SACEP / INMS

Regional Workshop on

Capacity development for the national authorities to formulate Nitrogen Management Policy and its implementation at national and regional level in South Asian Seas (SAS) Region

12 – 14 September 2017

Male', Maldives

Proceedings of the SACEP/INMS Regional Workshop on

Demonstration of Full Nitrogen Approach

'Capacity Development for the National Authorities to Formulate Nitrogen Management Policy and its Implementation at National and Regional level'

in South Asia

12 – 14 September 2017

Male' Maldives

Human perturbation of the global nitrogen cycle in the 21st century is leading both to massive benefits for food and energy production as well as multiple threats to the environment. Although nitrogen is abundant in the atmosphere in its unreactive form (N_2) it is unavailable for most organisms. At the same time, natural supply of reactive nitrogen (N_r) compounds is limited. Anthropogenic inputs of N_r include fertilizer production, biological nitrogen fixation, and nitrogen oxides (NO_x) from combustion sources. As a result of these inputs, humans have more than doubled global terrestrial rates of Nr formation.

South Asia mainly comprises the sub-Himalayan countries: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka, located between the Himalayas on the North and the Indian Ocean on the south. Together, they cover an area of about 4.5 million km² (over 1.7 million mi²), with less than 5% of the world's land mass, 14% of the global arable land, 2.73% of the world forest area and 4% of the world's

coastline and yet support over 25% of the world's population and over 45% of Asia's population.

Both agriculture and industry contribute massively to the region's economy. Uneven development is common, both within and between countries of South Asia, partly due to the huge diversity of soil types, water availability, climate, socioeconomic and governance factors. This also implies contrasting situations in terms of N management. While the smaller, irrigated areas are characterized by intensive fertilizer usage, there is only a little applied in the larger, rainfed areas. There is further difference in N management between the peri-urban areas dominated by intensive livestock farming, and the rural areas where this type of agricultural management is less prevalent. Usable N is lost to ground water and surface water bodies through agricultural run offs, sewage, animal and human excreta, and also into the air due to emission of reactive N compounds from agricultural soils, livestock, sewage dumps, residue burning, vehicular and industrial emissions and industrial waste (e.g. Food/Beverage Manufacturing, Slaughter Houses, Textile, Paper and Pulp, Agro-Based etc.).

The coastal habitats of South Asia are at a high risk of eutrophication due to the accumulation of reactive N, apart from other nutrients. There is substantial coastal eutrophication around the Indian peninsula, and N-loading has been observed also in several lakes and other inland water bodies, in addition, high levels of nitrates has been reported in the ground water in some places. The lack of their systematic geographical or chronological documentation has hampered credible trend analyses and thus, prevented informed decision on sustainable N management. The nitrogen transport by the rivers in South Asia was reviewed at the workshop and the average NO_3-N in water was estimated at 2.1 mg l^{-1} (with extreme values sometimes exceeding 10 mg l^{-1}) of which the average sediment bound N includes a significant contribution of PON

(particulate organic nitrogen). Emissions of nitrogen to air are substantial, with the Indo-Gangetic Plain showing the highest concentration ammonia air pollution in the world, as evidenced by satellite imagery. Nitrous oxide emissions from agriculture contribute substantially to global warming. Although this represents a small fraction of the available nitrogen, it is closely associated with major losses as di-nitrogen emission, which link to a substantial reduction in agricultural nitrogen use efficiency. Gaseous emissions of ammonia and NO_x, both contribute to particulate matter adversely affecting human health, and significant loss of biodiversity when deposited to natural ecosystems. This points to a currently poorly quantified threat of N to biodiversity in foothills (*Terai*) of the Himalayas.

Being the most populous and the fastest growing region of the world with a distinct socio-economic, cultural and climatic profile, a better quantification of the reactive N scenario in the South Asian region is essential for a more accurate understanding of the global N-cycle and for the development future solutions. The South Asian region also offers a tropical testing ground for previous assumptions made on the basis of Western experience, and the adoption of more informed means of estimating the region's N-budget as well as its contribution to the global N-budget. There is the opportunity for South Asia to lead the way globally, including celebrating recent successes, such as the Indian Neem-coated urea policy. The development/demonstration of local capacity for N-cycle assessment will catalyze better regional cooperation and future global engagement at the scientific and policy levels in reactive N management.

