should be taken into consideration. The reason for this is that the area of existing land resources cannot be increased. Therefore, a high level of production should be maintained within the existing land limits.

VII. Integrated Farming Scheme

A perfectly integrated farm includes many features. Animal husbandry, freshwater fishponds, mushroom cultivation, biogas units, bee keeping can exist. Due to the multiple economic activities of such a farm, the farmer can get stable sources of income at different times of the year.

VIII. Mitigation of Land Degradation

Small-scale land degradation, starting from a farm, takes a short time to become a large-scale problem spread over a large area. Therefore, land degradation should be well controlled at the land/farm level. Therefore, this is a very important part of good land use. Also, the national goal of land degradation neutrality targets (LDN) can be achieved in the future only by paying attention to it at the ground level.

IX. Market Goal Compliance and Entrepreneurial Form

In good land use, one should have a good understanding of market behavior. Otherwise, the commercial value of land use will decline. Therefore, the farmer should have some business/entrepreneurial understanding of the arrival of products in the market and he should be a farmer-entrepreneur.

X. Market surplus production and quality

Good land use is constantly focused on market surplus. This makes land use a profitable economic activity and improves the standard of living of land users.

XI. Integration of Agroforestry Systems

The establishment of agro-forestry systems in existing land use whenever possible can achieve several environmental and additional economic benefits of existing land use. This is a great help in increasing environmental services and biodiversity, especially in land use patterns.

XII. Good Agriculture Practices (GAP) Certification

This certification from the Department of Agriculture for "Good Agricultural Practices" is very important to sell the products of desired land use and existing practices with added value/ value as well as with the recognition of the consumers. Therefore, this certification is an integral part of good land use practices in the future.

Publication of Healthy landscape Project

Good Land Use Practices

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What is Good Land Use.

I. If the land use established by man on the ground and the multiple properties of the land based on it (soil, drainage, slope, nutrient level) match each other,

II. If the use of the land is financially or economically profitable as well as strengthens the economy,

III. If the use is pro-social or accepted by the society,

IV. If there is no environmental damage and resource degradation in the continuation of such use,

Such land use is good land use.

Advantages of good Land Use:

I. Good land use constantly shows the richness of the land.

II. The use of land has been made in a manner appropriate to the land, so that the land use can be maintained continuously.

III. Helps to strengthen the domestic economy.

IV. Does not create conflict with other land uses.

Therefore, it is social, economic, and eco-friendly, a satisfying land use for society.

Good land Use Practices:

I. Use of land according to land properties.

In the same case, crops or other uses should be selected to "match" the quality of the land. That is, there should be a match to the soil, nutritional factors, climatic factors, and other environmental factors.

II. Prioritizing soil and water conservation

Soil and water conservation is a major factor in the cultivation of crops. It is a tool to withstand drought, to prevent various degradation conditions, including soil erosion, and to maintain the fertility of the land. Also, maintaining soil and water storage in a particular area ensures continuous production capacity of that land.

III. Use of poison-free inputs

In the dry regions of the island as well as in other areas, the use of chemical fertilizers, insecticides and pesticides in agricultural inputs has been a serious problem as well as an environmental crisis. Therefore, there is an urgent need to correct this situation and it is necessary to turn to organic farming and other scientific approaches as a remedy. Partial and complete greenhouse farming is an example of this. This ensures the production of healthy food and contributes to the creation of a healthy society.

IV. Maintaining optimal and continuous crop cover.

This is a unique feature of a good land use pattern. Under-utilization conditions are not observed in a field with optimal crop cover, which is also a proof of high cropping intensity. An example of this is the cultivation of a short-term crop in addition to the two main seasons. This enables higher economic benefits from the land and reduces land degradation.

V. Application of Micro-irrigation Systems

Water is a very important and scarce resource in agricultural land use. Micro-irrigation systems are essential, especially in dry zone agricultural land use. Therefore, it is very important to use water in a more cost-effective manner so that the production level of land use can be maintained optimally and in the event of drought and emergency water scarcity, it is possible to easily cope with those conditions.

