNEP hopes to achieve this through an alliance of partners including consumer organisations and especially the media.

Environment and Economics

A key challenge in promoting sustainable development is the integration of environmental considerations into development planning and decision-making. In Chapter 38 of Agenda 21, governments called upon UNEP to focus on "developing and promoting techniques such as natural resource accounting and environmental economics, and to concentrate on the further development and promotion of the widest possible use of environmental impact assessment, including activities carried out under the auspices of United Nations specialised agencies".

UNEP's Action Programme on Environment and Economics was initiated in 1993 and is being implemented in close collaboration with other relevant organisations. The programme emphasises practical approaches for strengthening national capacity-building in developing countries and countries in transition to market economies in four specific areas. They are; valuation of environment and natural resources; environment and natural resource accounting (ERA); economic instruments; environmental impact assessment.

The main objectives of the Environmental Economics programme are:

- a) To further develop environmental economic tools for the integration of environmental considerations into development planning and decision-making;
- b) To contribute to international efforts leading to the promotion and application of environmental economic tools;
- c) To promote the integration of physical, social, environmental and economic aspects into development planning (projects, programmes and policies);
- d) To promote the understanding of the implications of environmental standards, policies and agreements for developed and developing countries and Countries in Transition (CITs);
- e) To enhance understanding by both developed and developing countries to the costs and benefits of adopting sound environmental management and sustainable development;
- f) To identify actions required as well as institutional, human and financial resource requirements to implement sustainable development programmes;
- g) To promote the implementation of international environmental agreements and programmes;
- h) To establish and maintain a network of international institutions in environmental economics;
- i) To enhance the capacity of developing countries in the use and application of integrated economic analysis and instruments.

The conceptual framework, methodologies and approaches for the implementation of activities are contained in the work programme. The focus of the work programme during 1996/1997 will be on field testing, whilst the implementation of the Action Programme will be based on four strategies namely; review and analyse the experience of countries from all the regions; linkages and support to UNEP's programmes; ensure coordination (United Nations system, international,

national and research institutions); enhance and strengthen capacity-building of developing countries and CITs to implement environmentally sound and sustainable development programmes.

Environment and Natural Resource Information Networking

UNEP's environmental data and information networking activities comprise the following: INFOTERRA, a comprehensive information exchange network to stimulate and support scientific and technical query-response services; GRID, the Global Resource Information Database network of collaborating data centres, and the Environment and Natural Resource Information Network (ENRIN), a capacity-building programme for data management in support of environmental assessment and reporting tasks and to manage appropriate GRID or INFOTERRA compatible databases.

The capacity-building projects focus on: environment and natural resource assessment; State-of-the-Environment reporting (SOE); Global Environmental Outlook (GEO) referenced database development and use, emphasizing the transfer of assessment methods and GRID compatible analytical geographic information technology, and environmental information exchange through the INFOTERRA national focal points.

The desired result is to ensure better access and more effective use of environmental data and information for decision-making through a cooperative assessment framework, built upon groupings of environment information networks servicing existing sub-regional and regional cooperation agreements. The combined resources of these environmental database and information custodians will assist member states in undertaking collaborative assessments of environment and development issues relating to internationally shared resources.

The ENRIN approach to capacity building has four steps, each carried out with partner institutions. First, consultations are held to evaluate requirements and develop strategies to address priority environment assessment, reporting and/or associated data management issues.

Next, on the basis of regional or national consultations, representatives of participating countries and institutions and ENRIN formulate investment projects to enhance or develop the necessary institutional skills, technology and staff capacities.

Third, a joint effort is made to secure financing for implementation. Seed funding from the Environment Fund of UNEP is used to leverage funds from multi lateral and bilateral donors. Finally, long term technical backstopping is provided through in-kind contributions from the GRID and INFOTERRA networks.

Gender and the Environment

Sustainable development will be achievable, only if humankind accepts the unique contributions of women and men as equal partners with a shared responsibility for the care of the planet. Even though women have played a critical role in environmental management on the ground, in most instances, their knowledge and experience has not contributed significantly to the environmental decision-making processes at local, national, regional or global levels.

Within UNEP's core mandate to protect and preserve the environment in the interest of all human beings, the promotion of equity between men and women in environmental planning and the resolution of environmental problems has been a longstanding concern.

The call for gender equity was strengthened by the United Nations Conference on Environment and Development (UNCED), in 1992 namely Agenda 21, Chapter 24 which mandated that gender considerations be fully integrated into all United Nations policies, programmes and activities and by the Beijing Platform for Action, section K of Chapter IV which called upon UNEP to integrate women and environment issues.

To further these global mandates, UNEP's Governing Council has adopted two decisions 17/4 (May 21, 1993) and 18/6 (May 26, 1995) calling for the full integration of gender issues into UNEP activities and for equity in the hiring and promotion of women in the secretariat. To ensure that the directives of the two Governing Council sessions are met, UNEP's Programme of Work for 1996-1997 has set up a Gender Issues Office under the Policy and External Relations Division.

UNEP seeks to promote the sharing of best practices in environmentally sound management and problem solving which have been initiated by women. These achievements are then analysed so that they can be built upon and utilised in differing situations. Research is also undertaken on mechanisms and methodologies to build the capacity of women's organizations involved in environmental awareness raising and management. Emphasis is placed on recognition and understanding of the values, knowledge, and resource management practices of indigenous communities as it might be applied to contemporary environmental challenges. A pilot project has been designed to use indigenous knowledge as a tool for women's empowerment. In cooperation with the NGO community, a pilot project has also been designed to create gender assessment criteria to screen environmental projects and to develop gender-sensitive public awareness campaigns.

Global Environmental Outlook

One of the major components of the new UNEP's State of the Environment Programme is the Global Environment Outlook (GEO) project, a region-based, participatory, global assessment project, addressing current and emerging environmental issues, within the socio-economic development context.

The major features of the GEO project in process are as follows. A policy-oriented biennial report series to keep under review the state of the world's environment, identify major current concerns, trends and emerging issues, their causes and impacts and possible international policy options and actions to address them; a global network of approximately 20 assessment Collaborating Centres; four international working groups to develop policy-relevant, integrated assessment and forecasting methodologies, and integrate and harmonize development efforts and region-based consultative processes, based on UNEP's Regional Offices networks

The overall objective of the plan is: to promote the effective implementation of a policy for conservation and management of marine mammals which is as widely acceptable as possible among governments and peoples of the world.

Industry and Environment

The Industry and Environment Programme was established by UNEP to promote sustainable development of industry. It provides a platform for dialogue between the various partners concerned, and acts as a catalyst for action.

The goals are to; build consensus for preventive environmental protection through cleaner and safer industrial production and consumption patterns; help formulate policies and strategies to achieve cleaner and safer production and consumption patterns, and facilitate their implementation; define and encourage the incorporation of environmental criteria in industrial production; stimulate the exchange of information on environmentally sound technologies and forms of industrial development.

To achieve these goals, UNEP has developed five main programmes in the Industry and Environment area; awareness and preparedness for Emergencies at Local Level (APELL) to promote industrial accidents prevention; cleaner production (CP), to catalyse pollution prevention, and make efficient use of raw materials; Ozone Action, to promote the phasing-out of the use of ozone depleting substances; Industrial Pollution Management, to help improve pollution control in specific industrial sectors and tourism; Environmental Technology Assessment (EnTA), to encourage the use of Environmentally Sound Technologies.

Partnerships in Capacity-Building

UNEP's Capacity-building Mandate is to provide support to governments in the integration of environmental issues into their development policies and programmes, provide technical, legal and institutional advice to governments, provide special expertise and operational capacity in the environmental field to capacity- building projects and programmes of United Nations organisations, and provide training.

The areas of expertise include:

- a) Monitoring, assessment and management of fresh water resources;
- b) Integrated coastal area management, in particular: development of coastal profiles; coastal strategies and management plans; assessment and control of pollution; assessment and monitoring the state of the marine environment, conservation and management of marine mammals and coral reefs;
- c) National biodiversity planning;
- d) Management and risk assessment of bio-technological applications;
- e) Impact assessment of climate change and adaptation strategies;
- f) Management of dryland resources, desertification/land degradation monitoring and assessment;
- g) Environmentally sound management of human settlements, in particular: pollution control, waste water use and solid waste management, environment-health linkages;
- h) Toxic chemicals and hazardous waste management, chemical risk assessment;
- i) Industrial pollution management, cleaner production, prevention of, and response to, industrial accidents;
- j) Promotion and transfer of environmentally sound technologies;
- k) Prevention of, and response to, environmental emergencies;
- l) Sustainable tourism;
- m) State-of the environment reporting, environmental and sustainable development indicators, data collection and processing methods, GIS, remote sensing and data base management, environmental information systems and networks;
- n) Promotion of environmental awareness and mobilisation of environmental actions through the empowerment of major groups by networking, information exchange and through participation. Query-response services;
- o) International environmental law and national legislation and institutions for environmental management;

- p) Economic tools, Economic instruments, valuation of environmental and natural resources, environmental and natural resource accounting;
- q) Environmental Impact Assessment (EIA);
- r) Trade and the environment, integrated trade and environment objectives for sustainable development;
- s) Environmental education, integrated and specialised environmental management training;
- t) Gender and the environment.

Public Information and Awareness

UNEP implements a comprehensive information and public relations strategy in support of UNEP's programmes and regional priorities. It is not an easy task. UNEP has not only to disseminate the findings of science and technology in a simple, easy to understand language, but has also to play a leading role in enhancing awareness and better understanding of environmental problems. Raising public awareness is linked to almost all areas of Agenda 21.

Three major themes have been identified, namely; environmental citizenship; public information, awareness; empowerment of selected agents of change.

Sustainable Production

The unsustainable patterns of production particularly in industrialised countries, continues to cause deterioration of the global environment. There is a need to address the demand for natural resources and to the efficient use of those resources consistent with the goal of minimising depletion and reducing pollution.

Within this context, the need to re-orient production processes, products, and services has emerged as a key issue on the sustainable development agenda at UNCED. UNEP's Cleaner Production Programme is one of the initiatives underway that aims to bridge the existing information and capacity gap on sustainable production and consumption issues, focusing primarily on production.

UNEP Cleaner Production Programme was launched in 1989 as a response to a request of UNEP's Governing Council with the following objectives:

- a) Increase worldwide awareness through developing and establishing a consensus on what "cleaner production" is;
- b) Promote the exchange of information on environmental policies and strategies, environmentally sound technologies, environmental management systems, and products;
- c) Support the growing international network of organisations with cleaner production activities to exchange experiences;
- d) Support demonstration projects and help build capabilities through training, education, technical assistance through the establishment of National Cleaner Production Centres.

To realise these objectives, the Programme organizes its work in two priority areas: capacity-building and information transfer.

The exchange of information on cleaner production is one of the most important elements of the Programme. The information is collected and transferred through various means, including

publications, diskette database, and individualized query responses. In order to provide information in the most effective way, UNEP monitors and adapts information distribution mechanisms.

The International Cleaner Production Information Clearing-house (ICPIC) Diskette contains, technical case studies of cleaner production applications, examples of successful policies and strategies, publication abstracts, and listing of contacts and institutions involved with cleaner production activities.

The Query service: offered by the Programme helps explain the concepts, demonstrates the technical and policy feasibility of cleaner production, and provides information on how to implement it.

The Regional Seas Programme

The Regional Seas Programme was created in 1974 as a global programme implemented through regional components. At present, it includes thirteen regions world-wide with well over 140 coastal States and Territories participating. It is an action-oriented programme focussed not only on the mitigation or elimination of the consequences but also of the causes of environmental degradation. It has a comprehensive, integrated, result oriented approach to combating environmental problems through the national management of marine and coastal areas. The success that the Regional Seas Programme has had since its inception in 1974 - twenty two years ago lies in its result oriented approach.

The Regional Seas Programme presently has numerous activities in the area of integrated coastal area management, including projects, training, awareness exercises, seminars, workshops, curriculum development, etc. and is taking a lead role on issues such as **land-based sources of pollution, environmental economics and natural resource accounting, and small islands**. In some of the major activities it cooperates closely with the World Bank and FAO, but also with most of the other United Nations agencies.

Environmentally Sound and Sustainable Development

Desertification, deforestation, river pollution, chemical hazards, soil erosion, industrial emergencies, acid rain, coastal and marine degradation, the retreating fisheries - this is the litany of development without environmental accounting.

We talk glibly of "environmental problems" but let us be very clear, from the outset, that although environmental deterioration involved changes in the natural resources (air, water and soil), these changes were due to human action rather than some natural cataclysm. In essence, an environmental problem is more of a social problem, than a scientific or technological one.

The cause of the environment is a battle fought in the present for the future. Tomorrow - as today - all life will depend on the life of our one earth - our air, water, soils, forests, fauna and seas. If we fail today to protect and enhance that web of natural resources we forfeit the future. Harsh experience has shown that there is no alternative to development without destruction or environmentally sound and sustainable development.

Environmentally sound and sustainable development is durable development which uses the natural resource base without degrading it. The natural resource base is finite, so its future use can only be guaranteed by husbanding it. Exploiting a resource to exhaustion can bring quick

profits - but there will be no long term dividends. If we exhaust our natural legacy, we will have less or little to pass on to future generations.

Managing the earth's resources in an environmentally sound and sustainable manner will require leadership across the board - in government, in international organisations, in the private business sector and right down to the individual citizen, each one of us. It will also require unprecedented global partnerships in international co-operation and the mobilisation of the innovation, dynamism and resourcefulness of the private sector.

The world today is at the crossroads of two alternative paths. One is the path signposted by unsustainable growth patterns and of seeking security through ever new refinements in the means of mass destruction. This path leads, literally, to a dead end. The other path is the path of environmentally sound and sustainable development and global co-operation. The United Nations Conference on Environment and Development at Rio has shown that this path can be taken - and the goal reached within a reasonable time-frame. It is for us to ensure that the right path is chosen.

Agenda 21, as we are all aware, is not a one-time prescription for curing the ills of our planet. Rather, it is a new framework of cooperation amongst governments and the many other institutions and sectors of society that might be engaged in its implementation to effect the transition to environmentally sound and sustainable development. Agenda 21 is a global programme. But it can only be implemented by actions taken at various levels local, national and regional and by a broad range of organizations, governmental and non-governmental.

UNEP's mission statement encapsulates not only what the organisation does and why it does it but, more importantly, how it does it through partnerships. In essence, UNEP is here to provide leadership and encourage partnerships in caring for the environment by inspiring, informing and enabling nations and peoples to improve their quality of life without compromising that of future generations." UNEP counts on each one of you to help make this a reality for the well being of our planet Earth.

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NETWORK FOR ENVIRONMENTAL TRAINING AT TERTIARY LEVEL IN ASIA AND THE PACIFIC

Mahesh Pradhan

The primary objective of the Network for Environmental Training at Tertiary Level in Asia and the Pacific (NETTLAP) is to enhance the capacity of environmental education and training institutions to conduct both degree-based and continuing professional development programmes of high quality and relevance. Governments in the region requested a focus on tertiary institutions, such as universities, technical institutes and teacher training colleges, due to the high multiplier effect of these initiatives.

In developing countries, in particular tertiary institutions are typically the primary forum for environmental training. Moreover, due to the current shortage of qualified personnel, graduates of courses offered by tertiary institutions in the region soon gain positions of responsibility in government and industry.

By “ training the trainers” of both the current and future environmental managers, NETTLAP capitalises on an opportunity with a large cost-benefit ratio. However, with thousands of tertiary institutions in the fifty four countries comprising Asia and the Pacific region, the challenge is to link with the multitude of trainers in an effective manner.

The Network was established at the request of member governments and there are now 35 countries with government-nominated National Focal Points for NETTLAP. Membership of the network has grown to over 2000 individuals who are active in environmental education and training at tertiary level.

NETWORK FOR ENVIRONMENTAL TRAINING AT TERTIARY LEVEL IN ASIA AND THE PACIFIC

Mahesh Pradhan

In 1983 the eleventh Governing Council of UNEP requested the Executive Director "... to convene a meeting of experts from the governments and scientific community to develop a programme of action for environmental education and training in Asia and the Pacific region ...". In response to this decision the Executive Director convened "*The Meeting of Experts to Develop a Programme of Action for Environmental Education and Training in Asia and the Pacific*" in Bangkok, from 11-15 November 1985. The meeting was attended by representatives from fifteen countries in the region as well as nine representatives from United Nations and regional organisations.

The overall objective of the Programme of Action that was developed during the meeting was to provide a framework for catalysing, co-ordinating, and organising environmental education and training activities in the Asia-Pacific region at national, sub-regional, and regional levels for both formal and non-formal systems of education and training directed towards environmentally sound socio-economic development. The Programme of Action was consistent with the recommendations of the 1977 Tbilisi Intergovernmental Conference on Environmental Education and Training which was convened within the framework of the UNESCO-UNEP International Environmental Education Programme.

The meeting formed two Working Groups, one to consider the formal and the other the non-formal aspects of environmental education and training in the Asia-Pacific region. Details of the Programme of Action are outlined in the report of the meeting: *Environmental Education and Training in Asia and the Pacific* (UNEP, 1986). The consultative meeting, which identified greater collaboration and interaction in environmental education and training in the region as an important issue, agreed to launch an Asia and Pacific Network for Tertiary Level Environmental Training in order to:

- (a) exchange information on courses, training programmes, and research activities;
- (b) facilitate the exchange of experts; and
- (c) serve as an advisory group for environmental education and training in the region.

The Network for Environmental Training at Tertiary Level in Asia and the Pacific (NETTLAP) was established and is supported by UNEP to facilitate the transfer of outputs from its various sub programmes into the tertiary institutions of the region and thence into the public and private sectors and the community at large. Armed with the methodologies, tools and information related to environmentally sound and sustainable development, decision makers and others in the public and private sectors, will be better equipped to make optimal policy and management judgements regarding natural resources, people and the environment. NETTLAP is now used to disseminate a wide range of materials, not only from UNEP sources (both Headquarters and out posted offices) but also those emanating from non UNEP sources. In addition, governmental and non-governmental organisations are involved in the planning and implementation of project activities, where relevant, to ensure that the ultimate requirements of the participating countries are addressed in an appropriate manner. This approach will have the benefit of providing a distinct and effective focus for the project, thereby avoiding duplication of other environmental training efforts while at the same time ensuring that effective linkages are in place.

NETTLAP contributes to human resources development and the strengthening of tertiary institutions in the Asia-Pacific region. These are recognised, in Agenda 21 and elsewhere, as two of the key strategies in capacity building required to equip developing countries with the ability to pursue their goals of social and economic development while at the same time protecting the environment and conserving natural resources. More specifically, it has been recommended in Chapter 36.5(i) of Agenda 21 that "*Countries could support university and other tertiary activities and networks for environmental and development education . Existing regional networks and activities and national university actions which promote research and common teaching approaches on sustainable development should be built upon, and new partnerships and bridges created with the business and other independent sectors as well as with all countries, for technology know-how, and knowledge exchange.*"

The Role of NETTLAP

Staff of tertiary institutions (i.e. universities, technical institutes, training institutes and teacher training colleges) are key targets for environmental training for various reasons, including the:

- large multiplier effect inherent in training such staff, this arising from the immediate transfer to colleagues and to participants in tertiary education and training programmes (degree and diploma programmes, short courses, continuing education and continuing professional development courses etc);
- important role played by tertiary staff advising industry and government, including government ministers with respect to UNEP's priorities and achievements;
- frequent involvement of staff as technical consultants to government and in the private sector;
- important standing of staff as community opinion leaders; and
- existing experience of tertiary staff in environmental training, with reference to knowledge and skills base that should be built upon.

It is for reasons such as these that countries of the Asia-Pacific region called on UNEP to establish NETTLAP and involve staff of tertiary institutions in its environmental training programmes, as both participants and resource persons. NETTLAP is now a key component of UNEP's Regional Office for Asia and the Pacific (UNEP/ROAP).

The network consists of institutions and individuals active in environmental education and training at tertiary level in the Asia-Pacific region. NETTLAP works closely with its government appointed National Focal Points (NFPs) in the 36 countries participating in the Network. This ensures that the environmental training needs of countries in the region are clearly identified and optimum use is made of existing expertise and other natural resources.

Currently NETTLAP links over 200 key tertiary institutions and more than 2000 staff members who are active in environmental education and training and who can contribute to and/or benefit from the availability of resource materials and training programmes related to environment and development.

The objectives of the Network are fourfold. Firstly, to enhance the environmental expertise of tertiary level educators and through them the knowledge and skills of decision makers and policy formulators. Secondly, increase the environmental skills and awareness of tertiary level graduates. Thirdly, to enhance environmental technologies, and capacities for their use. Fourthly, to, strengthen the overall environmental expertise in the region at technical,

management and policy levels.

These objectives are to be achieved by:

- a) updating and strengthening environmental courses and programmes, and the environmental content in other specialised courses;
- b) preparation and dissemination of curricula guidelines, resource materials, learning aids and packages for environmental training;
- c) encouraging and disseminating innovative methods in environmental training;
- d) identification of needs and sharing of knowledge through ongoing interaction amongst network partners;
- e) implementation of targeted technical Training and Resources Development Workshops.

Achievement of NETTLAP's objectives is facilitated by the use of Thematic Networks, each with a Thematic Network Co-ordinator (TNC). Currently there are three on; Toxic Chemicals and Hazardous Waste Management; Coastal Zone Management; and Environmental Economics. The Regional Consultative Meeting on Environmental Training at Tertiary Level in Asia and the Pacific convened in November 1995 recommended that two additional themes be included to the existing three, namely on: Environmentally Sound Technologies and their Transfer; and Environmental Law. For each theme, sub-regional Thematic Network Nodes (TNNs) have been established to enhance coverage of the vast Asia-Pacific region.

National Partnerships for Environmental Training

The question of how to develop and benefit from partnerships when key players are working at different levels - international, national and local was discussed during the Regional Consultative Meeting on Environmental Training at the Tertiary Level in Asia and the Pacific which was convened in November 1995. In other words, how was it envisaged that the immense amount of information and the technical and practical expertise held by international organisations can be shared with those at the "grass roots" who literally have the destiny of our environment in their hands? As a consequence, NETTLAP has developed a response captured in the title *National Partnerships in Environmental Training* (NPET). At the international and regional levels the key players in this strategy are those organisations that are capable of providing an "umbrella" of support, principally at the technical level (e.g. UNEP) and at the financial level (e.g. DANCED, UNDP). Examples of other partners at this level would be the ASEAN Environment Committee.

At the national level the key players include government ministries with responsibilities related to environment and development. Examples include the Ministries of Environment, Health, Science and Technology and Natural Resource Development and national training institutes. Key partners at the local level include tertiary institutions involved in environmental education and training, local non governmental organisations and community organisations.

The local institutions are normally the nodes around which the other partners gather, creating in essence a local environmental training centre where there is expertise in training, administration and management. The target groups are those actively involved in local environmental planning and management - government officials, community opinion leaders, and academic and industrial organisations. The approach is to offer local training workshops that decision makers of integrate the information and methods developed at international and national levels with that available nationally and locally and transfer this capacity to partners who are charged with the responsibility for local environmental planning and management. Thus NETTLAP's strategy

brings together non-governmental and community-based organisations, as well as industry and government, in partnerships that strengthen the environmental education and training efforts of individual universities, technical institutes and teacher training colleges. The expertise, information and materials that NETTLAP gathers and disseminates at the regional level is readily accessible to these local partnerships. NETTLAP can provide a linkage between the resources available at the international level and the implementation at the national and local levels. In this way there can be an efficient transfer of the collective expertise and resources available for such international organisations as UNDP, WHO, ILO as well as UNEP working in partnership with such regional and national bodies as the Asian Development Bank and the Ministries of Environment of the respective countries.

The university training to be supported by the partnership should be based around flexible administrative structures and procedures for teaching and research to allow flexibility and promote responsiveness to emerging national, local and community needs and opportunities. Both remedial and preventative approaches to environmental planning and management should be emphasised. Consistent with integrated approaches to environmental planning and management, the training programmes should be interdisciplinary, thereby encouraging participants to transcend the boundaries of their own specialisations and consider issues and their solutions in their entirety.

Effective environmental planning and management requires that the practitioners not only be conversant with a wide range of disciplines, but that they also be skilled communicators, capable of advising decision makers and opinion leaders in ways which are complex enough to be realistic and scientifically correct, while being simple enough for lay people to understand and translate into action. Such an integrated approach to training has the benefit of providing an efficient use of resources by avoiding duplication of other environmental training efforts and ensuring that effective linkages are in place.

Implementation of NPET

Since NETTLAP reoriented its strategy to one of *Regional Co-operation through National Implementation*, major progress has been made with respect to establishing National Partnerships for Environmental Training in four countries. In addition to the substantive efforts in those countries, the intention is for these efforts to inspire other countries in the Asia-Pacific region to take similar initiatives with the support of NETTLAP and other agencies.

a) Philippines

With technical and other support from UNEP and UNDP, the Environmental Management Bureau of the Department of Environment and Natural Resources, Government of the Philippines, convened a National Consultative Forum of institutions and individuals active in environmental training. This was held in late September, 1995. The Forum decided to establish a network of institutions and trainers, with emphasis on regional clusters to ensure effective delivery of environmental training in all regions of the Philippines.

In response to decisions made at the National Consultative Forum, UNEP/ROAP has agreed to support the following activities: (a) preparation and publication of a National Directory of Tertiary Level Training Capabilities and Needs in Environmental Planning and Management;

(b) two one-day meetings of the Ad-Hoc Co-ordination Committee; and (c) a two day National Assembly for the Philippine Network of Tertiary Level Training Institutions in Environmental Planning and Management.

The Network also conducted Regional Consultative Meetings prior to the National Assembly known as the Philippine Association of Tertiary Level Institutions in Environmental Planning and Management (PATLEPAM), which was formally convened in March 1996.

NETTLAP will continue to provide technical support to the Philippines network and activities and ensure it has supportive linkages with institutional and individual members of NETTLAP, with UNEP, with other parts of the UN system and with other relevant organisations and institutions outside the Philippines.

b) Vietnam

UNEP provided catalytic support through NETTLAP's NPET strategy following a request from the Government of Vietnam to convene a National Forum of individuals and institutions active in environmental training. The Forum was to, identify national priorities for environmental training; review the draft national strategy for environmental education and training being prepared by the Government of Vietnam with assistance from IUCN, and assess the need for a national network for environmental training and, if appropriate, decide on the organisational structure and activities of the network.

