# SRI LANKA FAA 118/119 TROPICAL FOREST & BIODIVERSITY ANALYSIS

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# SRI LANKA FAA 118/119 TROPICAL FOREST & BIODIVERSITY ANALYSIS

**January, 2012**

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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ADB | Asian Development Bank |
| Aus AID | Australian Agency for International Development |
| BOBLME | Bay of Bengal Large Marine Ecosystem Project |
| BCH | Bio-safety Clearing House |
| BMARI | Bandaranaike Memorial Ayurvedic Research Institute |
| BOI | Board of Investment |
| CARP | Council for Agricultural Research Policy |
| CBD | Convention on Biological Diversity |
| CBO | Community Based Organization |
| CCD | Coast Conservation Department |
| CCS | Climate Change Secretariat |
| CDM | Clean Development Mechanism |
| CEA | Central Environmental Authority |
| CITES | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| CMS | Convention on Conservation of Migratory species |
| CR | Critically Endangered |
| CTB | Ceylon Tourist Board |
| CWR | Crop Wild Relatives |
| CZMP | Coastal Zone Management Plan |
| DAPH | Department of Animal Production & Health |
| DAU | Department of Ayurveda |
| DEA | Department of Export Agriculture |
| DFAR | Department of Fisheries & Aquatic Resources |
| DNBG | Department of National Botanic Gardens |
| DNZG | Department of National Zoological Gardens |
| DOA | Department of Agriculture |
| DWC | Department of Wildlife Conservation |
| EFL | Environment Foundation Ltd |
| EIMS | Environmental Information Management System |
| EN | Endangered species |
| EPA | Environmental Protection Areas |
| FAA | Foreign Assistance Act |
| FD | Forest Department |
| FFPO | Fauna and Flora Protection Ordinance |

| | |
|---|---|
| FMA | Fisheries Management Area |
| FO | Forest Ordinance |
| FR | Forest Reserves |
| GEF | Global Environment Facility |
| GMSL | Green Movement of Sri Lanka |
| GOSL | Government of Sri Lanka |
| GSMB | Geological Survey and Mines Bureau |
| IBA | Important Bird Area |
| INGO | International NGO |
| IR | Intermediate Result |
| IUCN | International Union for Conservation of Nature and Natural Resources |
| IWMI | International Water Management Institute |
| JBIC | Japan Bank for International Cooperation |
| JICA | Japan International Cooperation Agency |
| KDN | Kanneliya-Dediyagala-Nakiyadeniya Forest Complex |
| LRC | Land Reform Commission |
| MAB | UNESCO Man and Biosphere Programme |
| ME | Ministry of Environment |
| MEPA | Marine Environment Protection Authority |
| MoENR | Ministry of Environment AND Natural Resources |
| MPA | Marine Protected Area |
| NAQDA | National Aquaculture Development Authority |
| NARA | National Aquatic Resources Research and Development Agency |
| NCR | National Conservation Review |
| NGO | Non Governmental Organization |
| NHWAA | National Heritage and Wilderness Areas Act |
| NSF | The National Science Foundation |
| NTFP | Non Timber Forest Products |
| OSF | Other State Forest |
| PA | Protected Area |
| PGRC | Plant Genetic Resource Centre |
| PR | Proposed Reserves |
| SLEJF | Sri Lanka Environment Journalist Forum |
| SLRDC | Sri Lanka Land Reclamation and Development Corporation |
| SOW | Scope of Work |

| | |
|---|---|
| UDA | Urban Development Authority |
| UNCCD | UN Convention to Combat Desertification |
| UNEP | United Nations Environment Programme |
| UNESCO | United Nations Educational Scientific and Cultural Organization |
| USAID | United States Agency for International Development |
| VU | Vulnerable |
| WCMC | World Conservation and Monitoring Centre |
| WB | World Bank |
| WNPSL | Wildlife and Nature Protection Society of Sri Lanka |
| YZA | Young Zoologists Association |