VI. Maintaining a healthy Landscape.

In view of the current environmental problems and land-related crises, the quality of the land (especially the overall physical properties including the nutritional level as well as the non-degradation of the land)

Present issues in Cascade Systems

- The sustainability of the cascade systems is being challenged by various isolated development activities that are carried out without considering them as a system.
- Siltation of tanks due to soil erosion.
- Water leakage/waste in tanks
- Problems raised due to individual rehabilitation rather than treating tanks as a system.
- Low cropping intensity.
- Unplanned land use and increased impacts due to land use changes.
- Increased impacts due to climate change.
- Carrying out some development activities to damage the integrity of the cascade system
- Degradation of soil and water resources.
- Deforestation in tank catchments

Community responsibility for sustainability of cascade systems

The collective contribution of the community is highly needed for the sustainability of cascade systems.

However, it is quite challenging to get the collective input of the community as it is spread over a relatively large area when considering the whole cascade system.

Therefore, it is a national need to support the formulation and implementation of plans and strategies by organizing at farmer organizations level to protect such systems from destruction.

Furthermore, it is the responsibility of the community to take appropriate measures to maintain the various components of the tank cascade systems without being destroyed, and to increase the productivity by properly managing the associated lands in these systems. It will increase their income and achieve a higher standard of living.

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Environment friendly Tank Cascade Systems

Healthy Landscapes Project
Ministry of Environment

What is Tank Cascade System?

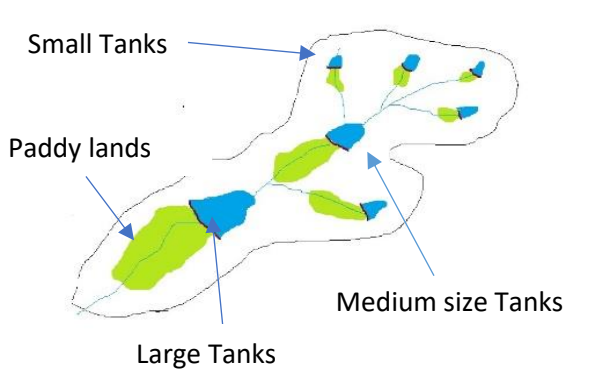
Farming in the Dry Zone particularly the paddy farming, is mainly associated with small tanks that supply water for paddy cultivation. If these small tanks are isolated, the capacity of a tank may not be sufficient for cultivation during prolonged dry spell. In order to overcome this issue, the tanks were inter connected in the past. A system created by building of series of tanks along a water way is called a "Tank Cascade".

In this system, small tanks are located in the upper part of the cascade, medium size tanks are located in the middle and comparatively large tanks are located in the lower part of the cascade.

This system includes paddy fields associated with each tank, accompanying hamlets (Gangoda), highlands (Chena) where other crops are grown and the forest that is located above the tank.

Therefore, the system as a whole is a unique combination of many natural and man-made ecosystems

Due to its uniqueness, the Cascade System was named as a globally important agricultural heritage system on April 19, 2018 by the World Food and Agriculture Organization (FAO).



Layout of a Cascade System

Why Cascade System is important?

About 14,200 small tanks are in operation in Sri Lanka, of which about 80% are under Cascade System.

Cascade System in the Dry Zone of Sri Lanka is a system that is not limited to just supplying water to crops, but also has various social and cultural elements associated with the natural environment. This system has many advantages and some of them are;

- Storage and provision of water for crops and reared animals as well as wildlife
- Provide suitable habitats for animals and plants.
- Maintaining ground water at optimum level.
- Creating a favorable micro-environment.
- These tank systems collect rainwater and thereby control droughts and floods.
- Support to inland fisheries.
- Minimize of soil erosion and maintain soil health.
- Helping to maintain the quality of water.

Major components of Tank Cascade System

These systems have many different sizes of tanks and other components, each of which performs its own unique function

The tanks in this system are known by different names depending on their location, size and function. e.g. Mahawewa, Pahalwewa, Ihala Wewa, Olagamwewa, Kuluwewa (silt trapping tanks), Godawala (water hole), Pinwewa etc.

In addition to this, paddy are cultivated under each of the interconnected tanks in this system. In the past, almost every tanks had a tank village, and with the growth of population, presently families in these villages shifted on both sides of the roads.