The Forum recommended, amongst others, the early setting up of the Vietnam National Network for Environmental Education and Training (VIETNET), which would co-ordinate the implementation of the General Strategy on Environmental Education and Training. NETTLAP will provide technical support for VIETNET in order to help ensure it has supportive linkages with institutional and individual members of NETTLAP, with UNEP, with other parts of the UN system and also assist in the mobilisation of financial resources from external sources.

c) India

Following a request from the Government of India, UNEP provided catalytic assistance in the organisation and implementation of a National Consultative Forum of individuals and institutions active in environmental training. The main objectives of the Forum were to: (a) identify the needs for environmental training at tertiary level in the themes identified by NETTLAP as also other themes that may be relevant to India; (b) to identify the nodal institutions and individuals to be potential partners; (c) to identify target groups to be trained; and (d) to bring together various key players working at different levels, such as community groups, tertiary institutions (universities, teacher training colleges, professional training institutions, industry management, NGOs), nodal institutions for the identified themes to ensure effective delivery of environmental training at the national level. Discussions are currently ongoing between the Ministry of Environment and Forests and UNDP to collaborate in the implementation of the Partnerships for Environmental Training (PET) project in India.

d) Thailand and Malaysia

The Danish Co-operation for Environment and Development (DANCED) has identified NETTLAP as the preferred instrument to initiate an inter-university network for Training and Research on Environmental Management (TREM). Through the network, the project will provide initial direct financial support to units within universities in Malaysia and Thailand, and

for inputs from like-minded universities and research institutes in Denmark.

The objectives of TREM are to, improve education and research in environmental management in institutions of higher learning and research; improve environmental management expertise among decision makers, including politicians, and help strengthen the capacity for integrated environmental management in South East Asia. The network is designed to promote three key features of TREM: multi disciplinarity, relevance to current problems and opportunities; and flexibility, relevance and responsiveness to market demands.

Multidisciplinary approaches are needed in order to ensure that people recognise that environmental impacts, whether positive or negative, are fundamentally a reflection of social choices and that these choices are in turn based on economic costs and cultural values. Hence the key to more effective environmental management lies in being able to alter those costs and values through behavioural and technological change.

Emphasis will be placed on combining conventional and innovative training content and approaches to produce a new breed of environmental managers capable of problem solving using interdisciplinary knowledge and skills. Such managers will also be skilled communicators capable of advising decision makers in a language which is complex enough to be realistic and scientifically correct, yet simple enough for lay people to understand and translate into action.

Conclusion

There are large multiplier effects associated with training staff in tertiary institutions. The key is the multiple roles such staff have in capacity building for sustainable development. Particularly in developing countries, tertiary institutions are typically the primary forum for environmental training, often being contracted by the government and private sector to develop and implement training courses and programmes. Moreover, due to the current shortage of qualified personnel, graduates of courses offered by tertiary institutions in the region soon gain positions of responsibility in government and industry. In addition, staff of tertiary institutions often serve on government and non-government organisations where their advice may be highly influential. For these reasons staff from tertiary institutions help ensure that maximum benefits are gained from UNEP's environmental training activities at the regional level.

By "training the trainers" of both the current and future environmental managers UNEP capitalises on an opportunity with a large cost-benefit ratio. However, with thousands of tertiary institutions in the fifty-four countries comprising the Asia-Pacific region the challenge is to link with the multitude of trainers in an effective manner. One successful approach used by UNEP is to convene workshops attended by experienced trainers, not only from tertiary institutions themselves, but also from within government and the private sector.

In the interim, NETTLAP will also continue to encourage other developing countries in the Asia-Pacific region to consider the benefits of the National Partnerships for Environmental Training strategy, to review the progress being made in the countries currently implementing the strategy and to consider whether such approaches would be viable in their specific circumstances.

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GLOBAL ENVIRONMENT FACILITY

Berna Bayindir

The Global Environment Facility (GEF) is a mechanism for international co-operation for the purpose of providing new and additional grant and concessional funding to developing countries and economies in four focal areas namely; climate change, biodiversity, international waters and ozone layer depletion. Activities concerning land degradation, desertification and deforestation, as they relate to the four focal areas are also eligible for GEF financing.

The GEF activities are designed to be consistent with national and, where appropriate, regional initiatives; strive to ensure sustainability of global environmental benefits; reduce the risk caused by uncertainty; complement traditional development funding; facilitate effective responses by other entities to address global environmental issues; be environmentally, socially and financially sustainable and avoid transfer of negative environmental impacts between focal areas.

The GEF's implementing agencies are United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and the World Bank. UNDP is responsible for technical assistance activities and capacity building. Through its worldwide network of offices, UNDP helps to identify projects and activities consistent with the purpose of the GEF and national sustainable development strategies. UNEP catalyses the development of scientific and technical analysis and provides environmental management in GEF financed activities.

GLOBAL ENVIRONMENT FACILITY

Berna Bayindir

The Global Environment Facility (GEF) is a mechanism for international co-operation for the purpose of providing new and additional grant and concessional funding to developing countries and economies in transition to meet the agreed incremental costs of measures to achieve global environmental benefits in four focal areas namely, climate change; biodiversity; international waters; and ozone layer depletion. Activities concerning land degradation, primarily desertification and deforestation, as they relate to the four focal areas are also eligible for GEF financing. The GEF also serves as the financial mechanism for the international conventions on biodiversity and climate change and the eligibility of both of these conventions is reflected in the Operational Strategy for the GEF.

GEF was launched as a pilot program in 1991. During the pilot phase which started in 1991 and continued for three years, an estimated US\$ 730 million was allocated to fund a work program of 115 global, regional, and country projects. In March 1994, some 73 participating governments concluded negotiations for restructuring the Facility as a major source for global environment funding and the core fund was replenished with more than US\$ 2 billion to be committed during a three-year period. A council of 32 members representing participating countries now convenes biannually to adopt, review, and evaluate the operational policies. The Council approves GEF work programmes and directs the utilisation of GEF funds. An independent Secretariat was also established.

An operational strategy was developed to ensure that GEF resources would be used cost-effectively and to maximise global benefits. Approved by the Council in October 1995, this strategy is intended to provide a programmatic framework for stronger integration among the GEF's implementing agencies (UNDP, UNEP, and the World Bank), the Secretariat, the Scientific and Technical Advisory Panel (STAP), and the international conventions on biodiversity and climate change, for which the GEF provides operational support. The Operational Strategy sets policy, strategy, programme priorities and eligibility criteria for access to the financial resources.

Implementing Agencies

The GEF's implementing agencies are United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and the World Bank. UNDP is responsible for technical assistance and pre-investment activities and capacity building. Through its worldwide network of offices, UNDP helps to identify projects and activities consistent with the purpose of the GEF and national sustainable development strategies. UNDP's GEF portfolio includes a project in China to raise the energy efficiency of the rural industrial sector by selecting several key Township and Village Enterprises (TVE) to carry out demonstration projects involving improved technologies, innovation, maintenance techniques, technical information, and staff training. UNDP is also charged with running the Small Grants Programme (SGP) for non-governmental organisations (NGOs) and community groups around the world.

UNEP catalyses the development of scientific and technical analysis and advancing environmental management in GEF- financed activities. UNEP is also responsible for advancing greater responsiveness of the GEF to global environmental priorities through informed decision-making, by providing strategic inputs, and fostering complementarity between actions in each focal area. The Scientific and Technical Advisory Panel (STAP), an independent advisory panel that provides scientific and technical guidance to the GEF is managed by UNEP. Among the projects that are implemented by UNEP are Country Case Studies on Sources and Sinks of Greenhouse Gases, and the Global Biodiversity Assessment.

The World Bank is the repository of the Trust Fund, and is responsible for investment projects. Among the projects implemented by the World Bank is the Kerinci Seblat Integrated Conservation and Development Project in Indonesia. The project and associated IBRD loan will secure the future of the exceptionally biologically rich Kerinci Seblat National Park by integrating park management and conservation with local and regional development.

The GEF operations are programmed in three broad, interrelated categories namely; operational programmes; enabling activities; and short-term response measures.

Operational Programmes

An operational program is a conceptual and planning framework for the design, implementation, and co-ordination of a set of projects to achieve a global environmental objective in a particular focal area. It organises the development of country driven projects and ensures systematic co-ordination between the Implementing Agencies and other actors.

At present there are 10 operational programs which are described in a short reference document prepared by the GEF covering the focal areas of biodiversity, climate change, and international waters. There will be no operational programs for the focal area concerning ozone layer depletion. Activities in this focal area will be focused on short-term response measures and enabling activities consistent with the Montreal Protocol on Substances that Deplete the Ozone Layer.

The initial operational programmes are:

- | | |
|--------------------------|---|
| 1. Biodiversity | Arid and semi-arid ecosystems |
| 2. Biodiversity | Coastal, marine, and freshwater ecosystems (including wetlands) |
| 3. Biodiversity | Forest ecosystems |
| 4. Biodiversity | Mountain ecosystems |
| 5. Climate Change | Removing barriers to energy conservation and energy efficiency |
| 6. Climate Change | Promoting the adoption of renewable energy by removing barriers and reducing implementation costs |
| 7. Climate Change | Reducing the long-term costs of low greenhouse gas emitting energy technologies |
| 8. International Waters | Waterbody-based programme |
| 9. International Waters | Integrated land and water multiple focal areas |
| 10. International Waters | Contaminant-based programme |

Enabling Activities

Enabling activities include inventories, compilation of information, policy analysis, and strategies and action plans. They represent a basic building block of GEF assistance to countries. They either are a means of fulfilling essential communication requirements to a convention, provide a basic and essential level of information to enable policy and strategic decisions to be made, or assist planning that identifies priority activities within a country.

Enabling activities will include preparation of plans, strategies or programmes to fulfill commitments under a relevant convention and preparation of national communications to a relevant convention when appropriate.

The purpose of the enabling activities is to provide the tools to assist the countries in formulating and directing sectoral and economywide programmes to address global environmental problems through a cost-effective approach within the context of national sustainable development efforts.

Short-term Response Measures

Although the large majority of GEF activities will contribute directly to operational programmes or enabling activities, some projects that are unrelated to either of these two categories will be of sufficiently high priority that they may be considered for financing. Such projects would not be expected to yield significant strategic or programmatic benefits as in the case of operational programmes, but they would yield short-term benefits at a low cost. For example, climate change projects aimed solely at reducing the net emissions of greenhouse gases or urgent measures to conserve an extremely endangered species may be considered under this category.

In the focal area of international waters, projects must address transboundary water-related concerns. Where these transboundary concerns, additional needed actions, and incremental costs are not adequately defined, an initial international waters project must be undertaken to formulate an agreed Strategic Action Programme (SAP) prior to development of a technical assistance, capacity building, or investment project. In such cases, SAPs become somewhat analogous to enabling activities in other focal areas.

Project Cycle – Procedural Steps

Each recipient country will be invited to identify an operational focal point with which the implementing agencies will collaborate on GEF operational activities. The GEF focal point will be responsible for:

- acting as the principal contact point for all GEF activities in the country;
- reviewing project ideas and concepts, endorsing their consistency with respect to the national programmes and the country's participation in the Climate Change or Biological Diversity conventions, and confirming their national priorities;
- facilitating broad as well as project-related consultation; and
- providing feedback on GEF activities.

The Implementing Agencies will work with the operational focal point to develop project ideas that are consistent with the country's national programmes and priorities as well as the GEF operational strategies.

When a recipient country requests financial and technical help with project preparation, it may seek such an assistance from a variety of sources. GEF project preparation funding is available through the Project Preparation and Development Facility (PDF). Where feasible, the PDF would normally complement other sources of finance for preparation of a project proposal. World Bank loans, UNDP technical assistance grants, bilateral finance, and private funds.

PDF funds are optional in that they may not be required or a project may be sufficiently prepared as to be considered for inclusion in the work program without an initial outlay for project preparation. PDF funds may be approved in three steps or blocks:

Block A (up to \$25,000) funds are utilised in early stages of project or program identification for pre-project activities at the national level;

Block B (up to \$350,000) funds are for provision of information required to complete project proposals and necessary supporting documents;

Block C (up to \$1,000,000) funds are applicable when additional financing is required for large-scale projects to complete technical design and feasibility work. Block C funds would normally be made available after the Council has approved the project proposal.

Before any PDF funds are committed by an Implementing Agency, the project idea will be discussed, reviewed, and endorsed at the country level by the operational focal point. In order to qualify for PDF funds a project proposal must fall within one or more GEF focal areas; the recipient country must meet the country eligibility requirements, and the proposal must conform to the strategic and operational priorities of the GEF's operational strategy, as approved by the Council.

The GEF Operations Committee (GEFOP) is an interagency committee with important responsibilities in the project cycle. The GEFOP is composed of representatives of the three Implementing Agencies, the Chairperson of STAP and as appropriate, representatives of the Convention on Biological Diversity and the Framework Convention on Climate Change. The GEFOP is responsible for recommending to the Chief Executive Officer project proposals for inclusion in the work programme to be considered by the Council at its regular meetings.

The Council approves work programmes at its regular meetings. In its review of the work programme, the Council will focus primarily on the strategic and policy issues raised therein. Once the work programme is approved, the Implementing Agency is responsible for the further preparation of any of its project proposals in the work programme. The Implementing Agencies are accountable to the Council for the preparation and cost-effectiveness of the projects they prepare, for the implementation of the operational policies, strategies, and decisions of the Council and for the activities of the executing agencies working through it.

GEF Project Eligibility Criteria

GEF resources are available for projects and other activities that address climate change, biological diversity, international waters, and depletion of the ozone layer. Land degradation, primarily desertification and deforestation, is also eligible for funding as it relates to each focal area.

Global Environmental Facility

Biodiversity and climate change projects must also fulfill requirements established by the relevant conventions, the Convention on Biological Diversity and the Framework Convention on Climate Change: these include the stipulation that the country hosting the project be a Party to the convention concerned.

A country is eligible to obtain GEF funds if it is a developing country Party to the Convention on Biological Diversity or the UN Framework Convention on Climate Change; and/or if it is eligible to borrow from the World Bank (IBRD and/or IDA) or receive technical assistance grants from UNDP through a country programme (Indicative Planning Figure).

Projects which win approval from the Council of the Global Environment Facility for entry into the GEF work programme must be consistent with a set of rigorously applied eligibility criteria. In order for any project to be considered for GEF eligibility, it must meet the test of these criteria which derive from both the GEF and from the relevant Conventions associated with the focal area in which the project in question falls.

The following six criteria can be considered the essential "entrance level" requirements for GEF consideration. In other words if a project does not conform to all of these criteria, it cannot receive GEF approval. The project must:

1. Address at least one of the GEF focal areas:

- . climate change,
- . biodiversity,
- . international waters,
- . ozone,

. in addition, projects on land degradation and desertification can be considered for GEF funding when they interface with one or more of these focal areas;

2. Produce global environmental benefits;

3. Represent the incremental cost of the alternative (the GEF project) to the national or regional baseline (business as usual);

4. Be located in an eligible country or region;

5. Be eligible under relevant Conventions;

(If the project is focused on biodiversity or climate change, the country must be a Party to the relevant convention);

6. Have the support of the host government(s);

Incremental Costs and Global Benefits

A concept of central importance to GEF programming is the idea of providing funding "for the agreed incremental costs of achieving agreed global environmental benefits." Every project which enters the GEF work programme must meet the incremental cost/global benefits test.

Action to achieve sustainable development at the national level, although clearly necessary and directly in the country's own interest, is insufficient to maintain sustainability at a global

level because many human activities have detrimental global environmental effects. Additional national action beyond what is required for national development is therefore also needed. Such additional action imposes additional (or “incremental”) cost on countries beyond the costs that are strictly necessary for achieving their own development goals, but nevertheless generates additional benefits that the world as a whole can share.

Global environmental benefits are met whenever a global environmental objective is met. Reduction in the emissions of greenhouse gases and protection of specified biodiversity are examples of global environmental benefits. In some cases, but not all, countries will incur incremental costs in order to realise global environmental benefits.

A simple example of an action that incurs an incremental cost in order to realise global environmental benefits is the use of advanced solar energy technology in a situation where a less costly coal-fired power generator with pollution control would have been sufficient to generate the electric power needed for development, while meeting national environmental standards. This action, the choice of solar over coal, imposes an incremental cost and avoids emitting the greenhouse gases that would otherwise be emitted. Yet it still meets the same national development goal (power) while also protecting the national population from pollution, in accordance with national standards. In such a case, the incremental cost is associated with the global environmental benefit of reduction in greenhouse gas emissions.

In broad terms, the concept of incremental costs is relatively straightforward. It is the extra cost incurred in terms of expenditure patterns, policy implementation and human and physical infrastructure requirements, under new obligations resulting from ratification of a given global convention.

In simple terms, this equates to the difference in cost of 1) a development strategy that would have been pursued without taking into account those obligations (“the baseline”) and 2) an alternative development strategy that delivers the same amount of domestic benefits while attaining additional global benefits (“the GEF alternative”).

It should also be noted that the GEF Council has recognised the need for a flexible application of the concept of incremental costs.

In addition to the 6 essential criteria mentioned above, GEF activities should be designed to: be consistent with national and, where appropriate, regional initiatives;

- strive to ensure sustainability of global environmental benefits;
- reduce the risk caused by scientific uncertainty (by, for example, maintaining a diverse project portfolio and paying particular attention to monitoring and evaluation);
- complement traditional development funding;
- facilitate effective responses by other entities to address global environmental issues (through, for example, outreach to government, NGOs, the private sector, bilateral and multilateral organisations, and foundations);
- be environmentally, socially and financially sustainable;
- avoid transfer of negative environmental impacts between focal areas.

EXAMPLES OF GEF - FUNDED ACTIVITIES:

In the focal area of biodiversity:

Management of Coral Reef Ecosystems of Andaman and Nicobar Islands

(India) The project will support improved protected area management , emphasising joint management with local communities; village development plans and agreements that address the negative interactions of local communities on biodiversity and develop and build upon the positive interactions; and research (biological and policy), education, and institution -building to improve knowledge of, and support and capacity for, ecodevelopment and conservation activities.

Total Costs:	\$0.35 million
GEF Allocation:	\$0.35 million
Implementing Agency:	UNDP

Biodiversity Enterprise Fund for Latin America

(Regional) The project will support the establishment of a fund of up to \$30 million to make equity and quasi-equity investments in Latin American companies that sustainably use or protect biodiversity. Investments may include sustainable agriculture, use of under-utilised species, sustainable forest management, non-timber products from forests and wildlands, and ecotourism.

Total Costs:	\$30.00 million
GEF Allocation:	\$5.00 million
Implementing Agency:	World Bank

Support for the Preparation of Biodiversity Country Studies-Phase I

(Global) The objective of this project was to develop guidelines and support for the preparation of country studies on the costs, benefits and unmet needs for conservation and sustainable use of biodiversity, thereby enhancing the capacity of developing countries in biodiversity assessment and planning. UNEP is implementing a second phase of this project with additional country studies.

Total Costs:	\$5.22 million
GEF Allocation:	\$5.00 million
Implementing Agency:	UNEP

In the Focal Area of Climate Change

GHG Enabling

(Bhutan) The project will enable Bhutan to meet its reporting obligations under the Framework Convention on Climate Change, leading to their National Communication as required under Article 12.

Total Costs:	\$0.30 million
GEF Allocation:	\$0.30 million
Implementing Agency:	UNDP

Energy Services Delivery

(Sri Lanka) The project will reduce Sri Lanka's GHG emissions, encourage participation of the private sector, NGOs and co-operatives in the provision of grid and off-grid energy services, and strengthen the public and private institutional capacity to deliver, energy services through renewable energy technologies and demand-side management (DSM). Its specific components will be a) a private sector renewable energy fund to support pre-grid, PV

electrification, mini-hydro schemes and other renewable energy sources; b) a pilot grid-connected wind farm (3MW), and c) technical assistance for the use of renewable energy in residential and commercial sectors, for the Ceylon Electricity Board (CEB) to prepare a DSM action plan and a National Renewable Energy Strategy, for CEB to facilitate small private power investments and pre-electrification.

Total Costs: \$ 53.80 million
 GEF Allocation: \$ 7.30 million
 Implementing Agency: World Bank

Country Case Studies on Sources and Sinks of Greenhouse Gases (Tanzania, Uganda, Morocco, Gambia, Poland, Venezuela, Costa Rica, Mexico, Senegal)

The objective of this project was to develop and refine the methodology for preparing national inventories of sources and sinks of greenhouse gases (GHG) and to develop the ability of countries Party to the UN Framework Convention on Climate Change to complete national GHG inventories using the approved guidelines.

Total Costs: \$ 4.59
 GEF Allocation: \$ 4.50
 Implementing Agency: UNEP

In the Focal Area of International Waters

Prevention and Management of Marine Pollution in the East Asian Seas

(Regional) The project will develop policies and plans to control marine pollution for land and sea-based sources, upgrade national and regional infrastructures and technical skills, and establish financing instruments for project sustainability. Project includes demonstration sites establishment of regional monitoring and information network, and involvement of regional association of marine legal experts to improve capacity to implement relevant conventions.

Total Costs: \$ 11.40 million
 GEF Allocation: \$ 8.00 million
 Implementing Agency: UNDP

Ship Waste Disposal

(China) This project combines GEF, IDA and local financing to reduce pollution in international and territorial waters caused by ship wastes. It provides technical and financial assistance to the Government of China and six port authorities, selected as models, for the construction and/or rehabilitation and expansion of ship waste disposal facilities. The project includes both national and individual port components.

Total Costs: \$ 64.80 million
 GEF Allocation: \$ 30.00 million
 Implementing Agency: World Bank

Bermejo River Binational Basin

(Regional: Argentina & Bolivia) The project is expected to promote an international river basin agreement under the MERCOSUR treaty to conduct a diagnostic study on the Bermejo River Binational Basin. They intend to advance proposals which would allow both countries wide ranging abilities to implement water quality and water quantity management practices within each other's territories. The project aims also at increasing public awareness on environment and development issues and providing an updated overview of major present and emerging international issues of the region, which will form the basis for determination of activities to be conducted during the project.

lobal Environmental Facility

Total Costs: \$ 0.23 million
GEF Allocation: \$ 0.23 (PDF B Fund) million
Implementing Agency: UNEP

In the Focal Area of Ozone Depletion

Ozone-Depleting Substances Phase-out

(Bulgaria) Sixty-five percent of Bulgaria's 1993, annual, weighted ozone-depleting substance consumption will be phased out (468 metric tons of ODS) through sub-projects in the refrigeration, foam blowing and solvent sectors. A recycling and servicing component will phase out further ozone-depleting substances already in use in refrigerator, and a third component will strengthen the national Phase-out Task Force.

Total costs: \$ 13.50 million
GEF Allocation: \$ 10.50 million
Implementing Agency: World Bank

Country Programme Formulation and Technical Assistance/Investment Project Preparation for Turkmenistan, Uzbekistan and Cyprus for Implementation of the Montreal Protocol

(Regional) PDF B Grant will identify and develop priority technical assistance and investment project proposals to assist these countries meet their obligations under the Montreal Protocol. The development of the country programmes is the essential first step in this process. In accordance with the GEF ozone strategy it concentrates, within the overall country programme framework, on the development of technical assistance and investment project proposals (appraisal stage) for subsequent implementation as investment projects.

Total Costs: \$ 0.20 million
GEF Allocation: \$ 0.20 (PDF B Fund) million
Implementing Agency: UNDP

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4. GEF Quarterly Operational Report, April 1996.
5. GEF Operational Manual for UNEP Staff, July 1996.

VII

CAPACITY BUILDING

Role of Legislation in Environmental Management

Project Design and Development

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ROLE OF LEGISLATION IN ENVIRONMENTAL MANAGEMENT

Lal Kurukulasuriya

UNCED's Agenda 21 states that laws and regulations suited to country specific conditions are among the most important instruments for transforming environment and development into action. The development of an effective legislative and institutional regime for environmental management in the context of sustainable development is both complex and difficult.

Environmental management comes into play heavily in the integration of environment and development, natural resource conservation and use, and the preservation of the national heritage. In this context forging a national consensus on the institutional and policy framework to undergird the legislation, poses many demanding challenges. Some of the issues involved are, achieving an acceptable balance between economic development and environmental protection, strengthening partnerships through institutional co-operation and co-ordination, and doing so within the particular national circumstances of each country against the backdrop of increasing globalisation.

There are a variety of contemporary legislative approaches to environmental management. Whatever the approach is, for legislation to effectively promote the goals of sustainable development, it must pursue achievable goals, and be firmly founded on country-specific policies and institutional arrangements in respect of which there is broad national agreement. Forging such consensus will be immensely facilitated by a legislative development process that is transparent, and widely participatory and consultative involving the relevant sections of society.

ROLE OF LEGISLATION IN ENVIRONMENTAL MANAGEMENT

Lal Kurukulasuriya

Law is one of the key instruments of social regulation. This is achieved through the establishment of norms of conduct and the creation of the required machinery with their accompanying empowerment for ensuring that such norms are effectively complied with. In the field of environmental management, law-both international and national has been extensively applied, especially in the past thirty years or so, to promote pollution control, natural resource conservation and use, and protection of the cultural and aesthetic environment, the triple goals of environmental management. Since the United Nations Conference on Environment and Development of 1992 gave legitimacy to the concept of Sustainable Development, these goals are no longer viewed from a purely environmental perspective but in the context of integration of environment and development.

Legislative Regulation of Environmental Management

The function of national legislation is to: reflect the particular policies and schemes considered by the Legislature to be most appropriate for achieving the desired goals; establish the institutional machinery for giving effect to those principles and schemes; and empower the related institutions to function efficiently within the framework of the established policy parameters.

Legal evolution is often a result of an important interplay of socio-economic and political factors. This is epitomised in the unprecedented expansion of international and national environmental law in the past quarter century responding to an increasing range of environmental problems associated with over exploitation of natural resources, inadequately regulated increased industrial production, and urban migration. Activities of environmental pressure groups, and regional and international organisations, including, multilateral financial agencies and bilateral donor organisations, have often provided an added impetus for accelerating the pace of change. The political legitimacy accorded at the United Nations Conference on Environment and Development to a new world development order based on the premise that development that is not sustainable is not development at all, has served as a beacon to chart this difficult path.

The following are among the fundamental premises for developing effective environmental legislation. First, the integrative character of environmental legislation highlights the need for a consensus on the underlying policies and procedures. This presupposes the widest participation of and consultation with all interest groups and accommodation of their respective interests and concerns to the best extent possible. This is particularly so in the contemporary environmental legislation which affects such fundamental national interests as national planning and development, control of agricultural and industrial pollution, conservation of the country's natural resource base and seeks to bring about a fundamental change in the traditional attitudes and approaches to management and administration in various national, sub-national and local institutions. A consultative and participatory approach to policy and legislative development is therefore a *sine qua non* of effective legislation for environmental management.

The second, has to do with achieving a judicious balance between environment and development in the particular context of developing countries. Many laws prohibit, often subject to well defined exceptions, various types of activities which are considered inimical to accepted norms of society. Environmental pollution on the other hand is an inevitable by-product of productive economic activity; something that cannot be entirely prohibited without causing serious economic dislocation. It could, and indeed must, be minimised, controlled and managed, where necessary by prohibiting or regulating environmentally harmful activities. As Mark Sagoff observes "It is a necessary evil, one which must be tolerated, at least to some extent, if economic activity we depend on is to continue and to flourish" The pivotal policy issue in the development of environmental legislation is therefore where each country decides to draw the line to prohibit or control activities that endanger the human environment without restricting or slowing down their economic and social development process. In the final analysis, it is the success of the development process that is the only guarantee against spiraling environmental degradation and unsustainable use of natural resources, poverty, unemployment as well as social and political dislocation.