SRI LANKA
Political Map
Provinces and Major Cities of Sri Lanka
N
Kankesanturai
Point Pedro
Jaffna Peninsula
Jaffna
PALK STRAIT
Delft Island
Eelephant Pass
INDIA
PALK BAY
Kilinochchi
Mullaittiyu
Mannar Island
Mankulam
ADAM'S BRIDGE
Mannar
NORTH
Pulmoddal
Vavuniya
Trincomalee
Hammillewa
Mutur
Anuradhapura
NORTH CENTRAL
Kalpitiya
Puttalam
Habarane
GULF OF MANNAR
Maho
Polonnaruwa
NORTH WESTERN
Batticaloa
Kattankudi
Chilaw
CENTRAL
EASTERN
Kurunegala
Matale
Kalmunai
Kandy
Negombo
Kegalla
Amparai
COLOMBO
Nuwara Eliya
Badulla
SRI JAYEWARDENEPURA KOTTE
Monaragala
Pottuvil
Moratuwa
Ratnapura
UVA
WESTERN
Kalutara
SABARAGAMUWA
Kataragama
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INDIAN OCEAN
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# EXECUTIVE SUMMARY

The purpose of this task was to conduct an analysis of (i) the current state of biological diversity and tropical forests in Sri Lanka, (ii) the actions needed in Sri Lanka to conserve tropical forests and biological diversity, and (iii) the extent to which the current and proposed actions of USAID/Sri Lanka meet or could meet the needs identified by the Tropical Forest and Biodiversity Analysis. This analysis is intended to serve as a tool to assist USAID/Sri Lanka in taking tropical forestry and biodiversity concerns into its proposed programs under the current Country Development Cooperation Strategy (CDCS) (2011-2013). This analysis is also necessary to comply with Sections 118 (Tropical Forests) and 119 (Biological Diversity) of the Foreign Assistance Act of 1961, as amended, as well as country strategy guidelines under ADS 201.3.4.11 and ADS 204.5.

**Forests and biodiversity:** Sri Lanka has an extremely high level of biological diversity at ecosystem and species levels, especially in relation to its small land area of 65,610 $km^2$. Sri Lanka is considered to be the richest in species diversity per unit area in the Asian region with regard to mammals, reptiles, amphibians, fish and flowering plants. The region including the Western Ghats of India and Sri Lanka is considered as one of the 34 biodiversity "hot spots" identified in the world. Much of the country's biodiversity is found in its forests, particularly those in the wet and intermediate zones of the southwest. The forest ecosystems range from lowland, sub-montane and montane rainforests in the wet zone, to moist evergreen forests of the intermediate zone, dry mixed evergreen forests of the dry zone, and thorn forests of the arid zone. The total forests cover in the country is around 1.94 million ha representing 29.6% of the total land area.

There are six types of grasslands in the country ranging from wet patanas, dry patanas, savannahs, villus, thalawas and damanas. Other ecosystems in the country include inland wetland ecosystems, and coastal and marine ecosystems including coral reefs, sand dunes, seagrass beds, estuaries and lagoons, mangroves and salt marshes.

The natural vegetation in Sri Lanka supports over 3771 species of flowering plants (angiosperms) from 214 families and 1522 genera (of which 24.6% are endemic), and 314 species of ferns and fern allies (of which 13.8% are endemic). Of the island's moss flora, 11% are endemic, in the lichen family 32% of the species are endemic, and all 58 species of Dipterocarps found in Sri Lanka, are endemic. Overall Sri Lanka has 262 species of migrant birds and 677 other indigenous vertebrate species (excluding marine forms), of which 43% are endemic. Endemism among vertebrates is highest among amphibians (85%), freshwater fishes (54%) and reptiles (50%). Sri Lanka is one of the richest countries for amphibian diversity numbering 53 species from 16 genera (of which 85% are endemic). The rich avifauna of the country is reflected by the presence of 482 species of birds which include about 113 migrants (6.8% are endemic). Among the invertebrates, a high percentage of endemism is evident among the freshwater crabs (100%) land snails (83%) and dragon flies (47.5%) with many of them being point endemics.

Around 6.5% of the angiosperm flora has been assessed as extinct, of which nearly 60% are endemic. Among the angiosperm flora, 61% are threatened. Fifty three (53%) of the endemic ferns species are nationally threatened. Among the total inland indigenous vertebrate species (677) recorded in Sri Lanka, 62% are endemic to the island and 33% are nationally threatened. A total of 21 species of endemic amphibians have been considered as extinct. Among the vertebrate fauna, the highest number of threatened species has been recorded among reptiles (56), followed by amphibians (52), birds (46), mammals (41) and fresh water fish (28). Among the inland invertebrates, the highest number of threatened species has been recorded among the butterflies (66), followed by freshwater crabs (37), land snails (33), dragonflies (20).