The South Asian Cooperative Environment Program (SACEP), Principal Facilitator of this workshop, is an Intergovernmental Environmental body that provides a platform for coherent and coordinated interventions on a South Asian scale. SACEP has established partnership with various agencies including INMS for technical support to protect marine and other pollution from land-based sources in South Asia, with a view to developing

implementation of a coherent multi-sector, multi-benefit policy approach for nitrogen management in the South Asian region.

SACEP is working with International Nitrogen Management System (INMS) collaboratively to address the emergent challenges of Nitrogen to environment. An important overall goal of INMS is to establish a framework for a global integrated nitrogen modelling approach that enables assessment of the benefits (expressed as improved food, goods and energy production, reduced pollution and climate threats) versus costs related to feasible improvements in the global and regional nitrogen management. The INMS has a multi-sector approach with a strong focus on agricultural N management, but also including N (NOx) emissions related to energy production and industrial N uses. INMS is managed under the lead of the International Nitrogen Initiative (INI) working in partnership with UN Environment. INMS establishes research demonstrations on the nitrogen cycle for each of the main world regions that include: South Asia, East Asia, Latin America, East Africa, East Europe, West Europe. The approach is to demonstrate how a joined-up approach to nitrogen management can catalyze stronger action for a cleaner environment (water, air, greenhouse gas, ecosystems, and soils) and improved food and energy production simultaneously. The INMS South Asian demonstration sees the INI South Asian Nitrogen Centre (SANC), working with SACEP. There are strong institutional and intellectual linkages among the partners of INMS within South Asia, as well as between the South Asian and global leaders of INMS.

The overall aim of the South Asian demonstration under SACEP/INMS is to collect all the available information on reactive nitrogen to quantify the overall N budget for the region. This provides the foundation to explore possible solutions and to scale up the benefits. Data are being collated on reactive N usage and/or its leakages from various relevant sectors such as agriculture, industry, traffic and domestic sewage and their N-loading into

the soil, air, inland water bodies and coastal systems, including past, present and future trends. Technologies and practices will be evaluated, incorporating the experience of case study interventions.

The objectives of the SACEP / INMS Malé Workshop were:

1. Awareness raising among the relevant stakeholders about the consequences of excess reactive nitrogen in coastal and marine system;
2. Capacity development for gathering all the available information on reactive N to quantify the overall N budget from the source of auricular activates, industrial effluents, domestic waste to the marine and coastal waters;
3. Experience sharing among the member counties regarding nitrogen management in South Asian Seas (SAS) region;
4. To understand the existing intervention at government level on reactive nitrogen management and receive handholding of the respective country government to introduce scientific information management at a policy level.

The meeting for Day 1 was held at the headquarters of the Ministry of Environment and Energy, Govt. of Maldives and attended by high government officials of related ministries and scientists representing Bangladesh, India, Pakistan, Sri Lanka and the host country Maldives, in addition to the representatives of SACEP, INMS and SANC. A total of 26 participants took part in the workshop and details of the participants and their contact addresses are given in Appendix 2. The representative of Nepal could not participate. The workshop was opened with statements by the Director of Environment, the Govt. of Maldives, followed by Dr. Khurshed, Director General of SACEP, and Prof. Mark Sutton, Principal Coordinator of the INMS Project. The workshop proceedings then began with a presentation by Mr. Pulakesh Mandal, Senior Program Officer, SACEP on the prevailing scenario on reactive N in the SACEP region. He

briefed the audience about the overall impact on marine life in the Indian Ocean region of SACEP from land-based pollution and leakage of reactive N to the ocean. He pointed out that eutrophication due to excess nutrients including nitrogen affects the biodiversity of the marine life and leads to an increase in jelly fish problem in the region.