Thirdly, The legislative and institutional strategies must be endogenous and must be firmly set within each country's national milieu. The country specific character of national environmental legislation has been repeatedly stressed in Agenda 21 and reaffirmed in the Rio Declaration on Environment and Development. Principle 11 of the Declaration states "environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries."

Legislative Approaches to Environmental Management

"Environment" in the modern context of sustainable development encompasses the physical and social factors of the surroundings of human beings and includes land, water, atmosphere, climate, sound, odour, taste, the biological factors of animals and plants, as well as cultural values, historical sites and monuments and aesthetics. This brings into sharp focus the enormous challenges of legislative regulation of environmental management.

A survey of national environmental legislation reveals an important range of juridical mechanisms for environmental management. Apart from the express consecration of environmental policy in constitutional form, the "prototypes" of environmental legislation include anti-pollution laws, the codification of environmental and natural resources laws, and framework environmental laws. They range from provisions in the Penal Codes relating to nuisance through sectoral legislation on matters such as land use, agriculture, industry, forestry, wild life habitat, to more organic legislation dealing with principles of and institutional arrangements for environmental management. The choice of a legislative technique largely reflects the historical evolution of a country's environmental policy and the nature of its legal system.

Constitutional Provisions

Since the 1972 Stockholm Conference on the Human Environment basic principles of environmental management are increasingly being incorporated into political constitutions. Thus, issues such as environmentally sound development, sound use of natural resources, prevention and control of environmental pollution, and the individual's right to a clean environment have found expression in constitutional form. These are often articulated in terms of a State's obligations to its citizens. In addition, however, a duty is often imposed on

citizens to safeguard the national environment. This constitutional trend is most manifest in developing countries. In the South Asia region for example, The *Constitution of India* declares: "Protection and improvement of environment and safeguarding of forests and wild life. - The State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country." and again. "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers, and wild life, and to have compassion for living creatures"

The Sri Lankan Constitution declares in its Chapter on Directive Principles of State Policy and Fundamental Duties: "The State shall protect, preserve and improve the environment for the benefit of the community.

The Constitution of Bangladesh on the other hand is narrower in scope, in that it refers specifically to protecting the cultural heritage when it declares in Article 23, "The State shall adopt measures to conserve the cultural traditions and heritage of the people and so to foster and improve the national language, literature and the arts that all sections of the people are afforded the opportunity to contribute towards and to participate in the enrichment of the national culture." and in Article 24, "The State shall adopt measures for the protection against disfigurement, damage or removal of all monuments, objects or places of special artistic or historic importance or interest." Of course the effectiveness of constitutional provisions such as these depends very much on the opportunities for administrative review, which vary from country to country. In the Philippines, for example, a successful court challenge to administrative decisions which threaten the sustainable capacity of the forest has been brought based on environmental guarantees contained in the Constitution. On the other hand, the Sri Lankan Constitution expressly states that Articles 27 and 28 referred to above "do not confer or impose legal rights or obligations and are not enforceable in any court or tribunal". Nevertheless, the elevation of environmental concerns to constitutional status is at least a statement of intent, and could enhance the priority to be conferred by Governments on sound national environmental management and sustainable development.

Sectoral Legislation

The evolution of environmental legislation can be traced from early resource exploitation legislation through later resource management legislation to more recent legislation conceived primarily from the perspective of environmental management. This has resulted in much of the provisions relating to natural resource conservation, pollution control and protection of history, culture and aesthetics being scattered in a wide range of statutes and in some instances, the common and customary laws of countries, developed at different times and in vastly different political, economic and social contexts. Achieving the necessary contextual change and harmonising these provisions is one of the difficult challenges of developing an adequate legal and institutional regime for environmental management in the context of sustainable development.

Anti-Pollution Laws

The immediate aftermath of the 1972 Stockholm Conference witnessed a growing concern in developing countries with problems of environmental pollution and degradation. The response of governments took the form of legislative enactments to deal with the causes of adverse environmental impacts, particularly industrial effluents and nuisances. Thus, in addition to new sectoral legislation to fill the more apparent gaps in national frameworks, comprehensive anti-pollution laws were enacted. Important examples are the 1974 Malaysian Environmental Quality Act, and the 1977 Pollution Control Ordinance of Bangladesh. The

main focus of the legislation was, however, on pollution control. Natural resource sectors continued to be managed as separate and distinct categories largely ignoring the indivisibility of the ecosystem and the inherent inter relationships. The compartmentalised consideration of environment and development remained the greatest limitation.

Codification of Environmental and Natural Resources Law

The comprehensive codification of legal provisions relating to the conservation and management of the environment and natural resources is another legislative technique which has been adopted in civil law jurisdictions in several African and Latin American countries. "Codification" here implies not merely the reproduction and restatement of existing legislative texts but the systematic consolidation and revision of the law. The first example of this type of legislation is the 1974 Colombian Code on Renewable Natural Resources and Environment Protection. The Code has since been implemented by specific regulations on forests, wildlife, national parks, inland waters, fisheries, marine resources etc. The Colombian Code is unique because of the volume and detail of its provisions, Its comprehensive approach has been followed by other developing countries: for example, the 1981 Cuban Act on Environmental Protection and Rational Use of Natural Resources, the 1982 Libyan Act on Environmental Protection and the 1983 Algerian Environmental Protection Code. Though not an exercise in codification, New Zealand's Natural Resources Management Act of 1991 must be mentioned as an effort to consolidate the schemes and provisions of some seventy six statutes dealing with environmental management and natural resource conservation.

The Framework Environmental Law

A more recent legislative technique for environmental management is the "umbrella" or framework law. Here, the legislation lays down the basic legal principles without any attempt at codification. It normally entails the declaration of national environmental objectives and policies, the establishment of relevant environmental management institutions, and the definition of the common procedural principles for environmental decision-making applicable to all sectors. In this latter respect, the legislation often covers such cross-sectoral issues as environmental impact assessment, environmental quality criteria, and public participation in decision-making and implementation.

Since the substance of the framework legislation is less detailed than in the anti-pollution laws or the comprehensive environmental code options, the implementation of its principles inevitably calls for further enabling legislation. Although both the environmental code and the framework law options represent an integrated, coherent and holistic approaches to environmental management, the framework law technique has the added advantage of flexibility. The basic legislation can remain intact while the implementing frameworks are reformulated in response to changes in socio-economic and ecological factors.

Legislative Responses to the New Challenges of Environmental Management

The substance of legislation will be determined largely by the socio-economic and political context of a particular country. There is no standard recipe as to the content of environmental legislation. There are nevertheless certain essential elements that play a key role in environmental management. Countries in the Asia Pacific region have applied a variety of legislative mechanisms and tools to address these. Some of these are well established management practices such as, land-use planning and zoning, licensing and standard-setting, and punitive sanctions but approached from the new perspective of sustainable development.

Others are of more recent origin. These include environmental impact assessment, incentives for compliance, public participation and emphasis on prevention of disputes rather than their resolution. These practices are examined under the following sub-headings, namely; Environmental planning and assessment; prohibition, control and management of polluting activities, compliance and enforcement mechanisms; Institutional arrangements and implementation of environmental conventions and agreements.

Environmental Planning and Assessment

Rational planning of the uses to which land is put is important for two basic reasons. First, productive land resources are becoming increasingly scarce, particularly in developing countries, due to urbanisation, desertification and pollution. Land-use planning is therefore imperative for sustainable development in the context of a limited resource. Secondly, land-use often entails the generation of environmentally adverse side-effects. Land-use controls are therefore necessary to anticipate and pre-empt such negative impacts.

Land-use planning and zoning have thus become important regulatory tools in contemporary national policies regarding environmental management. The basic components of these processes consist of the evaluation of land, the alternative patterns of land-use and other physical and socio-economic parameters, and the selection and adoption of land-use types compatible with sustainable resource utilization and environmental conservation objectives. The zoning process facilitates the allocation of land to competing legitimate demands on the basis of a balanced consideration of socio-economic, environmental and ecological factors. Thus, the whole country or a region may be divided by a land-use plan into broad land-use categories such as residential, industrial, agricultural, forestry and nature conservation areas. The 1981 Brazilian Act on Environmental Protection Areas is a good example of the legislative utilisation of these mechanisms. The Act provides for the declaration of certain areas as environmental protection areas in order to facilitate the conservation and improvement of local environmental conditions. After such a declaration all polluting activities are either restricted or prohibited by appropriate regulations.

Traditionally, land-use planning and zoning regulations are expressed in negative terms: prohibitions and restrictions are employed to control undesirable uses or unauthorized change in use. Thus, relevant planning regulations may prohibit the initiation of land development without the prior consent of relevant authorities. On the other hand, modern legislation lays emphasis on "positive" planning to promote economic land-use compatible with environmental objectives or special land-use management plans. Thus, the 1974 Colombian Environment Code classifies protected areas not according to varying degrees of prohibitions but according to their authorised uses.

Throughout Asia, the urban informal sector, whether retailing, services or small-scale manufacturing, plays a vital role in economic growth and the equitable distribution of the overall expansion of aggregate incomes. The challenge faced in the regulation of land uses, particularly at the micro level, is how to nourish such institutions among the urban poor, while at the same time safeguarding the city-wide interests with respect to environment, public health and community amenities.

Environmental Impact Assessment (EIA)

The need to integrate environmental considerations into national socio-economic planning is now widely recognised. The Environmental Impact Assessment process is the most widely used mechanism for achieving such integration. Like the assessment of profit, EIA is a part

of project preparation. The problem, of course, is that it has not always been treated as such. While no one is likely to pursue a project that is environmentally sound but unprofitable, there does not seem to be the natural inclination against pursuing profit at the expense of even irreversible environmental degradation. This has brought about a need for the application of EIA in the socio-economic planning and development process. Effective EIA depends on three fundamental prerequisites; namely; public participation, inter-sectoral co-ordination and the consideration of alternatives. Through these mechanisms, EIA can serve an integrative and preventive role in development planning.

“Community participation (public involvement) is one of the key factors in the planning and implementation of a project. The effectiveness of EIA is determined largely by how successfully the community has been involved.” The voice of people most likely to be affected by a proposed project should critically influence the EIA process. They, more than anyone else, can provide the information needed for sound decisions to be made about the nature and extent of likely adverse impacts and the overall acceptability of proposed mitigating measures. On the positive side, they can best assist the determination of economic and social benefits flowing from the project. All of this constitute invaluable inputs for better informed and more balanced project decisions. For these reasons, adequate public participation is crucial to the EIA process.

Hardly less important than public participation is the need to ensure consultation and active partnership among interested governmental and parastatal institutions. Whether operating at the national or local level, all of these bodies have relevant expertise and practical experience to contribute to the EIA process. Deciding who should be consulted on a particular proposal may itself be a difficult problem because of the wide range of national, provincial/state, local authorities, scientific disciplines and technical sectors which could be involved. EIA can help to ensure that none of these groups is denied the chance to comment on a proposed activity, thereby avoiding costly mistakes and facilitating inter-sectoral cooperation.

The heart of the EIA process is the analysis of alternatives. Every major - and, for that matter, even minor - development project carries with it some adverse environmental impacts. The search is not for development projects that have no environmental impacts. Rather, the EIA process aims at finding the best project option, in both environmental and socio-economic terms, under the circumstances. This means all available project alternatives should be reviewed for their relative costs and benefits before any commitment is made to a particular project or project formulation. The “no action” alternative as well as different siting, technologies, processes and raw materials need to be considered. At the conclusion of this wide-ranging and objective process, decision-makers are better equipped to design and carry out an “environmentally friendlier” activity.

Licensing and Standard-Setting

Prior to the Stockholm Conference, legislative provisions relating to environmental quality criteria and standards were largely related to the protection of human health and the prevention of industrial accidents. By expanding the range of activities to be regulated and strengthening the normative content of legislation through the establishment of specific identifiable limits and targets, governments have made it easier to demonstrate compliance or non-compliance, thereby easing the evidentiary burden and enhancing enforcement efforts.

Environmental quality and anti-pollution regulations still remain the most widely used legislative technique for pollution control, though several new approaches are evident in contemporary practice. These laws usually deal with air quality and water quality marine

pollution, solid waste disposal, toxic materials management and establish quality criteria, define pollutants, set permissible limits and regulate control, compliance and enforcement methods. One of the most widely used techniques of environmental control is the system of authorisations such as permits, certifications, and license administered by government departments.

The licensing system is usually based on environmental quality standards imposed by the licensing authority. An essential condition for authorisation is compliance with the standards. The standards may be defined in quantitative terms as minimum permissible concentrations in the recipient environment (water quality, ambient air quality, food quality), as source-oriented emission limits for specific pollutants, or as product standards in terms of technical specifications and performance criteria. The designation of standards as binding gives them normative status and hence they constitute important juridical technique for environmental regulation. Often this is a complicated technical task that requires extensive local research and analysis of the state of the environment and the impact of human activities. Further, since scientific knowledge is in rapid evolution, a certain degree of flexibility needs to be worked into the legislation to facilitate adaptation and effective implementation. This could be achieved by referring to best available technology, or by introducing a procedure for expeditious revision of standards. Most importantly, these standards must be cost-effective and must be implementable without causing unwarranted restraints on the developing country's national socio-economic development process.

To be effective as a means of regulating and controlling pollution, these standards must be implementable in the particular socio-economic circumstances and technological capabilities of each country. One sure way of achieving this is through a consultative process, involving the public and private sectors, relevant NGOs, academic institutions and affected sections of the public.

Many framework laws have invested relevant agencies with wide regulatory powers in regard to control of pollution. The Thai *National Environment Quality Act, 1992* provides that the Minister of Science, Technology and Environment may issue standards for controlling water pollution. Under his authority, the Minister has issued standards for the release of waste water from a variety of sources including apartment buildings, markets, and hospitals. The same provision in the Act provides that the Minister may also issue standards to control air quality. Under recently amended sectoral legislation the Minister of Industry has issued regulations on air quality standards from factories. In more recent times, efforts have been made to move away from the old bureaucratic approach and to institute a collective approach to standard setting.

Incentive Mechanisms

Several countries have therefore sought to stimulate compliance through positive sanctions such as public awards and financial incentives. In this regard the application of economic instruments for environmental management has attracted increasing interest. These include tax incentives, user pay schemes, environment funds, and the polluter pays principle. The 1977 Philippines Environment Code, for example, provides financial assistance for investments in environmental improvement and a series of tax benefits, ranging from import tax rebates for anti-pollution equipment to income tax deductions on development costs for pollution control technologies.

The creation of special funds that can be drawn upon by governments where necessary to deal with environmental concerns has become a standard practice in several developing countries. These resources are often used for financing capital expenditures in environmental protection systems and responding to environmental emergencies. Contributions to such funds are received from the regular government budget, fines or licensing fees received from polluting industries or activities, or even international donations. In Thailand the Environment Fund composed of moneys received from the Oil Fuel Fund, the government budget, service fees and fines, and donations from international sources is to be used for investment in and operation of public waste water treatment or waste disposal systems, air treatment equipment, or can be loaned to the private sector where there is a legal responsibility to install air, water or waste treatment equipment. In the Philippines, rather than a government established fund, the legislation provides for an Environmental Guarantee Fund to be established by certain companies. The companies are required to set up a private trust under the management of the company and the community, and supervised by the government, into which negotiated amounts are deposited daily or weekly to cover the cost of environmental programmes, monitoring, rehabilitation and compensation for damages caused by the company.

Another common approach to addressing the economic aspects of environmental degradation is the policy of the "polluter pays". For example, in the Republic of Korea, the *Solid Waste Management Act* revised in 1991 introduced a comprehensive system for the deposit of expenses for the collection and disposal of wastes. The Minister of Environment can order manufacturers and importers of certain products and containers to deposit money for waste collection and disposal expenses to the Solid Waste Management Fund. When the manufacturers and importers collect and return wastes from their products or containers to the designated places the Fund reimburses the deposit.

User fees are one of the most common means of making the polluter pay. In Thailand, for example, user fees or service fees are charged to those utilising public waste treatment services, such as toxic waste disposal sites or water treatment plants. In order to discourage evasion a penalty of four times the service fee can be imposed for failure to deal with waste in the prescribed manner. User fees are a simple and direct means of collecting revenue to pay for the capital and operating costs of waste treatment services. It can also serve as an incentive to reduce waste, as obviously, the less waste one produces the lower the fees.

Taxing enterprises for the amount of pollutants emitted or charging license fees for certain activities harmful to the environment is another means of imposing the costs of pollution on the polluter. For example, China has begun taxing enterprises according to the volume of sulphur dioxide emitted in an effort to control acid rain. In Malaysia, fees attached to licenses are dependent on a range of considerations including the location of the industry, the quantity of waste discharged, the pollutant or class of pollutants discharged, and the existing level of pollution.

Governments have also targeted certain consumer practices that pollute by imposing direct taxes on products that are deemed to be environmentally unfriendly. For example, the Government of the Republic of Korea was considering imposing a tax on disposable items such as wooden chopsticks, diapers, razors and paper drinking cups. In this case it is the consumer who pollutes by purchasing disposable items and therefore pays the price of having to deal with the extra waste created.

Many countries have also implemented tax regimes which provide positive financial incentives to protect the environment. In Thailand, anyone required to provide for air, water, or waste treatment can apply for assistance, to be determined on a case-by-case basis, for a reduction of import duty on items that cannot be obtained within Thailand and permission to bring in foreign experts to assist with the installation and supervision of such facilities who will themselves be exempt from income tax. Furthermore, investment in filters or other technical equipment used for the prevention of pollution in the industrial, agricultural, forest or other commercial sectors may be deducted from income tax, and such equipment is also exempt from import duties and sales tax.

The Philippines has long used economic incentives to encourage environmental compliance. An exemption of 50% of tariff duties and compensating taxes for imports of pollution control parts and equipment was available for five years from the coming into force of *Presidential Decree 1152*, a tax credit of 50% of the value of compensating tax and tariff duties on pollution control parts and equipment purchased from domestic manufacturers was available for a period of seven years after implementation of the Decree and another tax credit of 25% of the tax or duty value would be given to the manufacturer, and finally a 50% tax deduction was available to companies or individuals for research costs on projects to develop proven effective and commercially viable pollution control technologies. Furthermore, financial assistance and/or grants are available for the study, design and construction of environmental protection facilities for municipalities and small and medium scale industries.

An Eco-mark Programme was commenced in the Republic of Korea in 1992 launched by the Ministry of Environment to encourage the development of environmentally sound products. Products which have been identified as environmentally friendly may bear a mark indicating such designation. A similar programme has been implemented in India from 1993.

Legislation which allows the government to pursue polluters for contravention of environmental legislation is a means of making the polluter pay in a very personal way. Terms of imprisonment and fines are some of the more common penalties adopted, but many countries also allow the government to claim restitution or expenses for cleaning up the environment. In the Republic of Korea any person who causes environmental pollution due to his or her acts or business activities, is required to bear the cost for the prevention of such pollution, improvement of the contaminated environment and any other damages. In India the expenses, if any, incurred by any authority or agency with respect to the remedial measures to prevent or mitigate environmental pollution may be recovered by the authorities, with interest. In Malaysia all costs and expenses incurred for removal, dispersal, destruction or mitigation of effects of pollution may be recovered from the person responsible for environmental degradation, and in the case of oil spills, individuals can be held jointly and severally liable.

Sanctions

The effective implementation of environmental legislation presupposes the existence of appropriate sanctions to secure compliance in cases where voluntary compliance cannot be attained. Traditionally, environmental legislation has largely relied on negative sanctions such as administrative, civil and criminal penalties to attain its objectives. Whereas such measures are an essential component of implementation processes, their limits as enforcement tools, are easily reached. First, monetary fines or civil damages may not be effective instruments for the prevention of pollution where they are modest compared to the polluter's profits. Secondly, the punishment of violators through the criminal process may not achieve significant results where socio-economic realities force people to exploit, for

example, protected area resources notwithstanding prohibition. In an effort to enhance the efficacy of the command-and-control methods of management, States have imposed new types of liability imposed increased penalties and granted pollution control authorities wider powers to control activities which damage the environment. While these measures no doubt contribute toward the realisation of the goal of a healthy environment, the imperatives of a consensual partnership and collective responsibility for management of environment and development seems to dictate a more participatory and incentive-based management regime.

Institutional Arrangements

Following the Stockholm Conference, which brought into sharp focus the need for coordination of sectoral activities with a view to achieving environmental protection, there was a trend towards establishing bodies for coordinating these activities. One of the principal problems these institutions encounter is the apprehension of other ministries and agencies of an environmental ministry or Agency assuming certain controls over national activity ordinarily assigned to the line ministries, on the ground that those activities impinge on or affect the national environment. Inter-ministerial co-ordination committees and councils of officials drawn from various ministries and departments, non-governmental organizations and the public have contributed to defusing these tensions and promoting confidence building in the process of co-ordination. In some instances, such environmental management bodies are in the office of the President or of the Prime Minister to facilitate effective coordination.

The effective implementation of environmental legislation pre-supposes, first, the existence of appropriate institutional arrangements and processes and, secondly, the provision of adequate resources (human, financial and technical) for the operation of those institutions. The fact that the ecosystem consists of an indivisible whole would suggest that responsibility for its management, or at least the responsibility for co-ordinating the management, should be reposed in a central institution whose mandate would include at least four critical elements: Policy formulation, planning, co-ordination of activities and monitoring of implementation. This requires a harmonised, collective approach to environmental management, taking particular care to avoid apprehensions of perceived usurpation of established lines of governmental authority, and environment management processes being regarded as a drag on the imperatives of development, rather than a complement to development. Since institutions and processes are managed by people, it is in the minds of the people that the key to the success of these institutions and processes lie. An essential basis for instituting these new approaches might therefore include a shift in bureaucratic mind-set, steeped in linear and compartmentalised management techniques and approaches, in most cases, a legacy of a colonial past.

Legislation can also be an instrumentality for instituting novel approaches to dispute avoidance and settlement and promoting public participation at all levels in environmental decision-making and implementation. Such participation can be secured through the establishment of appropriate local level dispute mediation, conciliation and settlement institutions and the definition of "citizen rights" to enforce legislation. This latter aspect may become an important safeguard in cases where public agencies are remiss in their duties or themselves violate the law.

Implementation of Environmental Conventions and Agreements

Participation in an international agreement carries with it an obligation to institute adequate national measures for its implementation. Current developments demonstrate an increasing use of legislative mechanisms for this purpose. Recent environmental accords such as, the Montreal Protocol on Ozone Depleting Substances, the Biological Diversity and Climate Change Conventions as well as, the Basel Convention, CITES and Convention on Migratory Species impact upon a wide range of critical national interests involving the participation of several national, and sub-national administrative bodies, that legislation lends itself well to serve as an effective instrument for implementing the obligations in a co-ordinated and cohesive way. To allow for the flexibility necessary for creating such co-ordinated administrative regimes, the legislation usually specifies the principal concepts, obligations, rights and duties in regard to each Convention and leaves the detailed institutional arrangements to be specified in regulations.

It is important to emphasise that legislation by itself can achieve little or nothing by way of social regulation. It must be seen as an integral part of a multi-dimensional process towards achieving social and economic goals. Perhaps there is nothing more counter-productive, even dangerous, than to establish legal and institutional norms and regimes which can not be implemented, thereby giving the illusion of progress where none exist. On the other hand, simple and implementable legislation based on an institutional and policy framework that has attracted wide consensus and public support, even though less than ideal, could still be the most effective and expeditious means of promoting the goals of sustainable development at national level.

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PROJECT DESIGN AND DEVELOPMENT

Dr. Wimala Ponniah

A project is usually defined as a planned undertaking designed to achieve certain specific objectives within a given budget and within a specific period of time. A well defined project is usually characterised by a logical and complete project document. The project usually begins with the identification of a problem, followed by the formulation of objectives which spell out the decision, action or change in a target group or area expected to occur as a direct result of the project.

Project documents enable proper and effective monitoring, reporting, evaluation and accountability. Furthermore, well prepared project documents are attractive to donors and can be used to raise funds. High quality projects produce desired outcomes, making it easy for the implementing agency to be more accountable to donors. Accountability also increases the implementing agency's chances of raising more resources.

Poor project design results in vague objectives that are hard to meet. Project documents are poor because very often the results are not clear. Also, there is confusion between activities and outputs and there is no logical sequence. Furthermore, even performance indicators are not properly articulated.

PROJECT DESIGN AND DEVELOPMENT; THE UNEP MODEL

Dr. Wimala Ponniah

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Poor project design results in vague objectives that are hard to meet. Project documents are poor because very often the results are not clear - there is confusion between activities and outputs and there is no logical sequence. Furthermore, even performance indicators are not properly articulated. Poorly implemented projects lead to inappropriate outcomes whilst poorly managed projects are also poorly monitored and make it impossible for the implementing agency to account properly for the resources entrusted to it. Thus poor accountability and inappropriate outcomes result in unhappy donors, who in turn reduce contributions to the implementing agency.

Glossary of Terms

Before embarking on project formulation, it will be necessary to familiarise oneself with the following terms:

Project:	An undertaking designed to achieve specific objectives within a given budget and within a specific period of time.
Programme:	An organized set of activities, projects, processes or services directed towards the attainment of specific objectives.
Short-term objective:	This expresses the specific effect which the project is expected to achieve within its life-time, or directly thereafter.
Long-term objective:	This is the broad objective towards which the efforts of the project are directed.
Needs Statement:	A simple statement of the overriding issue the project seeks to address.

Result:	An outcome that satisfies a need or, in more straight forward terms, it can be defined as the impact of the project.
Outputs:	The results that can be guaranteed by the project as a consequence of its activities. Outputs are specific, measurable entities.
Inputs:	Goods, services, personnel, money and other commodities provided for an activity with the expectation of producing outputs and achieving the stated objectives.
Activity:	The action necessary to transform given inputs into planned outputs over a specified period.
Workplan and Timetable:	An operational schedule for project execution which links inputs, activities and outputs during a given period (e.g. a year, project life).
Target group:	(Direct beneficiaries) The specific group for whose benefit the project or programme is undertaken; closely related to impact and relevance.
Beneficiaries:	The direct (or intended) beneficiaries (target group) plus the indirect beneficiaries of the project.
Assumptions:	Event, condition or decision which is necessary for project success, but which are largely or completely beyond the control of project management.
Indicators:	Specific measures of evidence which demonstrate that objectives have been achieved; the yardstick against which change can be measured.
Institutional framework:	Denotes who will be responsible for the project.
Monitoring:	The continuous or periodic surveillance of the implementation of a project (and its various components) to ensure that input deliveries, work schedules, targeted outputs and other required actions are proceeding according to plan.
Evaluation:	A process to determine (as systematically and as objectively as possible) the extent to which project/programme objectives have been or are being achieved, and to analyse the reasons for any discrepancy.