Home gardens, which produce a wide range of valuable crops such as vegetables, fruits, timber, medicine, and spices, provide a significant component of the agricultural biodiversity in Sri Lanka. Home gardens are considered as important sites for in-situ conservation of crop germplasm. The long history of rice cultivation and the wide range of eco-edaphic conditions present in Sri Lanka have resulted in having a wide diversity of rice varietals. The country also has considerable biodiversity in terms of other crops such as cereals, field and cash crops, vegetables, root and tuber crops, and horticultural species. There are many wild relatives of important domestic crop species in the forests of Sri Lanka. There are a total of 410 species of these wild crop relatives from 47 families and 122 genera. Of these species, 289 are indigenous and 77 are endemic to Sri Lanka.

**Social and Economic Context:** Sri Lanka is one of the most densely populated countries in the world. It is also the second most heavily populated nation among the countries of South Asia. Despite the declining trend in population growth, the overall increase in population is expected to create considerable pressure on the environment and natural resources in terms of the growing need for land, water, infrastructure, goods and services, and employment. Extreme disparities in income distribution and poverty lead to competition for natural resources from critical and environmentally sensitive sources leading to their unsustainable exploitation. Intensive development in the country, accompanied by expansion of the land area under urban, agricultural, and industrial development, continues to contribute to the loss of natural ecosystems, and their inherent species and genetic diversity.

**Institutions, Policies and Laws:** The Government of Sri Lanka has made significant progress over the past 10-15 years in the establishment of an institutional, legal, and policy framework that is supportive of biodiversity conservation. Sri Lanka's Biodiversity Conservation Action Plan (1998) and Addendum (2007), Caring for the Environment Path to Sustainable Development Action Plan 2008-2012 (2008) and *Haritha* (Green) Lanka National Action Plan (2009) provide a framework for actions for biodiversity conservation and sustainable use. These action plans which have been adopted by the government as the national conservation agenda, and recommend priority projects and programmes for implementation in order to conserve forest and biodiversity resources in the country. At present, the supportive legal and policy framework has been established; the challenge in the future will be to implement these programmes effectively to achieve the expected task. Overall, there are 09 ministries, 21 government departments and agencies, several NGOs and donor agencies to implement and support these programmes.

**National Protected Area System:** The national Protected Area (PA) System in Sri Lanka is administered by 04 agencies namely the Forest Department (FD), Department of Wildlife Conservation (DWC), Central Environmental Authority (CEA) and Department of Fisheries and Aquatic Resources (DFAR). The FD and DWC are the two key institutions responsible for PA management. The FD manages around 1,180,277 ha of forest habitats whilst DWC manages around 888,126 ha of forest, wetland and marine habitats. The CEA and DFAR administer relatively small areas in extent; they include environmentally sensitive areas and fisheries management areas respectively. Legal protection for these PAs is provided by the relevant legislation. In addition to national legislation, Sri Lanka is a party to ten (10) International Treaties/Agreements concerning protection of forests and biological diversity.

**Threats to Biodiversity:** Biodiversity in Sri Lanka is currently under serious threat due to increasing population pressure on ecosystems, unplanned development activities, and degradation, fragmentation and loss of habitats, among other causes. As a result, most of the remaining habitats in terrestrial, freshwater, coastal and marine ecosystems are seriously threatened. The most criticial problem related to habitat loss and fragmentation during recent times has been loss of forests through clearing forests for conversion to non-forest land uses. Additional threats include illegal slash and

burn (shifting) cultivation in the dry and intermediate zones, conversion to monoculture plantations in the recent past, encroachment for settlement and cultivation of cash crops in the wet zone, illegal gem mining, illegal harvesting of timber, sand mining, over-harvesting of timber and non-timber forest products, over-visitation in some ecotourism sites, forest fires, inappropriate land use trends, prawn farming in some parts of the country, the spread of alien and invasive species, and the removal of wild species.

Among the costal and marine ecosystems, mangrove habitats, coral reefs, lagoons and estuaries are under serious threat. The most common threats are loss of habitats due to land reclamation, siltation and sedimentation, sewage and solid waste disposal, development of aquaculture, illegal & overfishing, improper fishing techniques, sand and coral mining, exploitation of species, poaching, ornamental fish and plant trade, spread of alien and invasive species, pollution, and the introduction of excessive nutrients or pesticides.