Subsequent presentations by government representatives and scientists from Bangladesh, India, Pakistan and Sri Lanka briefed the participants on the background scenario and the government initiatives to improve nitrogen management across different sectors and impacts. For example, Bangladesh explained innovative approaches to increase N-fertilizer use efficiency, and use of urea super granules (USGs), deep placement of urea, bio-organic fertilizers and low-input crop variety. Such measures have increased rice yield by 15–20% and reduced use of N-fertilizer by 20–30%. Livestock and poultry serving the growing protein demand, also help Bangladesh to obtain organic manure partially offsetting urea input. Pakistan mentioned the extent of use of fertilizer-N in agriculture, leakage of reactive N to the environment and use of mitigation measures like nitrification inhibitors. Sri Lanka imported a large amount of urea major fraction of which is applied to rice cultivation followed by horticulture. Due to low use efficiency, a major part of the fertilizer-N is lost leading to groundwater contamination and greenhouse gas emission through N_2O release. For India, the problems of air pollution from industry, traffic and agriculture related to nitrogen, and of coastal eutrophication were recognized to be severe. But at the same time, the meeting highlighted the 2015 policy of neem-coated-urea, which is giving an opportunity to reduce N losses (including from N2O), and improve nitrogen use efficiency. Future opportunities to go further were discussed, including building on the neem policy.

Further discussions focused on developing measures and introducing them at government policy levels for reducing soil, water and air pollution from

reactive N. The need for a more coherent policy approach to nitrogen was emphasized, which would maximize synergies and minimize trade-offs between different forms of N pollution. In particular, it was highlighted that the fertilizer value of N pollution in India alone exceeds around USD 10 billion / year. Options to be further developed in recovering this valuable nitrogen resource were listed and evaluated.

Key outcomes of the workshop included:

- Contribution to work plan of INMS South Asian Regional Nitrogen Assessment
- Preparation for standardization of methods to measure N cycle
- Identifying training needs, including a Nitrogen MOOC (Massive Open On-line Course) for various stakeholders
- Listing and of mitigation measures and technologies, in relation to the South Asian Demonstration
- Consideration of inputs in advance of the Fourth Inter-Governmental Review (IGR-4) of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) (Bali, 23-27 October 2017)
- Preparation of a Draft Resolution on nitrogen for submission to the United Nations Assembly (Annex 1) which was adopted unanimously.

The delegates requested SACEP to submit the draft resolution to the Governing Body of Member Countries. The assembly also discussed developing a project proposal to UK Government for a South Asian Hub on Nitrogen and Environmental Stewardship (SAHNES). The meeting provided the basis to prepare for a submission to the UK Global Challenge Research Fund call on 'Intractable Challenges'.

The closing ceremony was chaired by Mr. Abdulla Ziyad, Minister of State, Coastal Protection and Environment, Ministry of Environment and Energy,

Govt. of the Republic of Maldives. The Hon'ble minister expressed his satisfaction at the progress of discussion and the outcome of the workshop. He mentioned that concept of N pollution is new to his country and that there is an urgent need for re-educating the scientific staff and the public in general. He mentioned about the groundwater pollution from fertilizer use in select islands of Maldives, especially in shallow aquifers and requested the representatives from other south Asian countries to help in tackling such issues.

The meeting ended with a vote of thanks to the host, Govt. of Maldives, SACEP and assembled delegates who expressed urgency in carrying forward the INMS objective of regional demonstration on reactive N issues in the region.

RESOLUTION ON SUSTAINABLE NITROGEN MANAGEMENT FOR UNEA-3

Recognizing the multiple pollution threats resulting from anthropogenic reactive nitrogen, with adverse effects on the terrestrial, freshwater and marine environments, on air pollution and on greenhouse gas emissions, resulting beyond the recognized benefits of nitrogen use for food and energy production,

Noting that global economy-wide nitrogen use efficiency is only around 20%, so that 80% of anthropogenic reactive nitrogen is wasted, leading to pollution that threatens human health, wellbeing and ecosystem services and contributes to climate change and stratospheric ozone depletion,

Concerned that human alteration of the global nitrogen cycle already greatly exceeds the planetary boundary, while climate change is anticipated to further exacerbate nitrogen pollution losses,

Recognizing the existing actions already taken by countries as part of national action plans and intergovernmental agreements linked to water quality, air quality, climate and biodiversity,

Acknowledging that current policies related to reactive nitrogen in many countries are fragmented, limiting the extent to which a coherent global policy response has so far been developed,

Realizing that the lack of policy coherence on the global nitrogen cycle is resulting in unquantified trade-offs between different forms of nitrogen pollution and contributing to the barriers to adoption of policies for cleaner water, cleaner air, climate mitigation and adaptation and biodiversity protection,