- Follow-up:
- (a) At the end of a project, gathering the data necessary to undertake a final evaluation or terminal report.
 - (b) Further actions needed to achieve the long-term objectives of the project.

Requirements for good design

A good project design should explain:

- (a) Why the project is needed (rationale, justification, and description of the problem the project is to address);
- (b) What is the project's long-term objective;
- (c) What is the project's short-term objective, if successfully completed;
- (d) Who are the project's intended beneficiaries (immediate and ultimate);
- (e) What must the project produce in order to create conditions for the short-term objective to be realised (outputs);
- (f) What actions/activities are needed to produce the outputs;
- (g) What resources (inputs) are needed to produce the output and achieve the short-term objective;
- (h) Who will implement the project (management responsibility and structure);

What to watch out for:

The major weaknesses generally identified are:

- (a) Vagueness in stating the project's short-term and long-term objectives and in establishing linkages between the two;
- (b) Confusion as regards the meaning of short-term objectives, outputs and activities;
- (c) Lack of indicators to measure the degree of achievement of objectives;
- (d) Lack of consistency and coherence in distinguishing between activities and outputs, and between inputs and activities;
- (e) Omission of project beneficiaries (target groups);
- (f) Failure to spell out the assumptions that must prevail in order for outputs to be transformed into effects and effects into impact;
- (g) Occasionally unworkable management structure for project implementation;
- (h) Failure to mention who is responsible for which activities and how they are integrated into the workplan;
- (i) Failure to clearly define the follow-up activities needed;

- (j) Failure to make corresponding revisions in other parts of the project document when one component is being revised.

With UNEP's present emphasis on a results-oriented management approach, the focus of the staff and programmes has been shifted from the accomplishment of tasks to the achievement of results, thus instilling a client-service ethic. The massive restructuring process has improved transparency, cost-effectiveness and accountability within UNEP.

The new project proposal format designed in line with the results model is attached as follows:-

**UNITED NATIONS ENVIRONMENT PROGRAMME
PROJECT PROPOSAL**

SECTION 1 – PROJECT IDENTIFICATION

<p>1.1 Title of Sub Programmes: 1.2 Title of Project: 1.3 Project Number: 1.4 Geographical Scope: 1.5 Implementation: 1.6 Duration of the Project: Commencing: Completion:</p>	<p>1.7 Cost of Project: (Expressed in US \$)</p>																					
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In kind contribution																						
Total cost of the Project																						

Signature:

For the Co-operating agency/
Supporting organisation

For the Environment Fund of UNEP

Name and functional title

Name and functional title

Date:-----

Date:-----

SECTION 2 – BACKGROUND AND PROJECT CONTRIBUTION TO OVERALL SUB-PROGRAMME IMPLEMENTATION

- 2.1 Background:**
- 2.2 Project contribution to overall sub-programme implementation:**

SECTION 3 – NEEDS AND RESULTS

- 3.1 Needs:**
- 3.2 Results:**
- 3.3 Assumptions to achieve results:**

SECTION 4 – OUTPUTS, ACTIVITIES, WORKPLAN AND TIMETABLE, BUDGET, FOLLOW-UP

- 4.1 Outputs:**
- 4.2 Activities:**
- 4.3 Workplan and Timetable:**
The timetable for the implementation of activities and estimated expenditures should be presented on a quarterly basis
- 4.4 Budget:**
- 4.5 Cash Advance Requirements:**
Use standard text from the United Nations Environment Programme Manual on the Design and Approval of Projects
- 4.6 Follow-Up:**

SECTION 5 – INSTITUTIONAL FRAMEWORK AND EVALUATION

- 5.1 Institutional Framework:**
- 5.2 Evaluation:**

SECTION 6 – MONITORING AND REPORTING

To use standard text of the United Nations Environment Programme Manual on Design and Approval of Projects.

- 61. Progress Reports:**
- 62. Terminal Reports**
- 63. Financial Reports**
- 64. Terms and conditions:**
 - 6.4.1 Non Expendable Equipment**
 - 6.4.2 Responsibility for Cost Overruns:** (This will be amended to take into account Section D above)

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ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

Shiranee Yasaratne

The purposes of Environmental Impact Assessment (EIA) are to foresee potential environmental impacts and problems caused by proposed projects in order to provide decision makers with timely information and to make the project more suited to the environment through the incorporation of EIA findings and conclusions into project planning. It is designed to function as a management tool, not only for the purpose of identifying and mitigating negative impacts but also to facilitate the efficient and effective utilisation of natural and human resources.

Often EIA is thought of as conflicting with development imperatives and therefore to be inappropriate in its application in developing countries. However, some projects have been abandoned or postponed because of the lack of environmental concern resulting in depletion of resources, public opposition, unforeseen costs and disastrous accidents.

The typical sequence of carrying out EIA as an environmental management tool in developing countries is suggested based on the assumption that some legislative and administrative infrastructure for EIA system already exists. However, this could vary according to the economic, social and legislative status of each country. Even if a mandatory system does not exist, this sequence could be utilised for environmentally sound project management.

ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

Shiranee Yasaratne

There has been a growing recognition that development issues cannot be separated from environmental issues. Integration of environmental considerations into the development process is one of the essential preconditions for environmentally sound development. This integration should be promoted at many stages, for example in national development planning, regional development planning and in the planning of individual development projects. Environmental Impact Assessment (EIA) is considered to be the most effective tool for this purpose, especially at the stage of project planning. It is an important technique for ensuring that the likely impacts of development on the environment are fully understood and taken into account before the development is allowed to proceed.

The main objectives of EIA are to foresee potential environmental impacts and problems caused by proposed projects in order to provide decision makers with timely information and to make the project more suited to the environment through the incorporation of EIA findings and conclusions into project planning. It is designed to function as a management tool, not only for the purpose of identifying and mitigating negative impacts but to aid efficient and effective utilisation of natural and human resources.

EIA was first introduced as a legislative system in the United States of America in the 1970s. Following this, EIA has been introduced as a planning tool, in many countries. In the Asian region efforts have been made for over two decades to introduce, promote and improve EIA systems. Often EIA is thought of as conflicting with the urgent needs for development and to be inappropriate in its application in developing countries. However, some projects have been abandoned or postponed because of the lack of environmental concern resulting in depletion of resources, public opposition, unforeseen costs, disastrous accidents etc. Thus, there are clear pointers that major development projects will often not succeed without incorporation of environmental considerations into their development planning process from the early stages.

EIA Procedures

It is essential that EIA be carried out at a stage when its findings and conclusions could be incorporated into project planning and implementation. EIA should start early enough to provide information to improve basic designs and should be conducted as part of or parallel to the sequence of project planning. This would avoid costly duplication of efforts, as various sections of EIA studies are necessary for a project feasibility study.

The sequential steps of carrying out EIA as an environmental management tool is schematically represented in Figure 1. This figure shows the typical sequence on the assumption that some legislative or administrative EIA system exists. It could vary according to the economic, social and legislative condition of the country. Even if a mandatory system does not exist, this sequence could be utilised for environmentally sound project management.

a) *Screening and Preliminary Assessment*

- i) The project proponent examines whether any environmental study is required for the type of project being proposed and if so, whether an EIA is required or if an Initial Environmental Examination (IEE) suffices for a start.
- ii) If no IEE/EIA is required for the proposed project, minimal environmental consideration will be necessary at the planning stage.
- iii) If an IEE is required, the project proponent will prepare an IEE based on specified terms of reference. The purpose of IEE is to enable environmental agencies to screen projects to identify those for which no detailed EIA is necessary.
- iv) The environmental agencies review the IEE and if found to be inadequate it is returned to the project proponent for revision and resubmission. If a detailed EIA is not warranted, the project is approved from an environmental view point at its planning stage, with prescribed monitoring and mitigation measures.

b) *Establishing the scope*

- v) When a detailed EIA is warranted, the project proponent prepares EIA reports based on specific terms of reference.

c) *Public Participation*

- vi) Public participation, such as a public hearing, may be introduced to take note of the views of interested groups and others.

d) *Review Process*

- vii) The environmental agencies assess the EIA report for its appropriateness and adequacy of estimated impacts, proposed environmental protection measures, enhancement and mitigation measures, and monitoring programme.
- viii) If the EIA report indicates that the project has severe irreversible impacts on the environment, it is rejected on environmental grounds.
- ix) If the EIA report is found unsatisfactory or incomplete, it is returned to the project proponent with a list of specific parameters which should be revised.
- x) With the EIA approved, the project implementation can proceed.

e) *Monitoring*

- xi) The environmental agencies should also conduct spot checks during the implementation of the environmental protection, mitigation and

enhancement measures provided for in the EIA report. The monitoring is also to be periodically reviewed.

In the sequence of actions for EIA implementation, the screening and preliminary assessment prior to detailed EIA plays a noteworthy role in effective implementation of EIA procedures. Despite the usefulness of EIA in finding ways to make a proposed project more successful, a detailed EIA is not always necessary for every kind of development project. When the proposed project is considered not to have a severe impact on the environment based on the result of a preliminary assessment, it is justified that the project could be approved without a detailed EIA. This kind of preliminary assessment, generally called an Initial Environmental Examination (IEE), is introduced in many countries with a list of projects subject to EIA procedures. This IEE is also utilised for the process of establishing the scope of the detailed EIA as well as for assistance in early project planning.

Establishing the scope is another important stage which decides what will be covered in EIA reports and in what detail. There has been a tendency, particularly for the inexperienced, to adopt a broad approach covering too many topics which often results in long and complex reports. Such extensive work is not effectively utilised in decision making. The scope should first be based on preliminary but comprehensive work to include all the possible issues and concerns. It is important to determine the scope of an EIA study as early as possible but because "scoping" is a process, not an event, the participants must remain flexible.

After "scoping", the EIA study itself begins. The EIA study has also several steps, namely (a) identification of impacts to the environment; (b) prediction of degrees of impacts; (c) evaluation of impacts; (d) listing of alternatives and mitigation measures; (e) documentation of EIA report; In this sequence, the participation of interested parties should be incorporated.

The principal roles and responsibilities of the concerned parties are briefly outlined below:

1) *Project Proponents*

Project proponents are responsible for planning, executing and operating the proposed projects. Any modifications or change in the proposed projects, including the integration of mitigation measures into project designs and operations is decided by the project proponent. In most cases the preparation of EIA reports is their responsibility. In some cases, project proponents are responsible for the implementation of environmental monitoring recommended in the EIA reports.

2) *Permitting agencies*

These agencies are responsible for the administration of EIA systems. Their functions are mainly to draft and revise EIA laws/regulations/guidelines as appropriate, to interact with project proponents in conducting EIA, to review EIA reports and to inspect and/or monitor projects regulated by EIA systems.

3) *EIA Preparers / Consultants*

Generally EIAs are prepared by experts qualified for this purpose. Some countries have adopted licensing or formal/informal registration systems of organisations or consulting firms which are capable of carrying out EIA studies. Registration of EIA experts either for EIA studies or EIA reviews seems to be very effective in ensuring the quality of EIA studies and reports.

4) *The general public*

In some countries public involvement in EIA systems is mandatory. The general public, and, in particular the residents in the vicinity of a proposed project area are informed that an EIA is being conducted and are asked to provide comments on the proposal. Participation in public hearings may also be allowed in some countries. In recent years remarkable progress in public involvement in EIA systems has been observed.

Types and sizes of projects subject to EIA

In the Asian region, some countries conduct EIA on an ad hoc basis and thus do not have specified types of projects subject to EIA. Some other countries have at present only general criteria for selection of the projects requiring EIA. Many of them are trying to develop more specific criteria for selection. Countries that are at present developing their legislative EIA systems do not have information on the types and sizes of the projects subject to EIA. The types and sizes of the projects subject to EIA depend heavily on the country-specific situation, such as the number of projects expected to be undertaken, stage of economic and social development and environmental conditions in each country.

Status of EIA

The status of EIA in developing countries, differs from country to country. There are countries with specific laws on EIA while some others do not have specific laws but have general environmental legislation which empowers a government agency to require EIA for particular projects. Some countries do not have formal requirements but through administrative measures require EIA for specific types of projects. Since EIA is relatively new, many countries have been trying to introduce EIA systems or to improve existing ones. While the introduction of EIA is the first step in the sound management of our environment, continuing development of EIA must evolve applications appropriate for countries based on their respective local conditions. The application of EIA too is not uniform, greatly reflecting regional characteristics of environment, the planning processes of development projects and the overall legislative structures in the respective countries.

The Sri Lankan EIA Experience

Until the National Environmental Act (NEA) was enacted in 1980, there was no law governing environmental issues as a whole in Sri Lanka, although there were several key enactments relating to subjects like wildlife, land, forestry, water, urban development etc. The National Environmental Act of 1980 established the Central Environmental Authority (CEA) with laudable and wide objectives and a general mandate to protect and manage the environment. Until the National Environmental Act was amended in 1988, the Authority functioned primarily as a policy making and co-ordinating body in the field of environment. However, it soon became apparent that the role of the Authority was not effective especially with regard to preserving the quality of the environment. The Act was therefore amended in 1988, enabling the CEA to function as a regulatory body.

By a decision of the Cabinet of Ministers EIA was made mandatory for all development projects administratively with effect from 1st January 1984. However, this was found to be unsatisfactory. Part IV C of the Amendment Act of 1988 mandated the Authority to require proposals to establish "prescribed" development projects to be subjected to Environmental Impact Assessment (EIA) wherein evaluations would be made of the adverse and beneficial impacts of the proposed projects on the environment and measures to minimise such adverse

impacts would be identified. Prior to the 1988 amendment to the NEA, legal provisions for EIA in Sri Lanka was first introduced by the Coast Conservation Act No. 57 of 1981. These provisions were restricted to the Coastal Zone as defined by this act and the statutory obligation was at the discretion of the Director, Coast Conservation.

Regulations framed under Part IV C of the NEA

The provisions relating to EIA in the National Environmental Act (sections 23 Y, 23Z, 23AA - 23 FF) had to be supplemented by supporting regulations. These provisions came into effect only on 24th June 1993, when 2 orders under sections 23 Y and Z were made by the Minister of Environment & Parliamentary Affairs in Gazette Extraordinary No. 772/22. These two orders determined the projects and undertakings requiring to undergo the EIA process and the state agencies from whom approval should be obtained for this purpose (referred to as Project Approving Agencies). Under section 23 CC of the NEA the Minister also framed regulations for the procedures and methods to be applied in the implementation of the EIA process in the same Gazette Notification. These regulations are known as the National Environmental (Procedure for Approval of Projects) Regulations, No. 1 of 1993.

The NEA has identified two levels in the EIA process. The first level - i.e. the Initial Environmental Examination (IEE) is a report where possible impacts of a prescribed project are assessed with a view to determining whether the impacts are significant or not. An IEE must address the possible impacts and the intensity of such impacts. The second level - the Environmental Impact Assessment Report (EIAR) is a more comprehensive document whereby alternatives to the proposed project are considered and the option with the least impact on the environment is identified and assessed. Mitigation measures for the impacts identified as significant are part of an EIAR. An environmental cost benefit analysis is also undertaken where ever possible.

Prescribed Projects

The EIA process in Sri Lanka applies only to "prescribed projects", as gazetted under section 23 Z of the NEA. Under this order, three lists have been determined setting out the projects that would require an IEE/EIA before they can be implemented. One of these lists relates to 17 different types of projects (excluding industries) that are considered as generally having significant impacts. The second list sets out very high polluting industries which need an IEE/EIA wherever they are located. The third list is a list of medium and high polluting industries that would require an IEE/EIA if located in an environmentally sensitive area. A list of environmentally sensitive areas is set out in the regulations separately. This third list would be caught up in the EIA process only if such industries are located in the areas set out in the list of environmentally sensitive areas.

Project Approving Agencies (PAA)

Under the NEA approval for all prescribed projects must be granted by a Project Approving Agency (PAA). Schedule I of the gazette notification lists 14 PAAs as agencies having a dominant role in project approval. A single PAA is established as responsible for guiding the preparation of an IEE or EIA. When there is more than one PAA involved the appropriate lead agency is decided by the CEA. However, it is important to note that a PAA which is also a project proponent cannot function as a PAA for that project.

Procedure for conducting an IEE / EIA within the Sri Lankan legal framework:

The sequential steps of carrying out IEE/EIA are schematically depicted in Annex II.

Preliminary Information

A project proponent is required to give the PAA preliminary information on the proposed prescribed project as early as possible. It should include a description of the nature, scope and location of the proposed project accompanied by location maps and any other details as may be required by the PAA. The preliminary information submitted should be comprehensive and may even suffice to be considered as an IEE.

Environmental Scoping

Environmental Scoping is the process of identifying the important issues which must be addressed in detail in the IEE/EIA. Environmental issues involve national, regional and local government agencies and cover a broad range of responsibilities (wildlife, health, water, land use, tourism etc). Thus co-ordination among government agencies is crucial.

Scoping determines whether the project proponent should be asked to prepare an IEE or EIA and generates basic terms of reference for conducting the IEE/EIA. The involvement of affected groups and NGO too is crucial to IEE/EIA preparation. Therefore, the Project Proponent is expected to take the views of affected groups and local NGO fully into account in project design and implementation and in preparation of the required report.

Public Participation

The involvement of the public is a most crucial aspect of the EIA process. The provision for public participation is contained in the NEA. The notice of availability of the IEE/EIA Report for public review must be inserted in one newspaper each in the Sinhala, Tamil and English Languages and in the government gazette. 30 days are allowed for public review. Once the public comment period is over the PAA must decide whether the case warrants a public hearing. The public comments received during the 30 day period must be sent back to the project proponent for review and response.

The project proponent must respond to comments by making every effort to modify alternatives including the proposed action, develop and evaluate alternatives not provided, give serious consideration to providing supplementary information in the document and make factual corrections. All substantive comments received on the draft should be attached to the final statement.

Decision making

According to the regulations, the PAA will grant approval for the project subject to specified conditions or refuse approval for the implementation of the project with reasons for doing so. A project proponent who is aggrieved by a refusal can appeal to the Secretary to the Minister in charge of the subject of Environment. A member of the public aggrieved by a decision to grant approval for a project would have to seek recourse in courts.

Monitoring

The success of the EIA process would be totally negated if the conditions imposed by the PAA are not effectively monitored. The regulations state that the PAA should forward to the CEA a report which contains a plan to monitor the implementation of every approved project within 30 days of granting such approval. Monitoring by the PAA would involve compliance with conditions and the effectiveness of the mitigatory measures. A system of self monitoring would be most appropriate. The project proponent would submit monthly reports to the PAA regarding compliance with the specified conditions. Spot checks could be done by the PAA to verify accuracy.

Review of Application of the EIA Process and Constraints

The EIA process has developed rapidly in Sri Lanka over the past three years, but several institutional and legal barriers must be overcome to allow the process to fulfil its intended goals. The process offers the government an invaluable management tool for integrating environment and development goals. At the same time, this provision also offers citizens the only opportunity they have, to participate in major economic development decisions. However, these two goals have not been fully realised so far.

Institutional Constraints in Implementation of the EIA Process

The most significant issue arising under Part IV C of the NEA concerns the inability of PAAs to carry out their primary EIA management function as the law directs. PAAs have had difficulty meeting their EIA responsibilities, which include management of scoping procedures, development of Terms of Reference, oversight of EIA preparation, EIA review, and supervision of project monitoring requirements. Although CEA has steadily upgraded its staff and organisational capacity to the NEA's environmental requirements, yet it too cannot deploy all the skills and resources necessary to help PAAs with EIA management. At present CEA's small EIA management staff is insufficient to provide PAAs with EIA guidance on Terms of Reference, scoping, EIA preparation, review, and monitoring.

Legal constraints

A number of NEA provisions now inhibit practical application of environmental impact assessment to Sri Lanka's sustainable economic development programs.

Limitation of IEEs / EIAs to prescribed projects

By requiring an advance list of prescribed projects the NEA creates a rigid situation that contradicts needs for flexible EIA responses based on the environmental context, magnitude, or timing of a proposed project. The listing of projects provides practical guidance and certainty about when an IEE or EIA may be required, but it also focuses attention and argument over whether a proposed project is on the list. Therefore, additional provisions are necessary to ensure that certain projects likely to cause significant environmental impacts do not fall between the cracks because they were anticipated and listed beforehand.

Also by limiting IEE/EIAs to prescribed projects the NEA focuses attention unduly on project decisions, and it precludes the application of environmental assessments to those important government policy or planning actions that are likely to have significant impacts on the environment. Decisions to change policies, establish new regulations or make sector

plans can have immense environmental and related economic impacts. A format and procedure for some kind of environmental assessment report for such actions should be devised to match practical needs of government agencies and policy makers. Project level IEEs or EIAs cannot and should not assess these policy and sectoral program impacts or alternatives.

In general, although nominal environmental cells have been established in most PAAs, none have secure internal environmental cells that can implement their basic IEE and EIA responsibilities and provide policy makers with sound environmental information and advice. Part of the problem is that there are not yet enough experienced experts to staff all the PAAs on a permanent basis. The establishment of an Environmental Cell within each designated PAA is not a legal requirement at present under the NEA.

Use of Expertise

The skills and resources within universities, government, and the private sector have not been adequately mobilised to help PAAs, and the major ministries and agencies within which they operate. PAAs need ready access to the expertise that exists. Therefore, PAAs need to seek and use independent expertise in order to maximise their impartial environmental oversight capabilities.

Establishment of Advisory Panel

In addition it is proposed that legislation should accord a special role to an Advisory Panel for EIA. The Panel would comprise of independent experts who must ascertain for each EIA whether the contents meet the statutory requirements and whether the recommendation and comments of preparers and the public are valid. The result of this review will be a recommendation to the PAAs. The legal framework should allow the Panel to assist and advice PAAs and the CEA regarding technical matters concerned with EIA review, implementation, and monitoring. The Panel could also submit advice during the scoping of the activity and during the public review of the EIA. The combination of expertise with a position of independence will allow the Panel to observe and review all environmental information without bias.

Requirement for IEE Gazetting and Public Comment

It is now widely agreed that the current requirement for gazetting and public comment on IEEs is impractical and undesirable. Requirements for gazetting and public comment make IEEs not routine administrative documents. By freeing IEEs from these encumbrances they can be tailored to address the impacts of different kinds of projects with varying degrees of complexity and environmental impacts. CEA is in the process of assisting PAAs design IEEs that meet these practical requirements, from questionnaires to more elaborate formats. If IEEs are on public record and available for public viewing, the public will be assured that they are being prepared and that they help to determine whether and how they affect project decisions.

Prescription of Quantified Magnitudes

There appears to be no significant advantage for the list of prescribed projects to include quantified magnitudes. Such measurements - length of road, tons of output, hectares of land, and so forth - are very rough guides to significant impacts, but they are also highly

misleading. Projects just beneath the threshold may have substantial impacts and projects well over may be environmentally insignificant. Experience in Sri Lanka, and Thailand as well illustrates how these threshold figures can be abused - a common example being a hotel just below the room threshold. In contrast, criteria for significance focuses on determinations of "context and intensity" of impacts. This approach offers far more reasonable bases for judging EIA needs. This is the kind of approach being taken by international development banks.

Timing of EIAs and integration with the National Planning Process

The present approach to prescribed projects usually means that EIAs develop too late in the project planning cycle to have beneficial effects.

The planning cycle of projects proposed by public agencies is very different from that of private projects. Hence it is important to ensure that EIA's for public projects come as early as possible in the government project appraisal process. This has proved difficult to implement in practice because sponsoring agencies prefer to start EIAs after their proposals have been clearly defined. These EIAs are then too later for objective analysis of alternatives. It is therefore, essential that EIAs be more carefully integrated with the appraisal process carried out for the Public Investment Programme (PIP).

Constraints in Enforcement

Substantially improved enforcement is necessary on several fronts, beginning with voluntary measures. Revisions to the NEA should be designed to encourage self enforcement of sound environmental practices by the proponent. One such requirement is the recommended need for EIAs to contain monitoring provisions, which the proponent can design and carry out in ways that are most efficient for the project while meeting public needs. More effective penalties are also required to ensure that proponents or PAAs do not make costly commitments to a project such as signing a contract, or clearing land before an EIA is approved.

Sole reliance on government agencies to carry out effective compliance has not proved to be reliable, in Sri Lanka as elsewhere. More authority should certainly be given to CEA to obtain injunctive relief. On the other, given the practical and political constraints that are inherent in government when one agency must take action against another, the provision of citizen suits to enforce Part IV C as well as the Environmental Pollution Licensing Provisions of the NEA, should be considered.

Constraints affecting the public

Although the NEA allows for public participation in the EIA process past experience has shown that public commenting has not been as extensive and participatory as expected. This has been chiefly due to the inadequate knowledge of the role and responsibility devolved to the public in this process.

Access to IEE/EIA Reports

The law requires that the notifications should indicate the places where the documents are available for public scrutiny. Usually copies of the documents are made available in Sinhala, English and Tamil languages at the offices of the PAA, office of CEA and at the relevant

Divisional Secretariats. Copies of the documents are made available to the public on request. However, several administrative difficulties hamper the smooth implementation of this process. For example the copies are often not available at the Divisional Secretariats on the specified dates and facilities for making additional copies are also not available at these places. The public may miss the notices and thus be unaware of the availability of the document for public comments.