As far as the tanks and the associated environment is concerned, it performs very unique functions, and there are various components accompanying with this environment. Some of these features are Wewu Thavulla (tank catchment), Wewu Bamma (Tank bund), Horovwa (Sluice), Pita Wana (outer spill), Gasgommana (Tree belt), Kiul Ela (drainage canal), other canals, Kattakaduwa (interceptor), Kururu Paluwa (dedicated area for foraging birds), Iswatiya (soil ridges), Perahana (water Filter) etc.

There was forest over the tank, and *chena* cultivation was done in the open forest area. In the past, the clearing of the *Maha Mookalana* or dense forest was at a very minimal level, but these forest areas are now being gradually damaged or reduced due to various human activities.

The most common and wider spread process for soil/land degradation in dry zone is soil erosion. In addition, salinity also plays major role in land degradation. To reduce soil erosion, the following measures can be implemented.

1.Agronomic measures

* Mulching - either organic or inorganic, prevents raindrops from splashing over the soil and reduce erosion, retaining moisture, suppressing weed growth, and improving soil fertility.
* Minimum tillage- minimizes soil erosion and conserves soil moisture and nutrients, reducing land preparation costs.
* Alley cropping- This system can have many benefits such as increasing soil fertility, improving microclimate conditions, enhancing crop yield stability, reducing soil erosion, increasing Carbon sequestration, regulating runoff and nutrient leaching, and improving water quality.
* Intercropping involves growing multiple crops simultaneously, reducing soil erosion, utilizing resources efficiently, and maintaining soil fertility.
* Organic farming is an environmentally friendly agricultural system that uses organic sources for plant nutrient supply, such as farm yard manure, compost, vermicompost, green manure, residue mulching.
* Crop rotation. This system maintains a healthy ecosystem, improves soil properties, and ensures sustained crop production. It also reduces soil erosion by enhancing water infiltration and stabilizing aggregates.

2. Mechanical measures

* Soil bunds and drains are common in agriculture to collect surface runoff, increase water infiltration, and prevent soil erosion.
* Gully Control Structures: Gullying is occurring when runoff diverts into natural streams or open uplands encourage overland flow. Small gullies can be erased by filling them up and replanting. Stone check dams are piled across the gully with or without cement plastering, keeping a depression in the middle of the dam to spill over the excess flow.

3. Biological Measures

* Agroforestry is a system reduces soil erosion, prevents sediment runoff, stabilizes soil, and reduces river bank erosion. The benefits of agroforestry include environmental benefits like reducing pressure on natural forests, efficient nutrient recycling, better ecological protection, enhanced biodiversity, and improved microorganisms.
* Live fencing is a practice in Sri Lanka where trees or shrubs serve to demarcate land boundaries and act as protection from animals, wind barriers, economic providers and ornamentation. These fences conserve water and prevent soil erosion, creating a micro-climate and preventing water evaporation.

Salinization

Salinization is a significant soil degradation issue affecting agricultural production, food security, and sustainability in coastal regions and dry zones of Sri Lanka. It results from salt accumulation in paddy fields, causing dissolved salts to accumulate in soil. Coastal salinity, caused by seawater intrusion, is common in coastal areas, while inland salinity is caused by carbonate and bicarbonate salts accumulate in soil.

Some of the agricultural practices to reduce the salinity,;

- Avoid deep ploughing — less ploughing is recommended during Yala and drought-affected seasons, as deeper ploughing can increase salinity and mix salts deep in the soil.
- Wash paddy fields several times before sowing.
- Addition of organic matter to the soil — salinity can be reduced by applying organic fertilizer and other organic matter.,
- Paddy cultivation by Parachute method — a technique of tossing rice seedlings, uprooted from plastic trays containing a lump of soil. Since the paddy seedlings planted are about 12 days old, they are reducing their salinity impact during the growing stage.

* Application of gypsum—it could reduce soil salinity and enhance soil structure and permeability also improves

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Land Degradation

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Land Degradation

Land degradation means lowering the land's productive capacity temporarily or permanently through natural phnomena or human interference. Land degradation includes physical, chemical and biological degradation by various processes.

Land degradation is a pressing issue that is increasingly affecting the livelihoods of billions of people around the world. As the global population continues to grow, the demand for food, water, and energy is putting increasing pressure on the land resources available to support these needs. The extent of land degradation is becoming more severe, latest estimate indicate 2 billion ha. of land worldwide seriously affected.