Welcoming the recent establishment of the International Nitrogen Management System as a science support system for policy development across the nitrogen cycle, including working with regional groups and actors to allow regional perspectives to be developed within the global context,

Reflecting on the outcomes of the recent Malé deliberations of the policy planners and experts on nitrogen management from South Asian Seas region organized jointly by the Co-operative Environment Programme and the International Nitrogen Management System in

September 2017[1], which highlighted human alteration of the nitrogen cycle in South Asia as an urgent issue with increasing human and livestock, agricultural intensity and industrial activities contributing to a substantial worsening of nitrogen pollution unless action is taken;

Here call on UN Environment to

Consider the options to facilitate better coordination of policies across the global nitrogen cycle at the national, regional and global levels, including consideration of the case to establish an intergovernmental coordination mechanism on nitrogen policies, and consider the case for developing an integrated nitrogen policy, which could enhance the gravity of common cause between multiple policy domains,

Support exploration of the options for better management of the global nitrogen cycle and how these could help achieve Sustainable Development Goals, including sharing of assessment methodologies and emerging technologies for recovery and recycling of nitrogen and other such nutrients,

Facilitate assessment of the multiple environmental, food and health benefits of possible goals for improved nitrogen management, quantifying the net economic benefits for food and energy production, freshwater and marine environmental quality, air quality, greenhouse gas mitigation and stratospheric ozone depletion mitigation, underpinned by the development of reference values, while ensuring coordinated management of the relevant datasets to allow development of the integrated and sustainable nitrogen management regime,

Facilitate the promotion of appropriate training and capacity for policy makers and practitioners for developing widespread understanding and awareness of the nitrogen cycling and opportunities for action

Support development of a coherent and evidence-based policy approach for sustainable nitrogen management.

[1]Regional Workshop on 'Capacity Development for the National Authorities to formulate Nitrogen Management Policy and its Implementation at National and Regional level' in South Asia Region.

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Programme Schedule

Day 1 – Tuesday 12th September, 2017 **Venue: Conference Hall: Ministry Of Environment and Energy**		
08:30-09:00	Arrival and Registration of Participants	
09:00-09:45 09.00 -09.20 09.20-09.30 09.30-09.35 09.35-09.40 09.40-09.45	**Opening Ceremony** • Welcome Address • Opening Remarks by Chair, GPNM • Opening Remarks by SACEP • Opening Remarks by Principal Coordinator, INMS • Opening Remarks by South Asia Nitrogen Centre	 Minister/High Government Official of the Ministry of Environment and Energy, Republic of Maldives Dr. R. Ramachandran Dr. Khurshid, SACEP Dr. Mark Sutton Dr. T.K. Adhya
09:45-10:00	Group Photo	
10:00-10:30	**Coffee Break**	
10:30-10:50	**Presentation from SACEP**	Mr. Pulakesh Mondal, Senior Program Officer (Regional), SACEP
10.50-11.20	**GPNM and INMS: collaborating in the management of Reactive Nitrogen - the global Reactive N Scenario**	Dr. Ramesh Ramachandran, Chair, GPNM
11:20-11:50	**Introduction of INMS and overview of the project**	Prof. (Dr.) Mark Sutton
11:50-12:10	South Asia Demonstration Project	Dr. T.K. Adhya
12:10-12:30	ING and INMS Project	Dr. N. Raghuram
12:30-13:30	**Lunch Break**	
13:30-14:00	Country presentations on nitrogen management scenario of Bangladesh	Bangladesh
14:00-14:30	Country presentations on nitrogen management scenario of India	India
14:30-15:00	Country presentations on nitrogen management scenario of Maldives	Maldives
15:00-15:30	**Coffee Break**	
15:30-16:00	Country presentations on nitrogen management scenario of Pakistan	Pakistan
16:00-16:30	Country presentations on nitrogen management scenario of Sri Lanka	Sri Lanka
16:30-17:00	Summary of Day 1	Dr. Mark Sutton
17:00	**End day 1**	