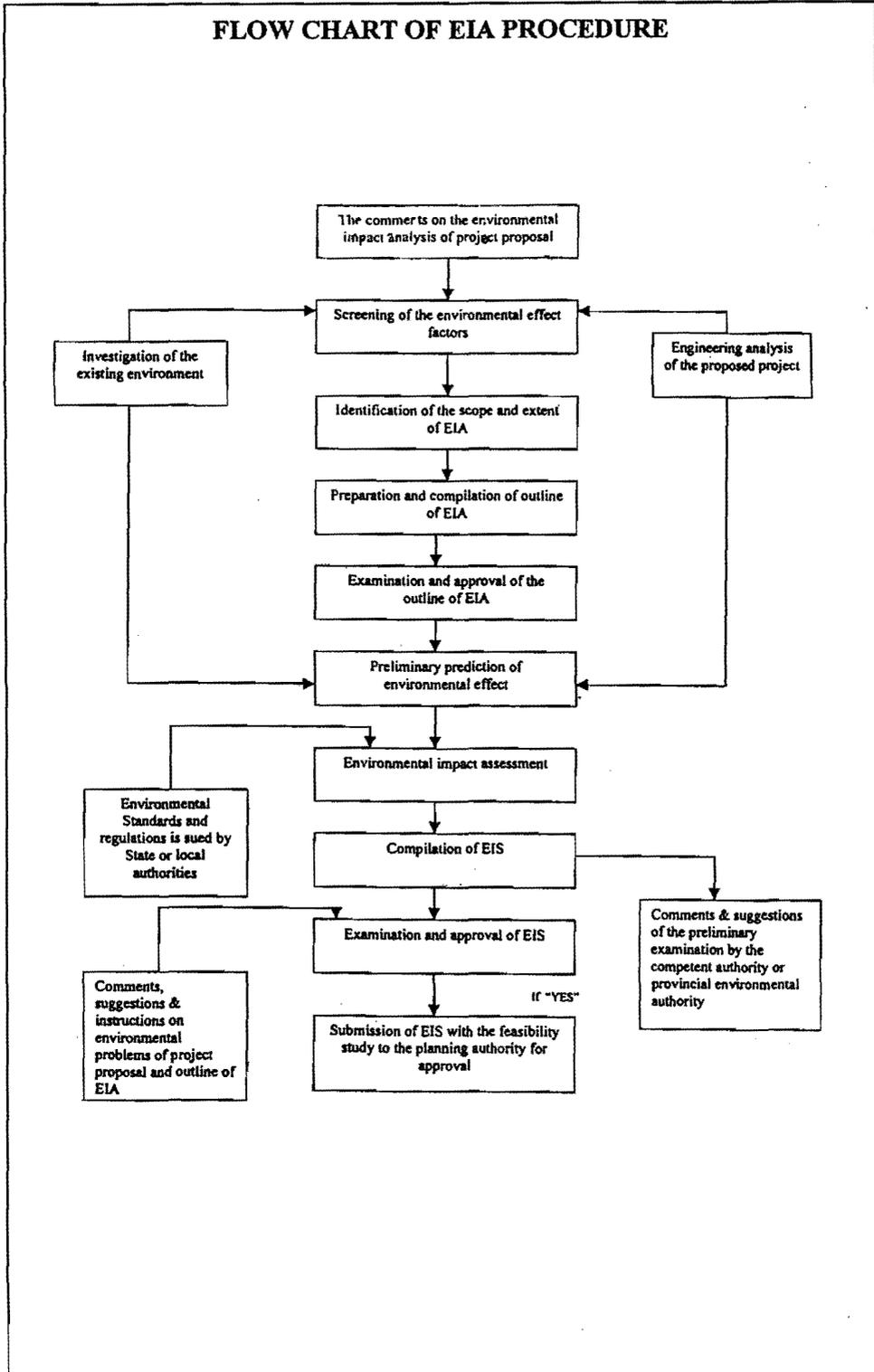
Writing of the IEE / EIAs and Public Commenting

Administrative guidelines issued by the CEA stipulate that IEE/EIA's should be written in plain language and may use appropriate graphics so that decision makers and the public can readily understand them. However, in most cases the documents are written in very technical language and thus the public find it difficult to understand and make comments on such documents. In addition, the public lack the knowledge and/or ability to properly comment on these reports.

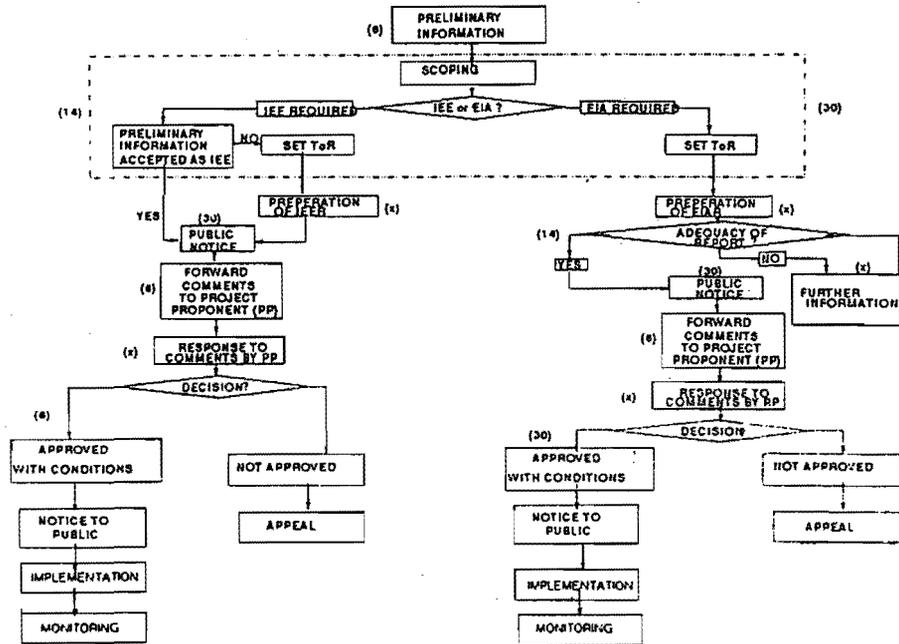
Recommendations

At the international, regional and global levels, although various efforts have already made, more concerted and systematic efforts are needed to assist developing countries to meet their EIA requirements. The following areas are suggested for national action.

- a. Seminars / workshops on environmental issues should be organised in order to promote the awareness of decision makers and politicians;
- b. Explicit and clear EIA procedures should be formulated in order to avoid any confusion regarding EIA implementation;
- c. Initial Environmental Examination should be encouraged to avoid unnecessary delay of a proposed project;
- d. Scoping procedures should be emphasised to make EIA more effective and efficient;
- e. Communication among permitting agencies and project proponents should be encouraged;
- f. Technical guidelines and other materials should be developed in order to provide appropriate guidance on EIA methodologies;
- g. Systematic and comprehensive training programmes on EIA should be developed and conducted taking into account the needs for manpower development in the field;
- h. Efforts should be made to obtain appropriate and qualified experts on EIA. For this purpose the introduction of a registration system on EIA may be a useful approach;
- i. The exchange of information and experience in EIA should be promoted in developing countries;
- j. Environmental data bases relevant to EIA should be developed.



ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE SRI LANKA



NOTE: Bracketed figures indicate MAXIMUM number of days

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MARKET BASED ECONOMIC POLICIES

Paul Steele and Dr. T .L. Gunaruwan

The economic literature generally suggests that incentive based instruments are preferred to the conventional 'command-and-control' type methods. Incentive based instruments can result in significant cost savings, both to the regulatory authority as well as to the regulated firms.

The former benefit from a reduced role in monitoring and enforcing the regulations on pollution control. Certain incentive based instruments also serve as a source of revenue to the regulatory authority. The latter benefit mainly from having greater flexibility to decide on the level of pollution abatement that is economically feasible.

Clearly the feasible level of pollution abatement may vary from firm to firm. It can be shown that the least cost strategy for abatement is achieved when firms have greater flexibility in selecting the appropriate levels for abatement. Of course the event of firms collectively selecting an excessively high level of pollution must be circumvented by introducing an appropriate price/quantity signal. This is the role of the regulatory authority under a typical incentive based approach such as effluent charges.

However, there is considerable potential for introducing new incentive based instruments. The paper examines the range of such options and evaluates the advantages and disadvantages of each approach. The paper concludes with recommendations for a set of strategies appropriate under the institutional and legal establishments found in Sri Lanka.

MARKET BASED ECONOMIC POLICIES

Paul Steele & Dr. T. L. Gunaruwan

To illustrate the role of market based instruments, let us consider a simple example of the problems faced by Asian environmental managers: An environmental agency wants to stop a state garment factory from discharging its waste into a canal, where people wash. What should this environmental agency do? There are four basic approaches:

- a. Use legislation to set standards limiting pollution. This is perhaps the most common approach adopted in Asia and the Pacific. Once the standards have been set, legal action can be taken against the factory. In practice however enforcement is often a problem as there may be resistance from the managers and workers of the factory as well as industrial groups.
- b. Provide information to the factory owners and employers on the health impacts of pollution and the most cost-effective form of pollution control. This requires general education of society about the health impacts of industrial pollution. It may be most effective to have special training for industrial groups provided by industry associations. This is a long term strategy and may take time to work effectively.
- c. Lobby the factory owner or ask the Ministry of Industries to intervene. This may be done behind the scene. However lobbying may already have been organised by local residents and NGOs, and the environmental agency may be reluctant to get involved. In addition, the environmental agency may have very little political influence or support.
- d. Provide an economic incentive to the factory owner to stop or minimise the discharge of effluent. Such incentives can be designed as subsidies to lower the cost of reducing pollution or charges to raise the cost of polluting the river. The subsidies could include low interest loans for the installation of pollution abatement equipment, or duty waivers on imported equipment. The charges could include higher water rates to encourage the factory to clean and reuse its water, taxes on the most polluting inputs (e.g. toxic chemicals), user charges on the effluent discharged to fund a common wastewater treatment plant, or a pollution tax on effluent to encourage the factory to set up its own treatment plant.

While all four of the approaches described above (regulations, education, lobbying and economic incentives) are useful, this paper will focus on the latter instrument of economic incentives. In the Asia region as in all countries, economic incentives are now receiving growing attention. The United Nations sponsored Agenda 21 agreed at the Rio Conference in 1992 states that: "In the near term, Governments should consider gradually building on experience with the economic instruments and market mechanisms by undertaking to reorient their policies".

This factory example above illustrates three of the benefits of economic incentives. First of all there is a reduced need for monitoring since if pollution control equipment is cheaper the factory will itself be more willing to install it. Secondly market based incentives can promote efficiency in the economy if they create incentives for resources to be allocated efficiently. For example, if water is scarce, then raising its price will encourage industry to reuse it. Finally, economic incentives raise revenue for the environmental management. For example,

by charging industry for effluent discharges, government can finance the creation of a common wastewater treatment plant.

Definition of Economic Incentives

The problem is that at present, consumers and producers do not face the true costs of environmental damage and natural resource destruction. For example, if people down river of the polluting factory become sick, the factory owner upstream does not bear their costs of buying medicine and having to take time off work. In other words if it is free to pollute rivers or the air, then industry will do this rather than pay for technologies to reduce pollution.

Similarly if farmers make more income from potatoes rather than tree crops (e.g. tea), as is the case in Sri Lanka, then farmers will grow potatoes, even though potatoes generally cause more erosion. And again, if diesel is cheaper than petrol, as in many Asian countries, consumers will prefer diesel cars, or convert cars to diesel, even though diesel is generally more polluting. In fact it has higher particulate pollution, which is the main cause of health impacts from air pollution.

By altering prices so that they include the associated environmental costs, economic incentives use the price mechanism to change behaviour. This is why such incentives are also known as market based instruments or incentives. Both terms are used interchangeably in this paper. There are two main reasons that environmental damage may not be reflected in market prices. These are known as; policy failure and market failure.

Policy failure (also known as government or intervention failure) occurs when the government alters the price of certain environmentally damaging activities by intervening through price subsidies, price controls, physical output targets, exchange controls to lower prices of environmentally damaging activities, or by not intervening to set environmental resource prices to cover cost. In this case, the benefits of environmentally damaging activities will be above the world price level.

In the case of the potato example, potato prices are very high in Sri Lanka due a high duty on imported potatoes. Diesel is cheaper than Petrol as the government taxes petrol, but not diesel. To return to the first garment factory. Example, the government may allow a lower water charge for large industrial customers. This would reduce the incentives for water reuse by the factory. Even when government intervention is justified, which it is in many cases, this must be implemented in the least cost manner. For example in the case of the garment factory it may be better to provide industrial subsidies by giving tariff reductions for importing more efficient industrial technology.

The most common policy failure relating to the environment is when governments allow natural and environmental resources to be provided at below their market clearing level. This underpricing applies to both those who supply and demand these resources (Steele and Pearce, 1994):

The suppliers of natural resources are undercharged when the resource rent earned from natural resource extraction and harvesting by private concessionaires is not sufficiently captured by government through taxation. This resource rent, which arises for all renewable and non-renewable natural resources (e.g. minerals, fisheries, timber or nature tourism sites) is the difference between the cost of extracting the resource and its price (also including a reasonable profit margin and possible risk premium). Since rent arises because of the scarcity value of a resource, even if it taxed to zero, it is still profitable to harvest the resource.

In most cases, clear property rights and careful management have enabled many Asian countries to extract over 80% of the rent from minerals. This is often achieved by auctioning off oil and gas deposits to the highest bidder as is done in Vietnam and India. These approaches could usefully be tried in other natural resource areas. In Indonesia the oil and gas company Pertamina must receive 85% of net revenue.

In the forest area, Malaysia and Papua New Guinea have recently increased their timber stumpage fees to increase the government revenue earned per harvested log. In Malaysia, Sarawak has been auctioning off timber concessions since 1981, and in 1987 this auctioning approach was written into the Philippine constitution. The problem is that often the logging sector is very oligopolistic with only a few large firms and the government authorities need to be vigilant against price collusion.

Another scarce natural resource whose rent is not sufficiently "captured" are natural parks and nature tourism sites. Foreign tourists, who pay several hundred dollars to visit a country, often have a very high willingness to pay to visit such areas. Nepal has recently increased the charges for entering national parks and in the Annapuran Conservation Area allowed the revenue from the \$7 entrance fee to be invested in biodiversity management and raising the living standard of the local population.

In Sri Lanka, the Department of Wildlife Conservation recently raised entrance fees to about \$ 12 for its parks, but unfortunately this money has to be returned to the Treasury. India and Thailand have also recently raised their park entrance fees for foreign tourists. Another scarce natural resource with a high rent value is groundwater. This is often available free (apart from the cost of pumping) and groundwater mining is a serious problem. There may be additional environmental impacts, such as subsidence in urban areas as has occurred in Bangkok. This can be reduced by levying groundwater charges. In Bangkok, groundwater fees were introduced in February 1985 and in just 3 months, the pumping rate fell by 1%.

Policy failure also occurs when the government provides those who demand environmental resources, or resources with environmentally damaging impacts at below their market price. Examples are when government supplies water, energy and electricity, timber pesticides and fertilizers at below the marginal costs of supply. The economic incentive here is to raise existing user charges so that they cover the marginal cost of supply or to the international price level.

Many governments are now acting to reduce these policy failures: both China and India are raising water and energy prices which creates incentives for water and energy conservation. In some cases, there may be fears that subsidy removal will have an unfair impact on the poor. In this case it is much more efficient to provide targeted subsidies. For example, Sri Lanka removed its price subsidy on kerosene fuel and instead provided a targeted subsidy of kerosene stamps to low income families.

In some cases, there may be no user charges on the provision of certain environmental goods and services. For example, waste collection and disposal is generally financed out of local government taxation. Industrial waste treatment and collection may be provided free or effluent is discharged to storm drains or not provided at all. In this case, the government needs to introduce user charges. Such user charges are preferably to financing from other sources as they will provide a reliable source of finance for environmental goods and services, and to create a level playing field, where the large polluters pay more than the smaller polluters. The economies of scale from large collection and treatment systems mean

that if industry can be mandated to finance these services through user charges then everyone gains.

This approach is being discussed as a way of financing common wastewater treatment in the main industrial areas of Sri Lanka at Ratmalana and Ja-Ela and also at the most built up tourist resort of Hikkaduwa. In Thailand and Hong Kong industrial waste treatment is already financed by such user charges. However unless the government forces industry to join up there is no way such a scheme will work. The introduction of user charges for solid waste collection and disposal provided a strong incentive for recycling. User charges were recently raised for waste collection in Thailand.

Finally, policy failure occurs when government provides subsidies for certain environmentally damaging activities. The most pervasive examples are the economic incentives for land clearance and land conversion that often lead to the loss of wetlands and forests. Here the policy instrument is to reduce environmentally damaging subsidies. There are subsidies for increased fishing effort which can lead to over-fishing in many countries. Some countries also have cheap credit for activities such as aquaculture that damage the environment. Some governments are reducing these policy failures: Indonesia has reduced its transmigration programme, Korea has phased out its cheap loans for trawlers and the Philippines its reducing the subsidies to aquaculture. Market failure arises when freely functioning markets produce prices that do not reflect the true social costs or benefits of an action. This happens when for example, the environmental costs of deforestation are not reflected in timber prices, or the environmental costs of mangroves destroyed by aquaculture are not included in shrimp prices, or the price of garments does not include the costs of water pollution from the factory. In economic terminology, the environmental damage or benefit is an external effect to or externality; that is external or outside the existing price mechanism.

Market failure can be corrected in a number of different ways. Firstly, by taxing of environmentally damaging behaviour through pollution fees or levies. These fees can be charged both on inputs which produce pollution such as toxic chemicals, vehicles or on the output of pollution that is tax on chemical effluents tax on air emissions. An example of input charges also known as product charges is a tax on high sulphur coal introduced by China, while Indonesia has a tax on each processed log to capture the environmental costs of deforestation. A more indirect product charge is a tax on vehicle use, which will reduce congestion and pollution from vehicles. A very indirect vehicle charge would raise the price of owning a vehicle through high duty while a more direct scheme raises the price of driving. This could include taxes on fuel or charges on driving. The latter approach has been tried in Singapore with a charge for cars entering the city centre. The advantage of input taxes is that they are often easier to enforce and monitor than charges on polluting output. The disadvantage is that they are much less direct and so do not provide any incentive for reducing the pollution associated with a particular input. Charges on polluting outputs would cover charges on pollution emissions to air and water. Malaysia introduced a very successful scheme of effluent charges in 1978 to lower pollution from palm oil and rubber factories and used the revenue raised to fund research into cleaner technology. Palm oil processors reduced their discharges of BOD by almost 90% between 1982 and 1987.

Secondly, an alternative approach to reducing market failure is to provide subsidies for environment improving behaviour. These subsidies can be both for environmental positive products and for environment improving activities. An example for products would be duty rebates or low interest loans on pollution control equipment. These exist in several countries in South Asia including Sri Lanka. Subsidies for environment improving activities include afforestation subsidies, or for investments in soil conservation.

While subsidies are useful, there are a number of caveats. In particular, subsidies should be short term and less than 100% of the total cost to provide incentives for private producers and consumers to use the subsidy for economically viable investments. Community forests planted with complete subsidies have failed across India. It is far more efficient to subsidize seed banks and extension and marketing services as the West Bengal government has chosen to do, leaving the farmers to select what to plant, when to plant it and to actually care for the trees.

While this paper has so far focused on the role of pricing in correcting market failure, there are two other "economic" ways to change behaviour.

The first is to provide deposit refunds or performance bonds which are payments that can be refunded if the item is returned for recycling (e.g. bottles) or if environmental restoration takes place (e.g. an abandoned mine is rehabilitated.) Korea recently introduced a deposit refund scheme on food and beverage containers, tires, batteries, lubricants, pesticide containers and plastics. While the scheme had some success it was hampered as the level of refund was too low to provide a strong incentive. This is now being corrected. In Sri Lanka as in many countries, glass, newspaper, cardboard and aluminum refunds are available from manufacturers. These schemes also provide an income to many poor urban waste scavengers.

A second way is to alter property rights of an environmental good or service to improve environmental management. The main concern is to strengthen incentives to make efficient use of resources. Thus both private and public ownership must be optimally combined to create such incentives. This combination requires a subtle combination of regulation, ownership and other incentives.

In some cases, a resource may currently have no owner. This is known as an open access resource since it is open to all to exploit. An example would be deep seas fisheries, which until recently were open to any fishing fleet. With the passage of the Law of the Sea and the creation of Exclusive Economic Zones access to such fish is now controlled by national governments. This has now allowed the islands of the South Pacific to form the Forum Fisheries Agency (FFA) which now extracts very large rents from the valuable fishery from foreign fishing fleets. The FFA signed an access agreement with the United States in 1988, which in 3 years brought in over \$ 49 million for the Pacific Islands. This approach requires strong monitoring, but funds for the monitoring can be generated from the revenue collected so that the scheme becomes self financing. The success of the FFA encouraged a similar approach by the countries of the Indian Ocean to harmonise tuna fishery access fees and enforcement. Here the economic incentive is the creation of an owner where none existed before.

In other cases, property rights can be more effectively managed by local communities. In Sri Lanka, fishery rights are often hereditary and closely guarded. Beach seine (madel) fishermen will "own" a stretch of the shoreline and will prevent over fishing by keeping outsiders out. In this case the government needs to intervene selectively to support local communities to ensure that ownership is not monopolized. Often the government has done the reverse and simply revoked these traditional rights. Once state bureaucracies have been set up and communities reduced their stake in resource management, it is difficult to return to a system of local management of resources. For example, Forest Departments and Irrigation Departments are notoriously reluctant to really assist in transferring control of resources to resource users. However this has to some extent been overcome in West Bengal, where the government has successfully developed Forestry protection Committees made up of local

villagers. In exchange for protecting forest and plantation from poachers, forest protection committees are entitled to 25% of the net sale of timber and rights to collect twigs, grass, fruit and flowers and seeds throughout the year. Here the economic instrument is to support and encourage community ownership where it is more effective than government control.

A third type of property rights would ensure that property rights are secured within a reasonable time horizon. Since many environmental investments take time to pay off, this security of tenure is vital, whether ownership is by the state or the private sector. For example timber concessions whether they are held by the state timber company, or by private contractors must be for a long enough period to make good timber management practices economic. If the concession is only awarded for 5 years, then there is an incentive just to take as much timber as possible regardless of the environmental consequences. In the same way, if small holder farmers do not have a reasonable time horizon when awarded land rights then they tend to use the soil as much as possible without being concerned about soil erosion. In Sri Lanka it had been government policy to grant encroachers' in stream reservations only a one year renewable lease, but at the same time to require them to grow tree crops to reduce erosion. However it was realised that as these encroachers are always afraid of not receiving a license renewal, they almost never planted tree crops which take at least one year to bear fruit. Now the government is discussing as a short term policy measure before long term measures are taken such as making more land available, providing 5 year renewable leases. Here the policy instrument is to ensure that owners of environmental assets have sufficiently secure property rights.

A fourth type of ownership policy is to foster public private partnerships of environmental goods and services, when pure government provision of resources is inefficient and undercharge. Examples might be the government provision of domestic sewage treatment or solid waste collection and disposal. By transferring ownership to the private sector, the private sector will raise fees to cover costs and their profit margin which the government might find politically difficult. The private sector may also have access to funds for borrowing which the government does not have without increasing inflation. Many countries are now installing environmental infrastructure, such as waste treatment facilities, through public-private partnerships and Build Operate Transfer (BOT) projects. Even environmental monitoring and inspection may be done more cheaply and effectively. Indonesia is now employing a private company to monitor logging concessions to ensure that environmental safeguards are adhered to.

The different types of economic incentives are presented in Table 1. As this illustrates, there are five main incentives for correcting market and policy failures. Since the existing price mechanism is such a combination of market forces and government intervention; in practice the allocation between market and government failure is not always clear. Thus it is easier to imagine the different incentives strung along a continuous line with correcting for pure government failure at one end, and correcting for pure market failure at the other end.

As the Table illustrates, the phrase economic incentives or market based instruments is a generic term to describe a whole range of policy reforms that use prices and ownership to provide incentives for sound environmental management. This is a different emphasis from the traditional regulatory approach which focus on legal remedies for environmental management. However regulations with fines as penalties also have an economic component, and many so called economic incentives require legal support in the same way that the tax system is enforced by the threat of imprisonment for non-payment of taxes.

Table 1: Examples of Economic incentives of Environmental Management

Aim	Instrument	Example
Correcting for Policy failure	Raise user charges to cover marginal costs	Removal of energy subsidies (India, China)
	Introduce user charges for environmental goods and services	User charges for industrial waste collection and treatment (Thailand)
	Removal of subsidies for environmentally damaging activities	Reduction of cheap credit for increase in fishing effort (Korea), end to tax incentives for aquaculture (Philippines)
Correcting for Market failure	Increased rent capture of natural resources	Raise timber stumpage fee (Malaysia, Philippines)
	Deposit refunds/performance bonds	Deposit refunds for mining rehabilitation (Malaysia)
	Creating more secure property rights for environmental goods and services	Longer time limits for timber concessions (Malaysia)
	Strengthening community management and ownership for natural resources	Increased local management of resources in forest areas, coasts and watersheds (Sri Lanka)
	Public-private partnership for provision of environmental goods/services	Build-Own-Transfer project for waste treatment (Hong Kong)
	Introduction of environmentally beneficial subsidies	Subsidies for environmentally clean pollution technology (Korea)
	Environmental charges/taxes	Charge on water pollution (China), charge on driving (Singapore)

The Advantages of Economic Incentives

The main advantages of economic incentives have already been mentioned. They are reduced monitoring, increased revenue and greater efficiency. Economic incentives are generally enforced more easily than regulations. The removal of an environmentally damaging subsidy will require no enforcement. In the case of an environmentally beneficial subsidy or deposit refund, the consumer of the producer will request the bond or subsidy, so again there is no need for monitoring. In the case of a tax or charge on pollution emissions, there is no environmental monitoring required. If non-payment does not take place, the only proof required will be non payment of the charge. If the charge is linked to water quality or some environmental parameter that does require monitoring, then the cost and burden of monitoring can be passed to industry with an estimated charge level implemented, which industry can contest if they feel it is unfair. In the case of strengthened property rights for environmental goods and services, the owner will ensure that these rights are protected.

Economic incentives if they reflect prices as an indicator of environmental costs/benefits, promote efficiency in the economy. They are often known as win-win policies since they promote environmental management, and lead to greater economic efficiency. Thus environmental agencies and the Treasury and National Planning Agencies will be supporting similar policies. The reasons for greater efficiency is that if society's scarce resources need to be allocated between different uses, then prices are more efficient than rationing by quantity. Artificially low prices of water and energy if they exist, lead to inefficiency in demand since resource users have less incentive to conserve the resource. Inefficiency in low prices is estimated to have caused up to 30% of China's pollution (World Bank, 1992). Similarly with low fertiliser prices soil conservation is not economic, with subsidies pesticide integrated pest management is not economic, with subsidies pesticide low fertiliser prices soil conservation is not economic, with subsidies pesticide sustainable logging is uneconomic. In Japan and Singapore where the price of water is high, reclaimed wastewater is used for flushing toilets. Artificially low prices also lead to inefficiency in supply. Low prices lead to a vicious circle of underfunding as service quality declines further. Underpricing also reduces the incentives for private suppliers and distributors. The combination of demand and supply inefficiency causes excess demand that cannot be removed by price changes.

The complementarity between economic incentives for promoting efficiency and environmental management means that they are particularly appealing to countries that are liberalising their prices. This explains why countries such as Malaysia, Philippines and Thailand which have already liberalised their economies significantly, also place a strong reliance on economic instruments for environmental management. South Asian economies remain relatively more controlled with a much heavier reliance on subsidies and thus have not made such widespread use of economic incentives. However as South Asia shifts to more market prices, it is important that the price mechanism is also adjusted so that economic incentives for environmental management have a major role to play.

Economic incentives in the form of user charges, rent taxes and environmental taxation provide revenue. In many cases, such as user fees for waste treatment, this is much more important than the incentive effects of economic instruments. Indeed often due to political considerations, economic instruments can be set too low to provide any real incentive effects, but they can still generate revenue.