In Sri Lanka, it is reported nearly 30 % of agricultural lands are degraded mainly due to soil erosion

There are several processes were identified in Sri Lanka which lead to the soil as well as land degradation. The major processes are soil erosion, fertility decline, increase of soil acidity, build-up of plant nutrients, salinity & alkalinity, soil compaction, water logging , pollution of soil and surface water, pollution of underground water, loss of agricultural lands etc. These processes are generally aggravated by land misuses due to increased demand for lands for various purposes .

In recent years, the Anuradhapura district has faced numerous challenges due to land degradation and leading to loss of biodiversity, decreased agricultural productivity, and negative impacts on the livelihoods of local communities.

Causes of Land Degradation and it's impacts on Natural Resources

- Deforestation: Clearing of forests for agriculture, logging, settlements, infrastructure, urbanization and other purposes has led to soil erosion, loss of habitat for wildlife, and reduced water retention in the soil.
- Overgrazing: Excessive grazing by livestock destroys vegetation and degrades soil.
- Improper land management: Poor agricultural practices such as monoculture and lack of soil conservation measures. This will lead to degrade the land by heavy soil erosion and resulting in heavy sedimentation of minor tanks.
- Climate change: Changing weather patterns and extreme events contribute to land degradation.
- Land pollution: Addition of toxic materials to the soil makes the soils polluted. Pollutants are added to soil by improper discharge of factory effluents and disposal of garbage.
- The over use of fertilizers agrochemicals in agriculture can contaminate groundwater. This has harmed soil quality, water resources, and overall ecosystem health.
- The construction of irrigation systems, such as reservoirs and canals, has altered the natural flow of water, leading to soil salinization, waterlogging, and decreased fertility.
- Improper construction and management tube wells and agro-wells lead to land degradation. These wells can deplete groundwater resources, leading to salinity development in agricultural lands. Because of over exploitation in the dry zone, some wells have been abandoned and there have been reports of brackish water coming through the wells. Groundwater density is very high in some areas. "Chronic kidney disease (CKD) is also reported to be more prevalent in areas where well water density is high.
- Forest fires are a major cause of soil degradation and nutrient losses via volatilization and erosion.
- Conversion of marshy/wet lands to other uses, disturbing water storage.

Measures to combat the Land Degradation

- Sustainable land management practices should be integrated into local development plans and zoning regulations to ensure that natural resources are protected and sustainable land use practices are promoted.
- Reforestation efforts should be a top priority. Planting native tree species can help stabilize the soil, prevent erosion, and create habitat for biodiversity. Additionally, promoting sustainable land use practices such as agroforestry can help increase soil fertility, improve water retention, and provide additional income for farmers.
- Promoting organic farming practices can help reduce reliance on chemicals, improve soil health, and protect the environment. Encouraging crop rotation, inter cropping, and integrated pest management can also help increase soil fertility, reduce erosion, and promote biodiversity.
- Sustainable water management practices should be implemented. This includes proper maintenance of irrigation systems, promotion of water-saving techniques, and protection of wetlands and rivers.
- Promote rational use of the ground water in the dry zone to ensure its sustainability
- Effective land use planning is also crucial in reducing land degradation.
- Monitoring and enforcement existing laws should be strictly implemented to prevent illegal deforestation, agricultural encroachment, mining and other activities that contribute to land degradation.

Land degradation effects on Village tank cascade system.

1. Forest land degradation is increased by illegal logging and overexploitation, agricultural expansion, mining and infrastructure development, forest fire and climate change, These incidents will lead to increase soil erosion and siltation in the village tanks cascade and reduce its capacity.
2. Pollution in the agricultural lands increased by excessive/improper use of pesticides, chemical fertilizers, poor management or inefficient disposal of waste. It leads to poor soil health, and pollution in the water.
3. Development activities in the Catchment areas lead to land degradation. There is a considerable proportion of the catchments of the tanks are still under forest cover. This will lead to sedimentation in the village tanks.
4. Climate change: The high temperatures and low precipit tion in the dry zone lead to poor organic matter production and rapid oxidation. Low organic matter leads to poor aggregation and low aggregate stability leading to a high potential for wind and water erosion. This will lead to sedimentation and disrupt the function of the village tanks.