Day 2 – Wednesday 13th September 2017 Venue: Auditorium, Customs Department		
09:00-09:10	Discussion approach for Day 2	Prof. (Dr.) Mark Sutton
09:10-09:30	GEF-GNC Project and the INMS Project	Dr. Christopher Cox, GPA-UNEP (through Skype)
09:30-09:40	Summary of Key Findings from the Indian Nitrogen Assessment	Dr. T.K. Adhya
09:40-09:55	Other presentation offers from scientists in Bangladesh/Nepal/Sri Lanka etc with focus on existing N assessment)	Colleagues from Bangladesh/Maldives/ Nepal/Pakistan/Sri Lanka
09:55-10.00	Questions????	
10:00-10:30	General presentation on tasks and planning for Component 3 Activity 3.1, aim of the workshop and background document. Aim of the workshop and background documents	INMS/SANC/ING Dr. T.K. Adhya Dr. N. Raghuram
10:30-11:00	**Coffee Break**	
11:00-12:30	Discussion on nitrogen co-benefits and opportunities (Part 1) • Science Relationships • Solutions Development • Policy arena • Outlining a plan of action	Group Discussion led by Prof. (Dr.) Mark Sutton, INMS All participants
12:30-13:30	**Lunch Break**	
13:30-17:00	Visit to GEF Project being co-implemented by UNEP and UNDP for Indian Ocean and Atlantic SIDS (see http://aio-iwrm.org/) to the island of Thoddoo	SACEP
17.00	**End of day 2**	

Day 3 – Thursday 14 September 2017 Venue: Auditorium, Customs Department		
09:00-10:30	Discussion on nitrogen co-benefits and opportunities (Part 2) • Science Relationships • Solutions Development • Policy arena • Outlining a plan of action	Group Discussion led by Prof. (Dr.) Mark Sutton, INMS All participants
10:30-11:00	**Coffee Break**	
11:00-12:30	Discussion on nitrogen co-benefits and opportunities (Part 3) • Science Relationships • Solutions Development • Policy arena • Outlining a plan of action	Group Discussion led by Prof. (Dr.) Mark Sutton, INMS All participants
12:30-13:30	**Lunch Break**	
13:30-15:00	Discussion on nitrogen co-benefits and opportunities (Part 4) • Science Relationships • Solutions Development • Policy arena • Outlining a plan of action	Group Discussion led by Prof. (Dr.) Mark Sutton, INMS All participants
15:00-15:30	**Coffee Break**	
15:30-16:00	**Closing Ceremony**	
	• Closing Remarks:	High Government Official, Ministry of Environment and Energy, Maldives]
	• Closing Remarks by SACEP	Dr. Khurshid
	• Closing Remarks by INMS	Dr. Sutton
15:30-16:00	**Evaluation Questionnaires**	SACEP
16:00	**End of Workshop & Departure**	

List of Participants

Regional Workshop on "Capacity development for the national authorities to formulate Nitrogen Management Policy and its implementation at national and regional level" in South Asian Seas (SAS) Region

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Male', Maldives.

NO	COUNTRY	NAME OF DELEGATION	DESIGNATION	INSTITUTION & ADDRESS	TELEPHONE OFFICIAL	TELEPHONE MOBILE	FAX	EMAIL
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9	Pakistan	Lt.Cdr Irfan Bashir PN	Lt.Cdr	Pakistan Maritime Security Agency, Plot No 34-A, Dockyard Road Karachi, Pakistan	+92-021-48508180		+92-21-99214625	hqpmsa@cyber.net.pk; hqpmsa@pmsa.gov.pk
10	Pakistan	Mr. Abdul Jalil	CHIEF/PROJECT DIRECTOR	Ministry of Planning, Development and Reform, National Fertilizer Development Centre, Islamabad, PAKISTAN	+92-51-9269744	+92-321-9835709	+92-51-9269640	jalilmarwat@yahoo.com
11	Sri Lanka	Mr. Gamini Wicramapala	Director (Policy Planing and Monitoring)	Ministry of Mahweli Development and Environment, Colombo, Sri Lanka.				