Obstacles to Implementation of Economic Incentives

The main resistance to the removal of policy failure is from groups who currently benefit from subsidies. The main claims are that subsidy removal will affect the poor, increase the cost of living and affect international competitiveness. While these arguments may have some validity depending on the particular circumstances it is important to test this out empirically. Too often such claims are not so clear cut when actually examined. For example the claim that user charges for waste collection, or sewage will impact the poor is rarely the case since the poor do not have access to such services. Often the existing subsidies most benefit the urban middle class and in fact such subsidies are at the expense of the true poor who are the rural and urban poor. It must also be remembered that it is the poor who most suffer from environmental pollution. They tend to live near polluted water bodies and waste dumps, and in noisy areas. Therefore reducing urban environmental pollution can benefit the poor most.

It is indeed true that subsidy removal will affect the poor disproportionately. It may be possible to provide the subsidy in a less distortionary fashion. For example instead of subsidising public transport by providing low price diesel, it would be more efficient to

reduce the duty on imported spares and parts to public transport as this would only benefit public transport. In some other cases, the subsidy could be targeted to benefit the poor only. In this way, Sri Lankan subsidies for kerosene fuel were targeted by introducing fuel stamps for the poorest members of the population. Another approach is through cross-subsidies, where charges are raised for the wealthier classes to cover the costs of the subsidy for the poor. This approach already exists in many countries where electricity and water charges increase as more units are consumed. This can be an effective way of protecting the poor while ensuring that the average price is sufficient to cover marginal costs. For example, this allows the same ends to be achieved but at much lower cost to the government in terms of revenue.

The other defence against subsidy removal will be the impact it will have on industry. This may appear convincing in the short run with a static view, but when a longer time frame and dynamic effects are considered, industry may actually benefit from the incentives to use resources more efficiently. For example Japanese industry has not faced any problems despite the very high price of fuel in Japan. Indeed this provided an incentive to make maximum use of technology and produce fuel efficient cars. Often the cost of power cuts and other unreliable or low quality service provision can be much higher to industry than simply charging a higher enough user fee to fund operation and maintenance and new capacity.

A third form of opposition to subsidy removal arises out of fears that this will increase the cost of living. However as in the case of the fears over international competitiveness, where it is necessary to take a dynamic and not a static view. In the short run it will be possible for administered prices subsidised by the government to lower inflation, but eventually the size of the government budget deficit created by subsidies will itself generate inflation as the government increases the money supply. The reverse process happens when subsidies are removed. In the short run prices will increase, but in the long run they will readjust as the deficit is reduced. Unfortunately, the removal of key subsidies will be much more noticeable than the apparently invisible effect of the budget deficit, and this effect is often missed by the general public.

The main obstacles to introducing economic instruments to correct market failure are generally institutional. Environmental agencies generally lack the economic experience and required skills to collect revenue and charge environmental taxes. The Finance agencies will resist the use of taxation for pollution control measures due to a general resistance by the treasury to "ear marking" revenue from taxation as this reduces the flexibility of fiscal policy. There is also concern that removing funds from parliamentary control can lead to increased corruption. Indeed for both these reasons, earmarking is generally not economically efficient as it means that government expenditure cannot be targeted according to national priority areas. However for this same reason, earmarking can safeguard areas such as environmental expenditure, which may be cut in times of austerity. Thus if biodiversity is financed out of entrance fees to national parks this can be a continuous source of funds even after current donor interest in funding biodiversity subsidies. Ear marking can also sometimes make environmental charges and taxes more politically acceptable. For example industry may be more willing to pay an effluent charge if they know the revenue will be returned to them as subsidies for pollution abatement equipment. However with opposition to earmarking by the Treasury and lack of experience in fiscal issues by environmental agencies, introducing environmental charges for financing pollution control is a difficult task. Fortunately, this is now beginning to change as the advantages of economic incentives are realised by both the finance departments and environmental authorities. Indeed properly introduced, economic incentives can as this paper has demonstrated promote both economic and environmental efficiency.

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STATE OF THE ENVIRONMENT REPORTING

P. K. Kotta

A major objective of environmental assessment and reporting is to provide overviews of environment and development issues, concerns and trends to raise awareness and generate policy action. Assessments evaluate cumulative impacts of environment and development processes to recommend preventive, corrective or reinforcing action. The primary needs for effective assessment include a functional assessment framework and a suitable mechanism to gather and analyse the necessary data and information.

Information for environmentally sustainable development planning and management is a major concern for developing countries. The UNEP Environment Assessment Programme (EAP) is intensifying efforts to catalyse national and international action to strengthen assessment, reporting and data management capacities of institutions undertaking environmental assessments for decision making, policy setting and planning for sustainable development.

UNEP is fostering the development of an international co-operative assessment framework for collaborative action with both national and sub-regional bodies. It is expected that these existing networks of suitably equipped national, sub-regional and regional agencies representing groups of countries with common interests will improve mutually beneficial assessments of the effects of environment and development interaction at the national and international levels.

With the assistance from UNEP -EAP and the Asian Development Bank, the SACEP Environmental Natural Resources Information Centre (SENRIC) was set up and is now operational. SENRIC will also serve as a centre for the South Asian Seas Region in the clearing house mechanism being set up in connection with UNEP's Global Programme of Action for the Protection of the Marine Environment from Land-based Activities

STATE OF THE ENVIRONMENT REPORTING

P K Kotta

The State of the Environment of a region or country refers to the prevailing conditions from two perspectives - biophysical condition and socio-economic condition. State of the Environment Reporting (SER) provides a general picture of the state of the biophysical and socio-economic condition and an understanding on how human activities affect the environmental conditions and its implications on human health and economic well-being. It also provides an overview on the outcomes of responses such as policy initiatives, legislative reform and changes in public behavior. Thus SER acts as a '*report card*' on the condition of the environment and natural resource stocks.

Awareness of Ecologically Sustainable Development (ESD) is now widespread among individuals, communities, and governments. Human lifestyle depends critically on a range of natural assets: soil, water, air, mineral resources, forests and other biological systems. ESD is not possible without adequate and accessible information about the environment.

The whole community is seriously concerned with issues such as environmental quality, air pollution, water pollution, marine pollution, loss of bio-diversity, and erosion of agricultural land. Decision makers need reliable data on these issues and other key indicators of the state of the environment. Without adequate and accessible information, there may be irreparable damage done to the natural ecosystem rather than achieving its ecological sustainability. The desired socio-economic developments may not be achieved due to lack of detailed understanding of the potential impacts.

State of the Environment Reports

Since 1974, UNEP has played a vital role in producing the State of the Environment reports, focusing on one or more emerging environmental issues and the impact of environmental quality on people and society. For example, UNEP's *The World Environment 1972-1992* offers a general picture on the environment from three perspectives: environmental threats such as toxic chemicals, air and water pollution, land degradation, stratospheric ozone depletion, loss of bio-diversity and climate change; human activities that exert pressure on the environment and the range of responses to the changing environment.

Over the past decade, countries in the Asia-Pacific Region have paid greater attention to the preparation of environmental status reports for their countries. These were produced in various forms such as State-of-the-Environment Reports (SER), National Environment Action Plans, National Conservation Strategies, and National Environmental Profiles. Similarly, agencies such as UN/ESCAP had prepared a State of the Environment for presentation at the Ministerial Meeting in 1990. Other agencies such as the ADB, UNEP and bilateral organizations have also prepared more specific and comprehensive reports designed primarily for their own operational purposes. An analysis of the existing documents relating to SoE showed the need to standardize and regularize the reporting process. Through consultations with Governments in the region, the EAP-AP of UNEP is addressing these needs through capacity building, disseminating SoE information, providing a framework for SoE database development and training.

B. Guiding Principles of State of the Environment Reporting

A set of principles that can help guide SER development: are as follows;

- a) The SoER should always be based on **accurate and scientific information**. The value of the SoER lies in the transformation of the raw data and information into useful information for raising awareness and decision making.
- b) Information should be presented **without bias or modification** from a range of sources, including monitoring systems, field surveys, and remotely sensed sources.
- c) **Partnerships and agreements** with the community, industry, non-governmental organizations and governments are essential for SER success.
- d) The national SER should also include information addressing **global, universal and regional issues**. For example, climate change and ozone layer depletion are obviously global issues. Global and regional issues need local and national level actions. Universal issues affect all countries, such as population pressure, but need local level action to change.
- e) The SER should always seek to assess environmental information and issues against the principles of **ecologically sustainable development**.
- f) The SER should be guided by a **conceptual framework** that facilitates the development of information to answer the following fundamental questions:
 - i) **What is happening ? Where is it happening ?**
(What are the environmental conditions and trends ?)
 - ii) **Why is it happening ? How is it happening ?**
(What are the human and natural causes of these changes ?)
 - iii) **Why are the changes significant ?**
(What are the biophysical and socio-economic implications ?)
 - iv) **What is our response ?**
(What are societal responses for protecting the environment ?)
 - v) **Is the response adequate?**
- g) The success of SER lies with the success in raising “common peoples awareness” towards conservation of ecosystem for sustainable development, because the state of the environment depends on how they understand, manage and protect it. One of the important guiding principles of the SoE reporting lies in its **clarity**, i.e. presenting the complex and critical linkages between biophysical and socio-economic environment in a layperson’s language.
- h) SoE assessments are cumulative in nature. They provide assessment of the overall impact of people’s activities on society at the national, sub-regional, regional and global levels.

Objectives of State of the Environment Reporting

The three basic objectives, which are common to all SER are :

- a) Provide foundation for improved decision making at all levels;
- b) Increase awareness and understanding of environmental trends and conditions;
- c) Facilitate the measurement of progress towards sustainability

The purpose of the SER is to document changes and trends in environmental conditions. Regular SoE reporting ensures public, industry, non-governmental organisations and all levels of government agencies access to up-to-date and scientifically accurate information about the environment. It provides basic reference to policy makers on the state of the environment and enables them to integrate it into sound policies to sustain ecological processes and improve total quality of life now and in the future.

A successful SER could have the following uses :

- Regularly provide the public, government, non-government organization, and decision makers with accurate, timely and accessible information on the condition of, and future prospects for, a nation's environment;
- Facilitate the development of and review and report on an agreed set of national environmental indicators and indices;
- Provide early warning of potential problems, as well as allowing for the evaluation of possible scenarios for the future;
- Report on the effectiveness of policies and programs that are designed to respond to environmental change including progress towards achieving environmental standards and targets;
- Contribute to the assessment of a nation's progress towards achieving ecological sustainability;
- Create a mechanism for the integration of environmental, social; and economic information with the goal of providing a clear picture of the state of the nation;
- Identify gaps in the nation's knowledge of environmental conditions and trends, and recommend strategies for research and monitoring to fill these gaps; and
- Help decision makers make informed judgments regarding the broad environmental consequences of social, economic, and environmental policies and plans as well as in meeting the nation's international environmental reporting obligations.

Users and Products

The needs of SoE information users are important in determining the most appropriate SoE reporting system. The SoE reports have a large pool of potential users for both the monitoring and reporting functions of the system. Below is a list of potential users:

- the general public, as well as certain specific community interest groups;
- schools, at the primary, secondary and tertiary levels;
- industry groups;
- government decision-makers;
- natural resource planners and managers;
- the print and electronic media; and
- international agencies.

Each of these groups has its own set of needs and expectations from the SoE reports. The level of details needed will vary greatly from the scientists to the schools. Fig. 1 shows the general hierarchy of the needed details.

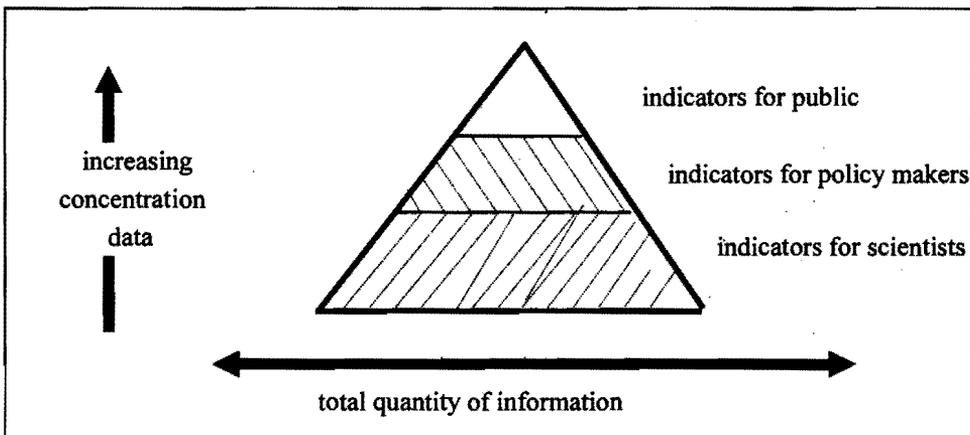


Fig. 1: Relationship between indicators, data and information to meet the users' needs

(Source: After Braat, in Kuik & Verbruggen, 1991)

Some of the **potential products** of the SoE reporting program that may be produced and used by different users are listed below:

- State of the environment report and summaries, subject specific reports, technical papers and reports, methods and applications;
- Indicator bulletins, with information about specific issues;
- Educational and public awareness kits;
- Brochures, newsletters, videos and computer based information.;
- An atlas of the nation's environment; and
- Integrated data sets for analysis and use in models and maps

The EAP-AP of UNEP has developed a framework for "Environmental Information Database" to support the SoE reporting process in the Region. This database can provide significant guidelines in establishing a SoER. Time series data is used to analyze trends in the parameters. The database and its reporting format have been accepted by the ESCAP member countries. This establishes a standard data format that will facilitate national, sub-regional and regional aggregations for policy inputs at these levels

Conceptual Framework

The OECD's pressure-state-response model is the most commonly applied framework in SoE reporting today (Fig. 2). It provides a systematic categorization of socio-economic, environmental and natural resource information under four headings: stresses or agents of environmental change, resources assets, environmental quality, and societal response.

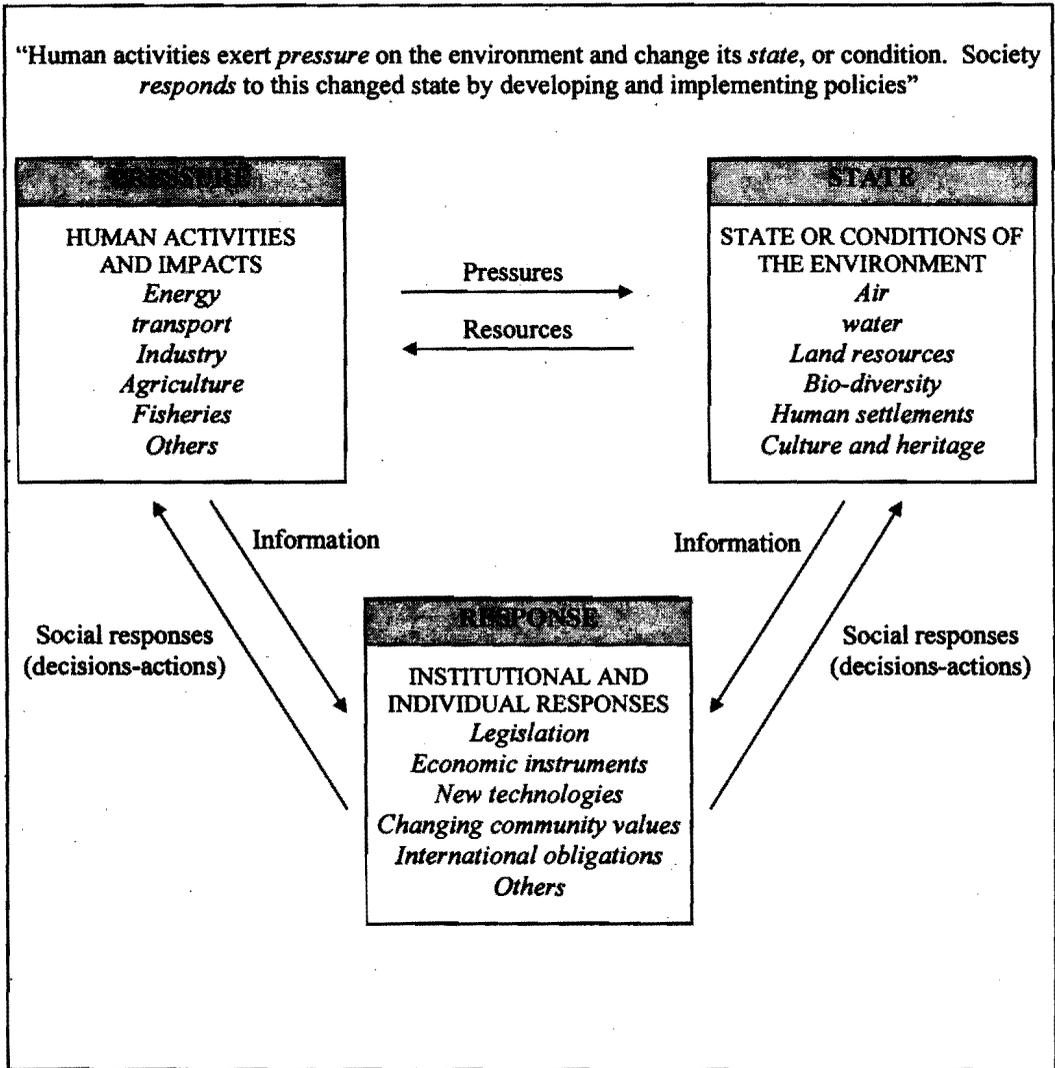


Fig. 2: Pressure-state-response model (Source: Adapted from OECD, 1993)

Human activities exert *pressure* on the environment. This causes the *state* (condition) of the environment to change. Society, at different levels, will then *respond* to this change with policies that affect human activities and directly affect the state of the environment as well. It is important to recognize that this model does have some limitations, mainly that it does not account for externalities and that the "line and box" approach is a major simplification of actual occurrences.

Pressure includes human activities and impacts such as energy consumption, transport, industry, agriculture, forestry and urbanization. It also includes the following four interactions between human activity and the environment:

- the environment serves as a source from which human economic activity derives minerals, food, fibres, and energy and in the process, potentially depleting these resources or the biological systems (such as soils, forests, or fisheries) on which they depend to support their life system;
- human activities create flows of pollutants, wastes and energy that re-enter the environment, treating it as a sink and again degrading the environment;
- human activities directly and indirectly reshape the environment and encroach upon and degrade ecosystems, thereby reducing the environment's ability to provide necessary support to the life system; and
- environmental conditions such as polluted air, water, and food have a direct impact on human health and welfare.

These pressures can lead to the changes in the conditions or state of the environment, which in turn can affect the human welfare. The state of the environment could include air and water quality, the stock of natural resources, bio-diversity, and the culture and heritage of the people.

Society responds to these changes at different levels in the form of new legislation, new technologies, changing community values, international obligations and economic reforms. These social responses affect both the state of the environment and human activities (pressure). The ability to respond depends on the quantity and the quality of the information available on the state of and pressures on the environment.

Further, the pressure-state-response framework provides a logical basis for the development of sustainable development indicators in order to support the SoER. For example, the state indicators that describe actual conditions in the environment are especially important in the problem identification and awareness building. Discovery of the Antarctic ozone hole, for example, helped to draw the international attention to the issue of stratospheric ozone layer depletion. Pressure indicators are key to policy formulation. Relevant indicators such as measures on emissions of ozone depleting gases become useful in the policy evaluation process when compared with the targets.

When presenting information, the biophysical or ecological boundaries may be used instead of the administrative ones depending on the issues.

Information

Decision making for sustainable development should be based on sound, reliable and timely information. Hence, it is very important for a nation to build a strong information and technology infrastructure for data management, modeling and analysis requirements that supports the SoER system. The SoER system should coordinate data management system in the nation so as to minimize duplication in data monitoring, storage and analysis. This could be done through partnerships with all the relevant organizations to benefit both data providers and users. Data for SoER may be taken from various sources such as national and state government agencies and departments, local governments, community-based

monitoring programs, universities and research institutions, and industrial organizations. The need for scientifically rigorous information standards and definitions must be communicated to all the data source centres. Consistency in the data standards should be encouraged. This will allow for national standards to be set for the monitoring and presentation of data for environmental indicators.

For this purpose, the EAP-AP of UNEP's Framework for Environment Assessment could be utilized (Fig. 3) to facilitate processing and transformation of data into relevant information for decision making.

The ability to carry out accurate evaluation of environmental changes depends greatly on the existence of baseline data against which the change can be compared. The baseline data is divided into biophysical and socio-economic information. Biophysical data include data on the atmosphere, topography, geology, hydrology, soils, flora and fauna. Socio-economic data include figures on population, health, poverty, education, administrative boundaries, land use, trade, infrastructure, settlements. Different baselines can be established to study different issues. The degradation of the environment since the 1980s would have 1980 data for a baseline, for example.

These data remain useless unless they are transformed into sound, reliable and timely information. This could be achieved through the use of modern scientific tools such as GIS and Remote Sensing. These tools facilitate the integration of biophysical and socio-economic data into useful information in the form of indicators and indices which reflect emerging issues.

The indicators for the environment can be divided into three main classes: a) pressure, b) state (or condition), and c) response indicators. State indicators measure the quality, quantity, and distribution of natural assets and the environment, in physical terms. Pressure indicators describe "pressures" that are placed on the environment. These pressures can be designated positive or negative and are caused by the inhabitants of the earth. Since accurate state indicators can be difficult and expensive to measure, pressure indicators are often used as substitutes. Response indicators measure actions taken in response to environmental problems. Indicators can tell us whether things are getting better or worse, whether problems are growing, or whether current policies are achieving desired goals. Indicator selection is an important step in SoE reporting. Hamblin (1992) offers eight desirable characteristics (Box 1) for indicators and the Commonwealth of Australia (1994) provides a set of criteria (Box 2) for their selection (Appendix 1).

Following are the proposed steps for indicator selection:

- i) Listing of the priority issues and related parameters. This listing will likely be very long. It will not be possible or practical to collect data for all the parameters. An example is given for the Asia- Pacific Region in Appendix 2.
- ii) Each of the experts or government representatives would be asked to go over the list for comments and additional inputs;
- iii) Conducting a series of workshops and pilot studies to distill a manageable set of environmental indicators; and
- iv) Using the indicators in the first national SoE report on a trial basis and linking them to action plans.

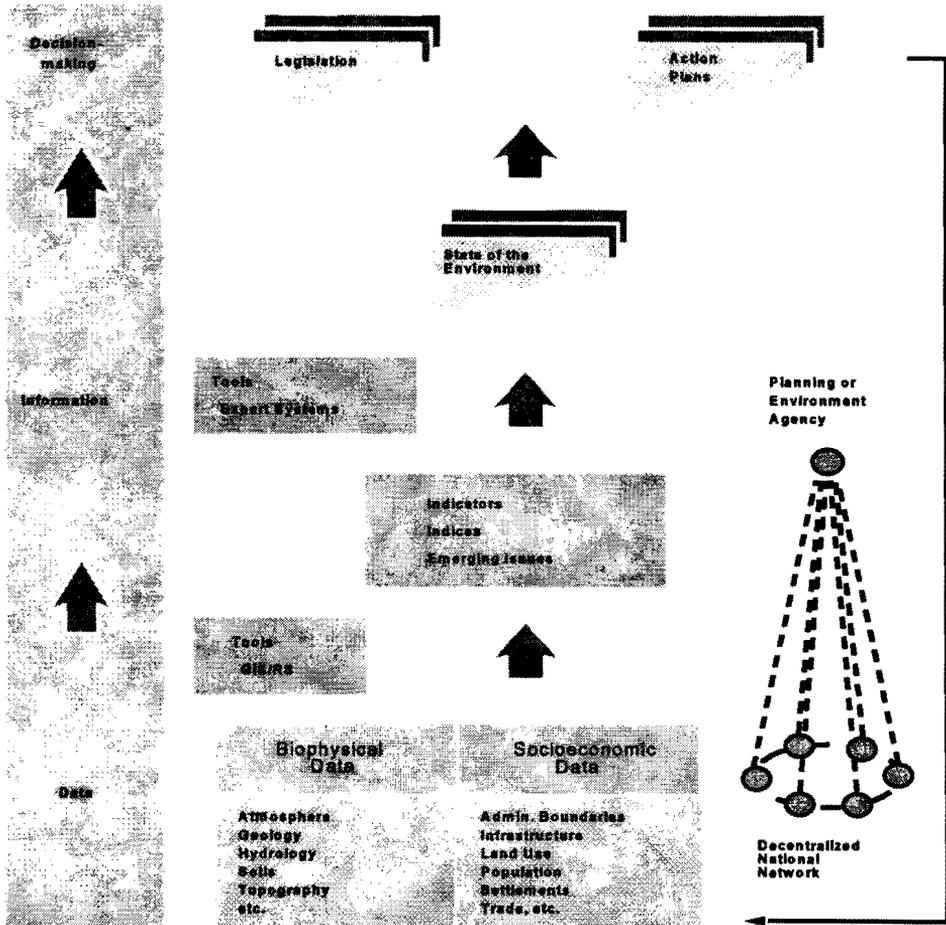


Fig. 3: Framework for Environment Assessment

Indicators can point to areas of concern. When a clear set of indicators are available, a nation can evaluate its environmental condition, in the context of baseline information. The issues that are of highest priority can then be identified. The issue selection process can be complex. There could also be a series of systematic consultations between government and NGOs, community, industry, the scientific groups as well as international agencies.

Efforts are being undertaken in numerous institutions worldwide for the development of sound environmental indicators. In the Asia-Pacific region, the EAP of UNEP is collaborating with other institutions and experts in the development of indicators.

The information on indicators, indices, and issues could be further processed through sophisticated tools such as expert systems. It can now be easily used as an input for the SoE assessment, SoER, legislation and action planning. This could help the Ministry of

State of the Environment Reporting

Environment or the planning agency to develop a strong predictive capacity, providing indications of the potential future impacts of present activities. This will allow for possible responses that would minimize damage and reduce cost.

SoER could aid the nation and international agencies in strengthening their ability to build accurate models that can be used in conjunction with broad based models like the OECD 'pressure-state-response' model with the overall goal of ecologically sustainable development. There are many models in existence, and more are being developed, that allow the user to use scenario-simulation or multi-criteria analysis to predict possible environmental futures. The SoE database format proposed by the EAP/AP of UNEP could serve such a purpose by supporting the development of sound environmental indicators for predicting the future of the environment.

Evaluation

The SoE reporting program should be subject to periodic review in accordance with standards set by the national government. Products of the SoER system could also be subject to independent review before they may be released. The SoER system could also conduct periodic internal review to maintain the levels of scientific accuracy and credibility for its results. For the evaluation process to be effective, the products of the SoE reporting system should be passed through a channel of experts of different disciplines. The expert or a group of experts could review the respective portions of the SoE report with reference to their area of expertise to ensure in depth evaluation.

Global State of the Environment Report

To provide the world with an assessment of the state of its environment for necessary and appropriate policy action, the United Nations Environment Programme is mandated to produce the Global State of the Environment Report by the year 2002. Several initiatives at various levels are ongoing which when coordinated and consolidated may form the foundation for the 2002 SoE Report. A significant number of nations have already begun SoER. This number is expected to rise as environmental awareness becomes more widespread. UNEP is providing assistance to developing countries for SoER.

In Asia and the Pacific Region, THE EAP-AP of UNEP is coordinating the implementation of its three component programmes at national, sub-regional and regional levels: capacity building and servicing, data management and assessment and reporting. At the regional level, THE EAP-AP of UNEP coordinates with and assists ESCAP in preparing the State of the Environment Report for the Region every 5 years (i.e. 1995, 2000) through the development and completion of the SoE database. The need to establish a Regional Resource Centre has been identified in the various consultations that had been held to address issues of co-ordination on environment information, system compatibility, data standardisation, exchange dissemination and use, indicators, frameworks, etc.

At the sub-regional level, environment assessment will be based on consolidated and aggregated national SoE reports addressing issues of mutual concern and transboundary issues. Trend analyses will be conducted to identify emerging issues. UNEP has a catalytic role in assisting governments to address transboundary issues.

At the national level, capacity building activities are current in 16 countries in the Region. These activities consist of transfer of tools, methodologies and technologies through training and provision of hardware and software that would facilitate data collection, storage, analysis and

presentation and dissemination of timely and relevant information in the form that can be appreciated and easily understood by decision makers and the general public. Data management consists of the completion of core data sets of both the bio-physical and socio-economic data at various scales and levels. Environment assessment is done through the preparation and production of national SoE reports backed up by an SoE database for a more quantitative analysis and which can be updated on a periodic basis allowing for a regular assessment and reporting.

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Appendix 1: Priority Environmental Issues and Selected Related Parameters *

Deforestation

Forest area (ha)

Officially managed

Protected

Not managed

Sanctuary

Transfer between forestry and other sectors (ha)

Net to settlement

Net to agriculture

Net to industry

Net to rangeland

Net to roads etc.

Land Degradation

Shifting cultivation (ha/y)

Deforestation rate

Salinisation rate

Soil erosion rate

Wetlands (ha)

Waterlogging (ha)

Frequency of flood

Livestock population (number/km²)

Land slope in most important degraded lands

Average wind speed (km/day)

Status of Drainage systems in degraded lands

Rainfall intensity

Soil texture

Limiting nutrition for plant growth

Land Desertification

Acidification rate

Salinisation rate

Deforestation rate

Desertification rate

Soil erosion rate (t/ha/y)

Wetlands (%)

Livestock population (number/km²)

Destruction of Bio-Diversity

Flora

Fungi no of species known and no of endemic species

Algae no of species known and no of endemic species

Gymnosphere no of species known and no of endemic species

Dicotyledons no of species known and no of endemic species

Monocotyledons no of species known and no of endemic species

Other plants no of species known and no of endemic species

Deforestation rate

Fauna

Mammals no of species known and no of endemic species

Birds no of species known and no of endemic species
Reptiles no of species known and no of endemic species
Amphibians no of species known and no of endemic species
Swallow bird, Butterflies no of species known and no of endemic species
Fresh water fishes no of species known and no of endemic species
Annual hunting of mammals, reptiles and birds

Inland Water Pollution

Temperature in most important rivers
pH in most important rivers
Coliform (100/ml) in most important rivers
BOD (mg/l) in most important rivers
Suspended solids (mg/l) in most important rivers
TDS (mg/l) in most important rivers
Nitrate (mg/l) in most important rivers
Heavy metals (mercury, lead, cadmium, copper zinc chromium) in most important rivers
Biota (species & numbers) in most important rivers
Temperature in most important lake
pH in most important lake
Coliform (100/ml) in most important lake
BOD (mg/l) in most important lake
Suspended solids (mg/l) in most important lake
TDS (mg/l) in most important lake
Nitrate (mg/l) in most important lake
Heavy metals (mercury, lead, cadmium, copper zinc chromium) in most important lake
Biota (species & numbers) in most important lake
TDS (mg/l) in groundwater
Nitrate in groundwater
Total hardness of groundwater
Groundwater pumping
Use of agro. chemicals
Untreated industrial waste
Untreated domestic waste

Marine Water Pollution

Total number and volume of oil spills
Sediment transport (amount in ppm)
Untreated industrial waste
Untreated domestic waste
Sea temperature

Air Pollution

Annual emission (t) and atmosphere concentration of carbon monoxide
Annual emission (t) and atmosphere concentration of carbon dioxide
Annual emission (t) and atmosphere concentration of so₂
Annual emission (t) and atmosphere concentration of nitrogen oxide
Annual emission (t) and atmosphere concentration of lead (Pb)
Acidity (rainfall pH)
CFC emissions
Halon emissions

State of the Environment Reporting

Ozone
Percentage of population using air conditions

Health Hazard

Mortality incidence
Malnutrition in children under five years
Cancer
Respiratory disease
Heart disease
Malaria, Cholera, Diarrhea, Schistosomiasis
Skin disease
Emissions of SO_2
Emissions of NO_x
Radiation doses to the human population

Noise Pollution

Percent of human population afflicted by noise
Percent of human population in noise prone areas
Traffic(# of flights/day , # of vehicles/day)
Frequency of noise
Number of industries

Population Growth

Total population and area
population density (p/km^2)
Population growth rate (%)
Total fertility rate
Infant mortality rate
Contraceptive prevalence rate
Average life expectancy (yrs)
Sex ratio (M/F)
Age distribution (< 5 yrs, 5-16 yrs, 16-60 yrs and 60 +)

Depletion of Ocean & Coastal Resources

Area under marine fishery (ha)
Fish from marine (tones/year)
Crustaceans from marine (t/y)
Molluscs from marine (t/y)
Percentage of marine fishes in total
Vessels (no) and nets (m^2)
Illegal fishing
Oil spill
Untreated waste disposal
Sea temperature rise

Depletion of Energy Resources

Production/use/export or import of bio-fuel mass
Production/use/export or import of coal
Production/use/export or import of hydropower/thermal power
Production/use/export or import of petroleum
Oil spill

Land Slides

- Frequency of land slides
- Deaths due to land slides
- Financial loss due to land slides
- Degree of natural slope
- Soil strength and structure
- Depth of soil
- Height of ground water table
- Ground water pumping rate
- Occurrence of rainfall over prolong period
- Mining activities
- Type of bed rock

Loss of Aquatic Fish

- Total production of fishes
- Illegal fishing
- Water temperature and pH
- Municipal waste production (t/y) by waste streams
- Industrial waste production (t/y) by industrial sectors
- Agricultural waste

Land Salinisation

- Salinisation rate
- Land area under agriculture
- Land area under irrigated agriculture
- Use of agro. chemicals
- Quality of irrigation water (EC, pH, & SAR) minimum & maximum
- Soil chemical analysis (pH, EC & SAR) minimum & maximum
- Water table height and pumping rate
- Evapotranspiration
- Waterlogging area (ha)

Low Agricultural Production

Land area and total production of

- Rice
- Wheat
- Maize
- Other food grains
- Oil seeds pulses
- Sugarcane
- Fruits
- Tuber vegetables & Leafy Vegetables
- Cotton
- Other

- Soil erosion rate
- Salinisation rate
- Area under intensive agriculture(2 or more crops/year)

Rural-Urban Migration

- Rural population
- Urban population
- Population density (p/km^2) -rural
- Population density (p/km^2) -urban
- Number of primary and secondary schools in rural areas
- Number of primary and secondary schools in urban areas
- Percentage of population without any schooling -rural
- Percentage of population without any schooling -urban
- Percentage of population without incomplete primary education- rural and urban
- Percentage of population without secondary education- rural and urban
- Unemployment in rural and urban areas
- Per capita income in rural and urban areas
- Carrying capacity of private cars in rural and urban
- Carrying capacity of taxis in rural and urban
- Carrying capacity of buses in rural and urban
- Carrying capacity of trains in rural and urban
- Carrying capacity of 3-wheeler in rural and urban
- Municipal waste

Flood Hazard

- Frequency of flood for all available years
- Deaths due to flood
- Financial loss due to flood
- Annual depth and volume of rainfall
- Volume of rainfall stored
- Percent of population in flood prone areas
- No of mismanaged storage dams/reservoirs
- Percent of lowlying areas

Drought Hazard

- Frequency of drought
- Financial loss due to drought
- Number of crop failure in every five years
- Percentage of population without access to clean water
- Percentage of agricultural land not cultivated due to water shortage
- Deforestation rate
- Expected annual average and actual rainfall

Cyclone

- Frequency of cyclone
- Deaths due to cyclone
- Financial loss due to cyclone

Earth Quake

- Frequency of earth quake
- Deaths due to earth quake
- Financial loss due to earth quake
- Population in earth quake prone areas

Waste Disposal Problems

- Municipal waste production (t/y) by waste streams (paper, plastic, metal, etc.)
- Industrial waste production (t/y & t/unit product)
- Production of agricultural waste
- Mining waste
- Production and disposal of radio active waste
- Emission of toxic substances from waste site
- Landfill space consumption: Volume of space occupied by landfill
- Number of contaminated sites
- Percentage recycling by materials
- Percentage of municipal waste treated, by methods
- Percentage of industrial waste treated, by methods
- Expenditure for pollution control
- Average cost of waste management, by methods

APPENDIX 1

***Note :** This list represents parameters that would be ideally available. It may not be possible or practical to collect data for all of them. This will vary from region to region and from country to country

Box 1 Desirable characteristics of selected indicators

Indicators should :

- be widely accepted as covering the issues;
- be over a period of time long enough to identify trends;
- have the same meaning in different regions as of the country;
- be easily understood;
- be indicative of community values;
- be based on readily available data;
- be perceived as politically unbiased; and
- be flexible in the face of changing community perceptions.

Source , Hamblin, 1992

Box 2 Selection criteria for environmental indicators

- serve as a robust indicator of environmental change;
- reflect a fundamental or highly valued aspect of the environment;
- be either national in scope or applicable to regional environmental issues of national significance;
- provide an early warning of potential problems;
- be capable of being monitored to provide statistically verifiable and reproducible data that show trends over time and, preferably, apply to a broad range of environmental regions;
- be scientifically credible;
- be easy to understand;
- be monitored regularly with relative ease;
- be cost-effective;
- be as aggregative as possible (that is, amenable to combination with other indicators to produce more general information about environmental conditions);
- have relevance to policy and management needs;
- contribute to monitoring of progress towards implementing commitments in nationally significant environmental policies;
- where possible and appropriate, facilitate community involvement;
- contribute to the fulfillment of reporting obligations under international agreements;
- where possible and appropriate, use existing commercial and managerial indicators;
- where possible and appropriate, be consistent and comparable with other countries and state and territory indicators

Source : Commonwealth of Australia, 1994

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NATIONAL AGENDA 21 ACTION PLAN

U. Sapukotana

Before developing a National Agenda 21, Action Plan, it is necessary to understand the concepts developed at the Earth Summit, the basic concept being that whatever programmes are undertaken should be sustainable in terms of time, space and resources. Although individual countries are expected to develop their own action programmes, they cannot possibly ignore the global perspectives

Poor people having little opportunities are compelled to encroach into environmentally sensitive areas such as natural forests. Environment-poverty consumption - population linkages should be addressed in a meaningful manner. Unsustainable consumption patterns at community, national and global levels have contributed towards depletion of the earth's resources.

Sustainable lifestyles should be adopted at all levels. Studies on interaction between demographic factors and sustainable development with emphasis on the links between demographic trends, natural resources and life support systems are necessary. Strengthening of the population database and implementation of appropriate programmes of population control are of critical importance.

Popular participation in decision making is a pre-requisite for sustainable development. Top down planning has not proved to be effective in most countries. It is necessary to involve beneficiaries including NGOs in the planning and implementation processes.

NATIONAL AGENDA 21 ACTION PLAN

U Sapukotana

The realisation that life on our planet earth is endangered, led to a major event in contemporary history. More than 150 Heads of State met at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, out of concern for the well being of future generations and solemnly pledged to pursue the path of sustainable development. The conference unanimously adopted Agenda 21; so named because it constitutes the global sustainable development agenda for the 21st Century.

Before discussing Agenda 21, it would be of interest to look at some of the concepts that were developed at the UNCED. The basic concept was that whatever development programmes we undertake, should be sustainable in terms of time, space and resources. It is now increasingly appreciated that the Earth's resources are not unlimited. The resources that were previously used over many generations are now being exhausted in a life time. The consensus was that the development process should continue with a greater sense of responsibility and respect to the future users of our natural heritage.

Even though some resources are located in individual countries, they can be an asset to the entire global population. The forests in Brazil have a capacity to absorb carbon dioxide and other gases emitted by industries in other countries and also serve as a gene pool to the whole world. Similarly the depletion of the ozone layer is caused by emissions of ozone depleting substances into the atmosphere largely by the more affluent nations. However, eventually, all inhabitants of the Earth may have to suffer the consequences of ozone depletion. The extent of damage caused by pollution of water is immeasurable. Sometimes rivers flow through a number of countries and pollution taking place in one country is carried across to another. Polluted rivers can affect beaches and destroy marine life.

Policies that promote economic growth but do not give enough emphasis to eradication of poverty, can result in the over exploitation of resources. Similarly policies that do not arrest wasteful consumption by the few who are rich would set a bad example to the less privileged people who are called upon to conserve resources. Likewise, it does not make sense when countries that over-consume resources advise others to be frugal in the use of resources. Studies conducted by the World Bank have shown that open market policies favour environmental protection. However open market policies and liberalised trade policies have to be managed properly to ensure that environment is protected. There is a danger that open market policies and liberalized trade could lead to indiscriminate exploitation of resources at least in the short term.

In developing a National Agenda 21 Action Plan it would be useful to look at each programme area in Agenda 21 in order to understand the proximate causes, the underlying causes, as well as activities needed to address the most critical environmental issues. The information thus compiled can be analysed and actions can be developed within appropriate policy frameworks. The following are some of the basic issues and critical subject areas that should be covered in the formulation of a National Agenda 21 Action Plan.

Poverty

In developing a National Agenda 21 Action Plan for a developing country poverty alleviation would play a pivotal role. Since poverty and environmental degradation are closely interlinked, studies need to be undertaken at national and sub-national levels to determine specific activities that need to be initiated to arrest such degradation. There is a need to isolate the poverty-environment linked issues from the larger issues of poverty. Unless this exercise is undertaken the simple initiatives will get submerged in the larger issue of poverty and result in non-action. At the same time current poverty alleviation policies need redefinition with a view to focusing them towards environmental protection. It is also necessary to target the programmes for needy groups of beneficiaries.

Population

Agenda 21 calls for more research on interaction between demographic factors and sustainable development with focus on the linkages between demographic processes, natural resources and life support systems. This should lead to a holistic approach to development which combines economic growth, environmental concerns and population issues.

An important activity that must be undertaken is to conduct regular censuses to determine the patterns of urban migration, the concentration of large populations in areas where land resources are limited or where industries are located. There is a need to formulate development policies based on demographic patterns and socio economic characteristics. The strengthening of population information programmes that provide equal rights to men and women to decide family size, to have access to information and education relating to family planning are important.

The provision of public utilities particularly for slum and shanty dwellers has to be done on a priority basis. Many urban centres in the South Asian region suffer from inadequate water supply, unhygienic lavatory facilities and insanitary means of solid waste disposal. In addition to the permanent settlers in urban centres there is a large migrant population which commutes to the city centres from suburbs and distant places. Surveys of such migrant populations are needed as the absence of such surveys could give a distorted picture to urban planners.

Consumption

Unsustainable consumption patterns at community, national and global levels have contributed to the over-exploitation of natural resources. There is a serious imbalance in consumption patterns at all three levels. The global disparities can be seen through a comparison of energy use by the developed and developing countries. The developed countries on an average use 3.7 metric tonnes of carbon per capita per year whereas developing countries use only 0.4 metric tonnes per capita.

The consumption of meat products by more affluent groups as against cereals leads to inefficient use of available arable land. It is estimated that twenty times more land would be required to generate food in the form of beef as against food in the form of cereals. The more affluent classes must be persuaded to change their lifestyles in order to ensure least environmental stress. If persuasion fails, controls can be introduced through selective taxes and tariffs on consumer

goods. Government policies should be designed so as to provide alternatives such as timber substitutes to reduce excessive timber consumption.

Trade

An important instrument for achieving sustainable development is the rationalization of internal and external trade. Trade policies should be studied carefully in order to understand their impact on environment. Trade liberalisation and removal of non-tariff barriers and participation in international trade agreements are important activities that need to be undertaken in this regard. A ban on the importation of timber or excessive tariffs placed on them can lead to accelerated deforestation. Artificially high prices of cement can lead to extraction of valuable natural resources such as corals for construction purposes.

Integrating Environment and Development

Hitherto, environmental protection and economic development have been thought of as mutually exclusive goals. This presumption is not right. On the other hand an integrated approach can complement each other for mutual advantage. It is noted that economic development or the lack of it has a bigger impact on the environment than of segmented activities of environmentalists put together. Therefore, integration of environmental considerations into the development planning process should be given priority attention.

Establishment of a policy framework is critical for the fulfillment of the goals of Agenda 21. Macroeconomic policy and fiscal policies impinge heavily on sustainable development. The economic and fiscal policies that were designed for achievement of pure economic growth objectives still persist in most countries of the region. The concepts of environmental protection and sustainable development are relatively new and these concepts have not been incorporated into the overall development process. Although effective instruments such as 'Environmental Impact Assessment' (EIA) have been introduced in most South Asian countries, there is a need to upstream the process to the stage of policy formulation.

Environmental Health

It has been clearly established that there is a distinct link between environmental degradation and human health. Because of this environmental health is now finding a place in National Environmental Action Plans. Improving the health condition of a country cannot be undertaken by health authorities in isolation. A multi-disciplinary approach needs to be adopted to meet the challenges of human health.

An initial activity that must be undertaken is the identification of major contributors to poor health conditions. They can range from poor trade and agriculture policies to polluted drinking water, polluted air, contaminated food items, poor solid waste collection and disposal and unhygienic habits of the community itself. Separate action programmes have to be developed by the appropriate agencies to address these issues. Meaningful public awareness programmes can be a useful instrument to address problems relating to environmental health.

Protecting the Atmosphere

In most countries atmospheric pollution is concentrated in urban centres and the sources are emissions from industries and vehicles. Countries that are moving towards industrialisation should particularly pay attention to atmospheric pollution caused by industrial emissions. Emission standards should be established in respect of industries and also vehicular traffic. However, the laws and regulations relating to standards are not being enforced in an effective manner. Without being over-dependent on 'command and control' type of curative measures it would be prudent to take preventive steps such as the establishment of industrial estates and providing tax incentives and use other economic instruments to promote cleaner technologies.

The Framework Convention on Climate Change provides measures for protection of atmosphere at a global level. National government policies in respect of protecting the atmosphere in the South Asia should include the reduction of CO₂, NO_x and SO_x emissions by using advanced generation technologies and high quality fuels. Increased fuelwood production would serve to meet energy needs of the people and at the same time the protection of the forest cover will create a healthy environment and serve as a sink for CO₂ emissions. The experience in most countries is that the level of forest depletion is not matched by new planting. Since most South Asian countries are still agriculture dependent and most people live in the rural sector, a well planned programme for countrywide expansion of fuelwood plantations should be implemented. Similarly the energy efficiency from fuelwood should be ensured by popularizing energy efficient fuelwood stoves and domestic fire places. All South Asian countries should pay greater attention to the development of renewable energy. It is possible to share these technologies among South Asian countries. Technologies relating to wind energy, solar energy and mini hydropower plants are now available in the region.

In regard to pollution by vehicular traffic, mass transit systems based on large capacity vehicles with high fuel efficiency and least exhaust fumes need to be introduced. Modernisation of the railway network including development of electrified commuter services in urban centres is a high priority activity. The poor quality of fuel also contributes to atmospheric pollution. Introduction of lead free petrol and high quality diesel should be among the major activities in this regard. In most countries the bicycle is a popular mode of transport. Popularising the bicycle may be an effective way of reducing pollution.

Management of Land Resources

In all South Asian countries land is a very valuable and scarce resource. Therefore it is most prudent to make optimum use of the land taking into consideration the demands of the future generations. It is important for countries to develop National Land Use Plans taking into account the long term requirements. National and sectoral land use plans need to be developed within the framework of the national land policy. They should cover aspects such as eco-system preservation, urban water supply and soil conservation among others.

Adaptive research should be encouraged to develop appropriate cropping systems for different land classes and special techniques such as the 'Sloping Agricultural Land Technology' (SALT) should be suitably adapted particularly for hilly lands. With the changing weather patterns and longer dry spells that are more frequent there is the prospect of desertification in the region.

Countries should take serious note of these developments and formulate action plans to arrest such trends.

Depletion of forests and destruction of micro eco-systems are a common feature in all South Asian countries. As a matter of urgency all countries should formulate and implement a National Forest Policy. The optimum forest cover should be maintained and the appropriate distribution of such cover should also be determined. Since many countries are facing shortage of water, it is necessary to identify and delineate the important watersheds of the country and develop an action plan to rehabilitate such watersheds. Siltation of waterways and reservoirs is the direct result of degraded watersheds.

The Forestry Master Plans should not confine themselves to government managed forests. They should cover all degraded forests, both public and private marginal lands, community forests, wetlands and marshes. Decentralised plantation and village forestry should contribute to local fuelwood requirements. Great care should be taken to select the appropriate indigenous species. Each country should take steps to enlist the participation of the community without being over-dependent on the government cadres to protect forests. The peripheral villagers should have a stake in the forest. The concept of 'forest management' as against 'forest conservation' should be promoted. Different forest classes have to be treated differently and for this purpose careful classification is needed.

Too stringent regulations governing timber transportation can be a disincentive to development of private forestry. Therefore, it is necessary to rationalize the laws and regulations governing timber transportation. The role played by NGOs and local communities in protecting forestry is well known. Examples can be seen in many countries including the 'Chipco Movement' in India.

Sustainable Agriculture and Rural Development

Countries in the region are faced with a challenge to produce the required food for their increasing populations. Countries like Nepal and Sri Lanka have utilized most of the arable lands whereas countries like Maldives have to depend on imported food as there is no land to be set apart for agriculture. People in South Asia have to till the same land that has been cultivated over and over again for thousands of years. However, ancient agricultural practices did not make excessive demands on the soil. They left lands fallow for considerable periods of time in order that the soils would get regenerated. This situation has changed substantially by the advent of commercial agriculture, and the pressure of population. In the meantime governments are compelled to offer food security and adequate nutrition to increasing populations. Heavy doses of chemical fertilizers have to be used as the new high yielding varieties (HYV) make big demands on nutrients. In addition to land degradation caused by use of agro chemicals and fertilisers, chemical residues seep into underground water sources and contaminate groundwater. Modern agriculture is such that it is not possible to dispense with agro chemicals and fertilisers. Hence agricultural scientists today are developing integrated approaches where combinations of chemical fertilizers and organic fertilizers are used in the fields.

Whereas there were strong linkages between animal husbandry and crop husbandry in the traditional agricultural practices, some of these practices have now become extinct. In many of the South Asian countries, 'slash and burn' cultivation system is still prevalent. Since there isn't enough land for rotation, the same land is used on a more frequent basis, thus leading to soil erosion. It is absolutely necessary for agricultural scientists to develop settled farming systems for the lands presently used for 'slash and burn' cultivation.

It is becoming clear that land management cannot be achieved by legislation alone. A strong-research and extension oriented farmer-dialogue has to be established. A two way process has to be developed where farmers gain from research findings and researchers in turn gain from the traditional knowledge of the farmers. Extension services in the agricultural sector are most of the time highly segmented. Different groups of extension workers work for rice, cereals and legume cultivation while other groups serve the animal husbandry and commercial plantation sectors. This does not lend itself to the adoption of integrated approaches towards agricultural development.

In order to maximise production on a static land area, research and development activities in relation to the available varieties of plant and animal genetic resources should be increased. Where possible, advanced bio-techniques need to be used in order to produce new varieties which have higher production potential, pest resistance and other qualities such as drought resistance. In planning out research and development, it is prudent for the researchers to be mindful of the possible climatic changes that may come within the next 50 - 100 years. We need to develop crops which are resistant to drought and also those that can withstand higher temperatures than at present.

Biological Diversity

It is only recently that South Asian countries have gained a clear understanding of the importance of biodiversity and its role in the sustenance of life systems. Most countries of the region are signatories to the Biodiversity Convention and have responsibilities under the convention. All countries of the South Asian region fall within the tropics and as is well known, tropical countries are rich in biodiversity. In the past most countries concentrated on wildlife which was applied to large mammals, birds and large vertebrate species and the natural genetic and biological diversity was not given attention. The large numbers of invertebrate species and micro organisms which form part of overall biodiversity and perform important functions for sustenance of life have been virtually ignored. Countries have to take into account biodiversity in its totality and develop appropriate programmes of conservation. For example fauna and flora are of major importance from the point of soil regeneration and ecosystem functions and also basic to sustainable agricultural development. Similarly, composite biodiversity for each natural ecosystem is indispensable for functioning of such an ecosystem. Therefore ecosystem preservation and conservation is basic to preservation of biodiversity and genetic diversity.

Countries should pay adequate attention and develop programmes to conserve ecosystems and special habitats in their totality. Among the activities that need to be initiated is the creation of awareness among the public as well as policy makers and developers on the value of biodiversity and the necessity to preserve as much as possible of this valuable heritage.

Governments should institute and encourage programmes of 'in situ' and 'ex situ' conservation of biodiversity through governmental agencies as well as through NGOs and people's organisations. Governments should also institute and encourage research and development in the field of biotechnology and use appropriate techniques for the improvement of plant and animal species that are of economic importance. In order to involve the community in this exercise the direct benefits to them should be clearly identified and explained. Since some of the tropical plants and herbs are used extensively in the pharmaceutical industry as well as in the perfume and cosmetic industries, such plants will fetch higher prices in the future. Hence the government

should take the initiative to prepare the stage for bio-prospecting, keeping in mind however the threats to such plants and species by commercial over exploitation.

Protection of Oceans, Coastlines and Fisheries

Factors relating to protecting and managing the oceans, coastlines and fisheries are common to most South Asian countries. The lagoons and estuaries serve multiple functions. Some poorer communities depend on these resources for their livelihood. Most lagoons which are situated close to urban centres are subject to pollution by sewage, solid waste and industrial effluents. Countries should recognise the important role played by the lagoons and estuaries as life supporting ecosystems, and action taken to develop management plans for their conservation.

Sustainable exploitation of fisheries is an important factor to be considered by all concerned countries as large populations of fishing communities are dependent for their livelihood on the fishery resources. It would be necessary for research organizations to monitor the stocks on a periodic basis. While mechanised fisheries would be needed to cater to large scale demands of increasing populations, excessive use of mechanised equipment can lead to fast depletion of fishery resources. A right balance needs to be maintained between traditional and modern fishing systems. Large scale development of prawn and lobster farms in some countries have created ecological problems, particularly along the coastline. While prawn and lobster farming brings a good income to the farmers, expansion of commercial farms needs to be regulated and the damage to the eco-systems assessed.