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22	SACEP	Mr. Pulakesh Mondal	Senior Programme Officer (Regional) - SASP	South Asia Co-operative Environment Programme, No. 69/4, Maya Avenue, Colombo 06, Sri Lanka	+94 11 562 1320	+94 773 114 744	+94 11 258 9369	pulakesh.mondal@sacep.org
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Background Document

Background of the workshop

Human perturbation of the global nitrogen cycle in the 21st century is leading both to massive benefits for food and energy production as well as multiple threats to the environment. Although nitrogen is abundant in the atmosphere in its unreactive form (N_2) it is unavailable for most organisms. At the same time, natural supply of reactive nitrogen (Nr) compounds is limited. Anthropogenic inputs of Nr include fertilizer production, biological nitrogen fixation, and nitrogen oxides (NOx) from combustion sources. As a result of these inputs, humans have more than doubled global terrestrial rates of Nr formation. An important overall goal of International Nitrogen Management System (INMS) is to establish a framework for a global integrated nitrogen modelling approach that enables assessment of the benefits (expressed as improved food, goods and energy production, reduced pollution and climate threats) versus costs related to feasible improvements in the global and regional nitrogen management. The benefit and costs need also to be expressed in net economic terms, despite its uncertainties. The N management system has a multi-sector approach with a strong focus on agricultural N management, but also including N (NOx) emissions related to energy production and industrial N uses.

Aim of the Component 3 of the INMS Project establishes targeted research demonstrations on the nitrogen cycle at a regional scale for each of the main world regions. The approach is to demonstrate how a joined up approach to nitrogen management can catalyze stronger action for a cleaner environment (water, air, greenhouse gas, ecosystems, and soils) and improved food and energy production simultaneously. The choice of regional scale reflects the need to link between local and global scales, to share regionally specific lessons and to work in partnership with regional intergovernmental and other international processes.

The main elements are:

1) Design common methodology for regional demonstration of nitrogen flows, priorities, mitigation options, co-benefits, success stories, barriers-to-change and ways of overcoming barriers.
2) Conduct the regional demonstrations to refine regional nitrogen assessments and improve understanding of regional N cycle.
3) Use workshops to synthesize outcomes from demonstration activities focusing on reducing adverse N impacts & maximizing co-benefits.
4) Build consensus on benchmarking N indicators for different regions and systems, linking between the regions and global scale analysis.

5) Refine the regional approach to demonstrate the benefits of joined up N management, leading to concrete plans of how a perspective from the N cycle can be embedded in the future activities of GPA and other national programs and international conventions.

Five regional demonstrations are included with funding support from GEF according to three cases. In addition, at least one demonstration is planned without specific funding from GEF for a fourth case:

1) Developing regions with excess reactive nitrogen: South Asia, East Asia, Latin America
2) Developing Regions with insufficient reactive nitrogen: East Africa
3) Transition economies with excess reactive nitrogen: East Europe.
4) Developed regions with excess reactive nitrogen (West Europe). It is expected that additional input from a North American demonstration may also be developed during the course of the project.

South Asia mainly comprises the sub-Himalayan countries: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka, located in the Southern part of Asia between the Himalayas on the North and the Indian Ocean on the south. Together, they cover an area of about 4.5 million km² (over 1.7 million mi²), with less than 5% of the world's land mass, 14% of the global arable land, 2.73% of the world forest area and 4% of the world's coastline and yet support over 25% of the world's population and over 45% of Asia's population. The South Asian Association for Regional Cooperation (SAARC), which was established in 1985, includes all eight nations comprising South Asia. The South Asian Cooperative Environment Program (SACEP), Principal Facilitator of this workshop, is an Intergovernmental Environmental body of the SAARC countries that provides a platform for coherent and coordinated interventions on a South Asian scale. SACEP has conducted a Scoping Study on Nutrient loading and eutrophication of coastal waters of the South Asian Seas (SAS) Region (http://www.sacep.org/pdf/Reports-Technical/2014.05.21-22-Scoping-study-on-Nutrient-loading-in-SAS-Region.pdf). This study examined the problem of eutrophication of coastal waters for the maritime countries of South Asia with two seas separated by the Indian landmass. This comprehensive study has also recommended series of important policy options and recommendations for further implementation. SACEP has established partnership with various agencies including INMS for technical support to protect marine pollution form land based sources in South Asia, with a view of implementation of the policy recommendation for the nitrogen management in the south Asian region.