Destruction of coral reefs by the tourism and construction industries as well as by rural communities as a source of livelihood have created a major problem in certain countries. These practices have to be checked both through regulatory systems as well as through economic instruments. Pollution of the marine environment is also caused by shipping. There are minor oil spills and also oil washed out from the tankers. The countries located in the proximity of the shipping routes need to alert themselves to possible major oil spills caused by accidents and action plans should be developed to meet such emergency situations.

Human Settlements

In developing country specific strategies, Agenda 21 identifies several critical programme areas for consideration by national governments. They are; providing shelter for all; improving human settlement management; promoting sustainable land use planning; providing environmental infrastructure; promoting environment friendly energy and transport systems; promoting environment friendly construction activity and human resource development for the establishment of sustainable human settlements.

Each country should develop action programmes to address above issues based on their own priorities. Housing and construction policies as well as research and development activities should be geared towards the achievement of these objectives. Action programmes should not be confined to public sector organizations. Private sector organizations, NGO and above all the communities themselves should develop and actively participate in these action programmes. Un-planned human settlements are at the root of several environmental problems. Rural poverty leads to urban migration where people drift aimlessly to urban centers looking for better prospects. The urban local authorities in charge of providing the infrastructure facilities such as housing, water, and sewerage systems cannot simply cope with the increasing migrant populations. Connected to the problems of human settlements is the problem of health and

sanitation. Very few people have access to clean potable water and as a result large numbers suffer from environment related diseases such as diarrhoea, malaria, hook worm, etc. Public awareness programmes will be useful to sensitize the beneficiaries to their own responsibilities in order to maintain clean and healthy settlements.

Protection of Vulnerable Social Groups

It is important for every country to identify the disadvantaged and vulnerable groups in society and channel their energies for productive purposes. In many countries, women are placed in disadvantaged positions and they are not given an opportunity to contribute as equal partners in social and economic development. Certain limitations placed on them such as lack of access to education, land ownership, employment etc; have retarded economic growth and social development.

Sometimes women are exploited for the advantage of the rest of the society and the sociological implications of such exploitation needs to be studied carefully and suitable remedial action taken. Many women from the region go to the Middle East for employment owing to lack of opportunities in their own countries. However, the social implications of females leaving their families and the ensuing psychological impacts cannot be treated lightly.

Similarly special programmes should be developed for the youth. The problems of the youth are manifold and they are more complex than the problems of the adults. They are exposed to the commercial world outside through electronic media which leads them to high expectations. Unless youth are directed along productive channels they could become easy prey of different destructive social forces. Harnessing the productive energies of the youth is a major challenge for most of the member countries.

Popular Participation in Decision Making

Popular participation in the decision making process is one of the principal requisites of sustainable development. Most member countries adopted a top - down approach in planning and decision making and rarely did they consult the beneficiaries. The recent developments of the NGO movements have compelled governments to adopt more consultative approaches as some of them are very articulate about their right to be heard. It is to the advantage of the policy makers to get a feel of the needs of the people in order to ensure successful implementation of programmes and projects. In order to make the dialogue easy with farming communities, farmer organisations should be formed. They could have a regular dialogue with the government officials as well as with the political leadership. In this manner they should develop the bargaining power to win their rights.

Empowerment of the people can be measured by the extent to which they are made partners of the development process. A forestry development programme or a wildlife development programme cannot achieve a major degree of success by isolating the peripheral villagers. For those villagers to have a stake in either forestry or wildlife they must be provided with certain advantages and benefits. It is in this context that the new concepts of park management, and social forestry assume importance. With regard to water use farmers who have been passive recipients of water under irrigation schemes are gradually entering into the decision making process. Limited experiments of water management with farmer participation in countries like

Pakistan, Nepal, and Sri Lanka by International Irrigation Management Institute (IIMI) have shown a high degree of success.

Institutional Capacity

An essential pre-requisite for the successful implementation of Agenda 21 is the building up of adequate capacity within the national governments to meet the demands of such implementation. Capacity building includes the processes and means for national governments and local communities to develop the skills and expertise needed to manage the environment and natural resources in a sustainable manner. The essential ingredients of capacity building are enforcement mechanisms, technical skills and a legal framework for the implementation of Agenda 21 programmes. National governments have to take stock of the current human, technical and financial resources and identify any additional resources needed for implementation.

Governments should take certain initial steps before developing a National Agenda 21 Action Plan. The National Development Plans should be reviewed in order to ascertain whether sustainable development concerns are adequately addressed and environment and natural resource considerations are integrated. A detailed review of priority programmes should be undertaken within the framework of Agenda 21. Not all programmes identified in the global agenda would apply to individual countries. A review of decision making systems should be undertaken to determine patterns of interaction in decision making and the relative influence of the respective groups in decision making.

Several countries have already developed their National Conservation Strategies (NCS) and National Environmental Action Plans (NEAP). The National Agenda 21 cannot be conceived in isolation of National Environment Action Plans. The strategies of Agenda 21 should be prepared in the light of the existing development plans. Agenda 21 is certainly a wider conception than that of the NEAP as some of the plans have confined themselves to protection of tangible physical resources. Agenda 21 takes a holistic approach looking at all social, economic and other factors that impinge on the environment.

There could be areas of overlap between two or more programmes. Where such overlaps occur, a common implementation programme could be developed. In certain countries NEAPs have been subsumed in the Agenda 21 Action Plans, whereas in others, they continue as independent programmes. One advantage in having a separate Secretariat handling the NEAP implementation is that its programmes are more manageable and better focused whereas the Agenda 21 Action Plans encompass the entire governmental machinery and therefore render focussing difficult.

An assessment of the human resource development requirements for implementing National Agenda 21 Action Plans is an urgent necessity. Such requirements should not be confined to public sector institutions. The private sector and NGOs are equally important partners as they need to play a positive role in implementing Agenda 21 Programmes and Projects.

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ENVIRONMENTAL CAPACITY BUILDING

K. H. J. Wijayadasa

Environmental Capacity Building (ECB) can be defined as an amalgam of programs and projects whose objective is to ensure integrated environmental and developmental management; planning and policy formulation; legislative, and institutional and human resources development in an efficient, sustainable and equitable manner by improving economic efficiency, enhancing environmental protection and natural resources management and reducing poverty.

The ability of a country to achieve sustainable development will be determined firstly, by the capacity of its people and secondly, by the capacity of its institutions. This would in a way underscore the importance of policy measures, planning, economic instruments, management tools, legislation and enforcement. Hitherto, capacity building for economic development adopted a sectoral and an institutional approach.

It has been found that short term ad hoc ECB interventions which are essentially piece-meal are not sustainable. Long term interventions are necessary to support sustainable policy processes. The building of administrative capacities and capabilities to support policy reforms is of long gestation.

Emphasis should be placed on developing national capacities for ECB relying on local knowledge, experience and expertise to the extent possible. In the transference of environmentally sound technology, appropriate adaptation and successful application are more important than acquisition of such technology.

ENVIRONMENTAL CAPACITY BUILDING

K H J Wijayadasa

What is Environmental Capacity Building?

Capacity Building (CB) can be described as an amalgam of programmes and projects whose objective is to ensure institutional development sectorally and/or nationally for more efficient, effective, equitable and sustainable management of the development process. Thus it would encompass all aspects of good governance vis-a-vis policy formulation, legislation and enforcement, delivery of public infrastructure services, mobilisation and management of financial resources, and collaboration with private sector institutions.

The World Commission on Environment and Development has defined sustainable development as "a process in which the exploitation of natural resources, the direction of investment, the orientation of technological development and institutional change meet the needs of the present generation without compromising the ability of future generations to meet their own needs." Therefore, South Asia's strategy on sustainable development should be aimed at promoting economic growth in an efficient, sustainable and equitable manner by improving economic efficiency, enhancing environmental protection and natural resources management and reducing poverty. In this context, Environmental Capacity Building (ECB) for sustainable development would occupy a much larger canvas than capacity building for conventional economic development.

Moreover, environment being multisectoral, multidisciplinary and multifaceted in character the addition of the environmental dimension to capacity building calls for an integrated or holistic approach to ECB as against the traditional sectoral and institutional approaches. Accordingly, ECB can be defined as an amalgam of programmes and projects whose objective is to ensure integrated environmental and developmental management; planning and policy formulation; legislative, and institutional and human resources development in an efficient, sustainable and equitable manner by improving economic efficiency; enhancing environmental protection and natural resources management and reducing poverty.

The ability of a country to achieve sustainable development will be determined firstly, by the capacity of its people and secondly, by the capacity of its institutions. This would in a way underscore the importance of policy measures, planning, economic instruments, management tools, legislation and enforcement. Hitherto, capacity building for economic development adopted a sectoral and an institutional approach. ECB can succeed only if it were to adopt not only a cross-sectoral approach but a wholly integrated and holistic approach to sustainable development.

What makes ECB a critical factor in Sustainable Development?

The region has to contend with four major environmental problems. They are the degradation of ecosystems, the depletion of natural resources and the loss of biodiversity; unmanageable levels of soil, air and water pollution; inadequate shelter, sanitation, health care and water supply; and the threat of climate change and sea level rise. All of them have their roots in poverty, population pressure, lack of development and the unsustainable development process itself. Invariably the poor are both the victims and the agents of environmental

degradation. Consequently, in South Asia the vicious circle of poverty, population growth, underdevelopment and environmental degradation is in operation.

Arresting environmental degradation and the depletion of the natural resource base has to occupy the most prominent place in any program of ECB in South Asia. Most countries of the region are already afflicted with problems of deforestation, land degradation, loss of biodiversity and shortages of freshwater. This is particularly alarming in the light of the fact that around 40 percent of the GDP is derived from primary agricultural and industrial activities.

Poverty has driven millions of poor people to eke out an existence through environmentally destructive practices such as slash and burn. Rates of reforestation and natural regeneration are far below the current rates of deforestation. In several countries, desertification has reached the point of no return to green landscapes. Many of the resources almost everywhere are being exploited at a rate which is not sustainable in the not so long run.

Industrialisation and Urbanisation which are haphazard, dirty and rapid have created the most chaotic environmental conditions in the growth centers of South Asia excepting in the well planned industrial zones and satellite cities. Air pollution in the megacities has been aggravated by traffic congestion and emissions from factories and power plants. Surface, coastal and groundwater pollution has been caused by the discharge of untreated effluents, sewage and solid waste into waterways and soil.

As far as economic development is concerned South Asia is lagging behind some of the more dynamic regions of the world such as South East Asia and East Asia. In recent years, with the recovery of the world economy several countries of South Asia have improved their growth performance. However, the benefits have not been distributed evenly within countries and between countries.

What are the Critical Subject Areas and Components of ECB?

ECB is a newly emerging discipline. The subject areas within its purview are wide ranging and undefined. Its applications are by and large cross-sectoral and cross-disciplinary. Under the circumstances, it will be necessary to demarcate the critical subject areas in ECB together with their main components.

Accordingly, the following are deemed to be the critical subject areas in ECB:

- (a) **Policy** including policy development, and review vis-a-vis environmental management, regulation, institutions, training, economics, technology, integration of environment and development and sustainable development criteria and indices.
- (b) **Planning** covering strategic, physical and regional planning.
- (c) **Management** encompassing all aspects of sustainable management of ecosystems, natural resources, including agriculture, pollution, waste, etc. and the management tools and techniques including environmental impact assessment (EIA), and market-based economic instruments.

Environmental Capacity Building

- (d) **Legislation** including constitutional provisions framework law, national, sectoral, provincial and local legislation on all aspects of sustainable development as well as all subsidiary legislation and administrative law.
- (e) **Institutions** covering all aspects of institutional infrastructure, good, governance and institutional development pertaining to administrative and organisational structures, enforcement capacities, financial resources, technology transfer, awareness, database, and management information.
- (f) **Human Resources** encompassing all aspects of human resources development for sustainable environmental management, policy development, planning, legislation and institutions pertaining to skills, training, orientation, experience and expertise.

What are the Environmental Capacity Building Needs of South Asia?

In South Asia, environmental policy development is still in the formative stages, let alone policy on sustainable development. All countries have recognised the importance of integrating environmental concerns into the development process. Environmental safeguards have not been written into the Constitutions of some of these countries. All these countries accept sustainable development as an integral part of state policy, but many countries have not spelt it out in the form of national policy statements, proclamations or decrees. In the area of policy analysis and policy review also, the picture that has emerged is very similar. All the countries are absolutely keen to get the policy framework right and working.

Strategic, physical and regional planning are the three vital components of planning for sustainable development. Many countries have recognised the need to formulate, adopt and implement National Development Plans (NDP) focusing on conservation of natural resources and biodiversity, industrial and urban pollution abatement as well as basic issues of poverty, consumption and population. National Conservation Strategies (NCS) or National Environmental Strategies (NES) have been formulated in several of these countries. Action has been initiated by several countries to formulate National Agenda 21 Action Plans (NA21AP). Physical Planning, covering town and country planning and infrastructure planning needs strengthening. Integrated Regional Development Planning (IRDP) has not received the attention it deserves.

In all eight countries, a great deal of attention has been paid to Environmental Management, especially in relation to conservation of natural resources and biodiversity and management of terrestrial, ecosystems. In almost all these countries, deforestation, desertification and depletion of freshwater resources and air, soil and water pollution in the industrial and urban centers are causing serious concern. However, the existing capacities and capabilities are not adequate to arrest the degradation of the environment, let alone remedy it. Basically there are three factors governing this. Firstly, the policy and planning frameworks that can address the challenges of sustainable development are not in place. Secondly, the legislative and institutional infrastructure is of the "command and control" type. This is not conducive to environmental management through the application of management tools and techniques such as EIA, economic instruments, incentives and the price mechanism. Thirdly, the trained personnel who are equipped to bring about policy and technological changes, economic and administrative reforms and restructure the legislative and institutional frameworks are in

short supply. The application of market-oriented economic policies and the use of economic instruments for environmental management are just being introduced. As far as the application of EIA is concerned the progress is satisfactory.

Basic environmental law or framework legislation governing overall national level policy, strategy, coordination, planning, monitoring, licensing, standard setting, etc. is in operation only in some countries. Many countries have fairly comprehensive national and sectoral legislation governing conservation of natural resources and biodiversity and air, soil and water pollution control. At the provincial and local levels, environmental legislation is almost non-existent, excepting some delegations and side references.

There are no in-built mechanisms for review, revision and updating of legislation. In some countries, instituting the appropriate legislative framework together with the regulatory and enforcement mechanisms are deemed to be high priority areas. This has been constrained by three factors. In the absence of any sense of urgency, environmental legislation is not given the high priority it deserves. There is a dearth of competent national legal experts and subject matter specialists. In some countries there are strong political and bureaucratic lobbies which are against foreign expertise being deployed to formulate national legislation.

The existence of an institution at the highest possible policy making level solely devoted to sustainable development such as a Cabinet Sub Committee or a National Council of Ministers chaired by the Head of State or Government can make a big dent. Such apex level bodies are in existence in many countries of South Asia. Lead agencies have been set up in several countries. This is indeed a massive step forward in environmental protection and management. At the sectoral and regional levels, small units or cells have been set up in areas such as forest conservation, power generation and industrial and urban pollution control. There is very little legal provision for further devolution of powers and administrative decentralisation. Lack of vertical and horizontal coordination is a serious issue. Most institutions lack implementation and enforcement capability. Some are prone to bribery and corruption due to woefully inadequate wage structures.

All these countries lack institutional capacity and trained manpower in specialised areas such as monitoring and assessment, database and information management and the acquisition of environmentally sound technologies. The biggest impediment to ECB appears to be the financial constraint. Even though there is a progressive increase in budgetary allocations for environmental protection and management, such increases are a mere pittance in the face of growing demands especially because of the high rates of environmental deterioration and degradation.

A great deal of effort and investment has gone into the development of human resources. However, lack of expertise and trained personnel continues to be the biggest constraint to placing sustainable development on course in all the eight countries. There are three reasons for this shortfall. Firstly, training is lopsided in the absence of human resources planning in relation to training needs. Secondly, in many of these countries, those trained have been placed in the wrong slots. In other words, they are square pegs in round holes. Thirdly, and most importantly, many of those who received training have gone elsewhere in search of greener pastures.

Hitherto, training had been heavily concentrated in four areas, namely: management of ecosystems and natural resources; abatement of air, water and soil pollution; environmental impact assessment; and institutional aspects including education, awareness and information. It will be necessary to shift the emphasis to five other areas namely: (a) policy development,

policy analysis and review; (b) strategic, physical and regional planning; (c) use of economic instruments and management tools; (d) standard setting, monitoring and assessment and acquisition, adaptation and application of environmentally sound technologies; and (e) the modernisation of the legal, regulatory and enforcement mechanisms.

What Are the Important Principles Governing Environmental Capacity Building?

The history of ECB in South Asia shows that there had been no master plan or framework within which ECB was undertaken. On the one hand the countries were reacting to the environmental problems and challenges they were confronted with; and on the other hand, the donor agencies thought it fit to respond positively.

It is true that these countries themselves are ultimately responsible for their own development in an environmentally sound and sustainable manner. The effectiveness of their policies and institutions is central to their successes and failures. Therefore, future ECB should be pursued having undertaken a study of ECB status, requirements and priorities intersectorally and after careful forward planning.

It will be necessary to replace the existing sectoral and institutional approach to ECB with an integrated and holistic approach. This is because environmental policy development is essentially multisectoral, multidisciplinary and multifaceted in character and it must be treated as an integrated whole, and hence indivisible.

Also, the existing product-oriented approach to ECB should be replaced with a process-oriented approach, because sustainable development is a long term process and not a short term product.

The existing approach to ECB in many DMCs is symptomatic. Quite often the root causes underlying the environmental problems are not remedied. In future national governments should endeavor to change this to a causative approach. ECB should be geared to eliminating the root causes of environmental degradation such as poverty, population pressure, illiteracy and over-consumption. As far as possible ECB should be policy-related and policy specific.

It has been found that short term ad hoc ECB interventions which are essentially piece-meal are not sustainable. Long term interventions are necessary to support sustainable policy processes. The building of administrative capacities and capabilities to support policy reforms are of long gestation.

People centered development is the most viable and the most sustainable form of development. There is no better alternative to development than participatory development. Therefore, to the extent possible, ECB should be community-based and community-driven. Also ECB should be comprehensive enough to take all relevant issues into consideration including those of gender, youth and the disadvantaged.

Emphasis should be placed on developing national capacities for ECB relying on local knowledge, experience and expertise to the extent possible. In the transference of environmentally sound technology, appropriate adaptation and successful application are more important than acquisition of such technology. Emphasis should be placed on the development of adaptive skills as well as skills development in technology evaluation.

An essential prerequisite to ECB is the creation of environmental awareness at all levels of society. Creating awareness among policy makers, legislators and key decision makers is often neglected. Political commitment, resource allocation and bureaucratic resourcefulness are the essential prerequisites in successful ECB.

What are the Guidelines for Environmental Capacity Building in South Asia Subject Area-wise?

The guidelines for ECB in South Asia Subject Area-wise are:-

Policy

The main components of policy are: policy development, policy analysis and policy review. Command and control is the main thrust of the environmental policy framework in many of the developing countries. Strategic planning, legislative means, regulatory systems and planning procedures are the most commonly used tools of environmental management and control. The least utilised are the modern management tools such as EIA and economic instruments. Economic policy reforms such as the removal of price distortions should take precedence over further environmental regulation because they have an impact on economic efficiency and environmental goals. Also, pollution control policies should be reformed and made into economic instruments. Over and above these, the use of targeted policies such as pollution levies which will induce conforming to emission standards should be encouraged. Also, creating an environment in which a competitive and efficient market economy can thrive is an indispensable first step in policy reforms.

Planning

This includes strategic, physical and regional planning. The strategic planning process takes care of the integration of environmental concerns into the development process. The instruments used in strategic planning for sustainable development are (NDPs), NESs, NCSs, NEAPs and since of late NA21APs. Of them, the most effective instrument for achieving the objective of sustainable development is the NA21AP. Physical planning especially in relation to urban planning and industrial zoning and integrated regional development planning are two important planning instruments that can guide future development to the goal of sustainability.

Management

The key to environmentally sound development is the management of the environment and its resources on a sustainable basis. Environmental management should therefore take into account the carrying capacity of the environment, the goals of development and the economic feasibility of implementing development proposals. If sustainable development is to be achieved, environmental considerations should be incorporated into the development process, and management tools such as EIA, ecolabelling, environmental auditing, risk assessment and accounting should be consistently applied.

One of the most effective ways of containing pollution and improving environmental quality is to establish and enforce environmental quality and emission standards at the national level. Environmental management is hampered by inadequate priority setting, inappropriate policies, weak institutions and erratic implementation. Even though there is an overwhelmingly large amount of regulations, the effectiveness of these regulations in

reducing pollution has been limited. The existing environmental management structures are not the most effective.

The colonial model of environmental management by regulation, enforcement and application of punitive measures is rapidly giving way to the use of modern management tools and techniques. To stimulate growth, reduce poverty and achieve other social objectives, many countries have adopted policies that interfered with the functioning of the market economy. These include subsidies, tariffs and other disincentives causing policy distortions and market failures. These have to be corrected by other regulatory systems and as a consequence the vicious circle of regulations, controls, subsidies and disincentives goes into operation. EIA has made a big impact in integrating environmental considerations into the decision making process and in the mitigation of adverse environmental impacts. The transition to the market-oriented economic system should be expedited. The use of economic instruments and management tools should be actively promoted.

Legislation

Environmental legislation is one of the most pervasive elements of cross-sectoral importance in environmental management for sustainable development. Many of the environmental laws are either inadequate or obsolete. Existing legislation on natural resources and ecosystems is highly conservation-oriented and regulatory in character. They should be made management-oriented and participatory in character. The legislative framework has to be updated and modernised to cope with the newly emerging problems and current demands of environmental management. Enforcement is constrained by inadequate sanctions and long drawn out judicial procedures. Building endogenous capacity to forge ahead with the updating and modernisation of laws should receive priority attention.

Institutions

First and foremost, the government's institutional machinery for environmental protection and management should be put in place. The organisational structure, administrative arrangements and staffing should match the onerous tasks to be performed. Institutions are not mere conglomerates of policies, procedures, systems, resources and staff. They are integrated parts of a whole which continuously interact and are interdependent. Public authorities play a crucial role in environmental protection and management. They formulate policies and strategies, enforce laws, regulations and standards, and lay down procedures and guidelines with a view to ensuring sustainable environmental management. The development of monitoring and assessment methodologies and their implementation are important activities in ECB.

Human Resources

The capacity of an institution depends on the structure and the quality of its staff. Structure relates to flows of information, authority and finances between and within organisations. Many organisations need restructuring and also improving the quality of service training and retraining at various levels and in different disciplines. Training in policy analysis, strategic planning, use of management tools and economic instruments. Modernisation of legislation and administrative restructuring should receive pride of place. Administrative training should include environmental management, environmental economics and integration of environment into development.

Training should be targeted to improving public sector management and operational efficiency. Optimum utilisation and continuity in-service of trained personnel should be ensured through strategic placement and incentive schemes. National training institutions should be strengthened and their capacities and capabilities in environmental protection and management should be improved upon. National level training programs using local resource personnel should be encouraged. Training-of-trainers in different disciplines such as environmental legislation, public administration and management, clean and low-waste technology, forestry, policy and planning, environmental economics, etc. should be entrusted to regional centers of excellence; some of which are already in existence.

What are the Priorities in Environmental Capacity Building in South Asia?

The Priority programme components in ECB in South Asia are as follows:-

- (a) ***Policy***
creating and/or strengthening the institutional capacity and the human resources for Policy Development, Policy Analysis and Policy Review, in relation to integration of Environment into Development, formulation and implementation of sustainable development policies and strategies, use of environmental management tools and techniques and economic instruments and transition to the market based system.
- (b) ***Planning***
building institutional capacities and the human capabilities to integrate sustainable development parameters into the strategic, physical and regional planning processes. Provide advice and assistance for the formulation and implementation of environmentally sound and sustainable national development plans, National Agenda 21 Action Plans and urban, industrial and regional master plans as applicable.
- (c) ***Management***
establish the legislative and institutional infrastructure and develop human resources necessary to enable a quick transition from the command and control environmental management set up to the market-oriented system in which natural resources are not deemed to be "free goods," through the application of management tools such as EIA and the use of economic instruments.
- (d) ***Legislation***
formulate, legislate and implement national framework legislation on the environment giving umbrella cover to all existing environmental legislation, covering gaps if any, and making provision in particular for setting standards, issue of licenses, application of EIA and other management tools, monitoring and assessment, etc. Also, formulate and/or update, legislate and implement comprehensive national, sectoral, provincial and local legislation governing conservation of natural resources and biodiversity; air, soil and water pollution control, management of ecosystems industry and urban conglomerates in particular.
- (e) ***Institutions***
establish and/or strengthen the institutional infrastructure and human resource capabilities at national, sectoral, provincial and local levels, to enable speedy policy formulation, decision making and the implementation and monitoring of sustainable development programs and projects. Also restructure, reorganise and reorient the administration with sufficient, devolution, delegation and decetralisation and

structure the state and private sectors and NGOs for effective, efficient and sustainable management of the environment. Develop Capacities for Monitoring and Assessment, Data Base and Information Systems and Transition to cleaner Technologies.

(f) Human Resources

formulate and implement integrated human resources development plans for sustainable development which will supplement and complement policy and planning, environmental management and legislation and institutions while strengthening the national capabilities for the conservation of natural resources and biodiversity, industrial and urban pollution control, monitoring and assessment, database and information systems, use of management tools such as EIA and economic instruments.

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SOUTH ASIA CO-OPERATIVE ENVIRONMENT PROGRAMME

The South Asia Co-operative Environment Programme (SACEP) is an association of 8 member states namely; Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. It came into being with the adoption of the Colombo Declaration and the Articles of Association at the Ministerial Meeting held in Colombo in February 1981.

The aims and objectives of SACEP are; to promote and support the protection and enhancement of the environment of South Asia individually, collectively and co-operatively and to encourage the judicious use of the resources of the environment with a view to alleviating poverty, reducing socio economic disparities, and improving the quality of life of the people.

Among the key functions of SACEP are; promoting co-operative activities in environmental protection and management which are beneficial to the member states; facilitating sharing of knowledge and expertise; and providing resources for project implementation through donor assistance and support.

Under its Strategy and Programme for 1992-1998 priority attention is being given to; Capacity Building; Awareness and Technology Transfer; Environmental Training; Management of Montane and Coastal and Marine Ecosystems and Wildlife and Natural Habitats.

Some of the major ongoing projects of SACEP are; as Secretariat for the South Asian Regional Seas Programme, the implementation of identified Priority Projects; SACEP / UNEP / NORAD Joint Project on Environmental Law in South Asia (1996 - 2000); preparation of The State of the Environment Report for South Asia; formulation & implementation of a Regional Plan of Action under the Global Programme of Action on Land-Based Sources of Marine Pollution; Assessment of Floral Biodiversity in the South Asian Region and implementation of the Project on Capacity Building for Environmental Training in South Asia.