Both agriculture and industry contribute massively to the region's economy. Uneven development is common, both within and between countries of South Asia, partly due to the huge diversity of soil types, water availability, climate, socioeconomic and governance factors. This also implies contrasting situations in terms of N management. While the smaller, irrigated areas are characterized by intensive fertilizer usage, there is only a little applied in the larger, rainfed areas. There is further difference in N management between the peri-urban areas dominated by intensive livestock farming, and the rural areas where this type of agricultural management is less prevalent. Usable N is lost to ground water and surface water bodies through agricultural run offs, sewage, animal and human excreta, and also into the air due to emission of reactive N compounds from agricultural soils, livestock, sewage dumps, residue burning, vehicular and industrial emissions and industrial waste (e.g. Food/Beverage Manufacturing, Slaughter Houses, Textile, Paper and Pulp, Agro-Based etc.).

The coastal habitats of South Asia are at a high risk of eutrophication due to the accumulation of reactive N, apart from other nutrients. There are pockets of coastal eutrophication around the Indian

peninsula, and N-loading has been observed also in several lakes and other inland water bodies, in addition, high levels of nitrates has been reported in the ground water in some places. The lack of their systematic geographical or chronological documentation has hampered credible trend analyses and thus, prevented informed decision on sustainable N management. The nitrogen transport by the rivers in South Asia was reviewed by Subramanian (2008). In this study the average NO3-N in water was estimated at 2.1 mg l-1 of which the average sediment bound N, mostly organic, was 0.2% with significant contribution of PON (particulate organic nitrogen).

The Indian Nitrogen Group (ING), the Principal Co-ordinator of the South Asian Demonstration project, was conceived in 2004 by the Society for Conservation for Nature (SANC), New Delhi, India. It was formally launched in 2006 to bring interdisciplinary convergence of scientists, industry stakeholders and government representatives from scientific, environmental, agricultural and other related ministries and is an active partner of INI. It highlighted the importance of reactive N management, the need for a better understanding of the reactive N scenario in India and identify the ways for better N management. INI has a regional South Asian Nitrogen centre (SANC) in New Delhi which will oversee and execute the South Asian Demonstration Project of INMS. SANC has strong scientific and industry partners throughout South Asia, as well as policy level interactions at the Indian government as well as with the intergovernmental South Asia Cooperative Environment Program (SACEP). Therefore, there are strong institutional and intellectual linkages among the implementing partners of INMS within South Asia, as well as between the South Asian and global leaders of INMS.

Aim and preparation of the workshop:

The overall aim of the South Asian demonstration under INMS is to collect all the available information on reactive nitrogen to quantify the overall N budget for the region, mainly based on data from India, Bangladesh and Sri Lanka and other South Asian countries to the extent available. The work program involves collation of data on reactive N usage and/or its leakages from various relevant sectors such as agriculture, industry, traffic and domestic sewage and their N-loading into the soil, air, inland water bodies and coastal systems. The data will be collected on national, state and even higher levels in order to broadly identify the most N-polluting sector(s) and region(s). The past, present and future trends will be identified from the available data, based on the changes in population, consumption, landuse, policies etc. The technologies and practices in widespread use, as well as the availability and penetration of more efficient technologies/practices and the experience with such interventions will be documented as case studies. Knowledge dissemination to stakeholders would result in better N use and management and better N end-usage.

The objectives of this workshop are:

1. Awareness raising among the relevant stakeholders about the consequences of excess reactive nitrogen in coastal and marine system;
2. Capacity development for gathering all the available information on reactive N to quantify the overall N budget from the source of auricular activates, industrial effluents, domestic waste to the marine and coastal waters;
3. Experience sharing among the member counties regarding nitrogen management in South Asian Seas (SAS) region;

4. To understand the existing intervention at government level on reactive nitrogen management and receive handholding of the respective country government to introduce scientific information management at a policy level.

Being the most populous and the fastest growing region of the world with a distinct socio-economic, cultural and climatic profile, a better quantification of the reactive N scenario in the South Asian region is very essential for a more accurate understanding of the global N-cycle as well as for the development of a realistic International N Management System. The South Asian region also offers a tropical testing ground for the assumptions made on the basis of Western experience, and the adoption of more informed means of estimating the region's N-budget as well as its contribution to the global N-budget. The development/demonstration of local capacity for N-cycle assessment could catalyze better regional cooperation and future global engagement at the scientific and policy levels in reactive N management.