**Actions Needed to Conserve Biodiversity and Tropical Forests:**

Although Sri Lanka has made a significant progress towards protecting its biodiversity and forest resources, a considerable amount of work remains to be done in order to accomplish the goals and objectives set out in the Biodiversity Conservation Action Plan. Based on the outcome of this analysis, the following actions are still needed to support the conservation of forests and biodiversity in Sri Lanka. These actions fall into following components:

1. *Strengthen the policy, legal and institutional framework for biodiversity and forest conservation:* This includes formulating a national policy on biodiversity conservation; review of related national policies; strengthening enforcement; strengthening the protection of indigenous crop and animal genetic resources; and establishing an effective coordination mechanism between the FD and DWC.

2. *Establishment of a database and monitoring of biodiversity:* This component includes the establishment and institutionalization of a biodiversity information management network and upgrading the Environmental Information Management System (EMIS) of the FD; an island-wide biodiversity survey; strengthening of the forest inventory and GIS information system in FD and DWC; and studies to determine sustainable harvesting levels of Non-Timber Forest Products (NTFP) and aquatic ornamentals.

3. *Establish an optimum Protected Areas (PA) system, prepare management plans, and ensure recovery of important threatened species:* Identify critically important habitats with high biodiversity, and demarcate and declare these under appropriate legislation; develop innovative systems for habitat management for critical landscapes with high biodiversity particularly under non-state sector ownership; identify areas for wildlife corridors and declare under appropriate legislation; prepare and implement participatory management plans for all PAs; prepare and implement recovery plans for *in-situ* and *ex-situ* conservation of threatened species; and actions to mitigate animal-human conflicts.

4. *Strengthen the ex-situ conservation of threatened species of flora and restoration of ecologically important habitats:* Strengthen the ex-situ conservation activities in the country for conservation of flora: expand programmes of aforestation, reforestation and forest rehabilitation; expand homegarden development and other social forestry activities in the country.

5. *Establish biodiversity conservation financing mechanisms and a biodiversity valuation system:* Develop appropriate mechanisms for biodiversity valuation; develop and maintain a database on values of biodiversity; and develop innovative financing mechanisms to generate sustainable self financing

6. *Regulate/control the over-exploitation of biological resources and improve resource management:* Prevent over-exploitation and regulate harvesting of native freshwater organisms; prevent over-exploitation and regulate harvesting of NTFP and promote cultivation of NTFP in home gardens; and improved resource management of the coastal/marine environment.

7. *Ensure management and control of invasive and alien species:* Develop a National Strategy/Action Plan for prevention of the introduction, and eradication and mitigation of the impacts of alien/invasive species; and establish and maintain a complete national level database on alien/invasive species.

8. *Enhance public awareness on the values of biodiversity and forest resources:* Implement an effective awareness programme to enhance the public awareness on the importance of biodiversity; integrate an agenda on biodiversity into the curriculum of primary, secondary and tertiary education systems.

9. *Biodiversity valuation & mainstreaming the economics of biodiversity conservation:* Creation of national awareness on economic valuation of biodiversity; capacity building on environmental economics; strengthening institutions on the application of environmental economics in biodiversity conservation; implement sector-specific training and awareness programmes on biodiversity conservation; eevelop and implement biodiversity conservation awareness programmes for decision makers; and ensure future investment/economic plans are biodiversity friendly.

# 1. SRI LANKA TROPICAL FOREST AND BIODIVERSITY (FAA 118 AND 119) ANALYSIS - INTRODUCTION

## 1.1 Purpose

USAID/Sri Lanka recently completed a new three-year Country Development Cooperation Strategy (2011-2013). Sections 118 (Tropical Forests) and 119 (Biological Diversity) of the U.S. Foreign Assistance Act (FAA), as amended, require USAID Missions to examine issues related to tropical forest and biodiversity conservation as part of each country development strategy or country plan. In accordance with the FAA and country stragegy guidelines under ADS 201.3.4.11 and ADS 204.5, the purpose of this analysis is three-fold; to identify:

(i) The current state of biodiversity and tropical forests in Sri Lanka

(ii) The actions necessary to conserve tropical forests and biological diversity in Sri Lanka, and

(iii) The extent to which the current and proposed actions of USAID/Sri Lanka meet or could meet the needs identified.

This assessment is intended to serve as a planning tool to assist USAID/Sri Lanka to define how its new three year country strategy contributes to conservation needs, and as an instrument to guide in better integrating environmental concerns into proposed programs in the short and medium term.

## 1.2 Methodology and the Time Frame

The Scope of Work (SOW) for the assessment is presented in Appendix A. Both the SOW and the format for this report were developed using recent USAID guidance for the conduct of Tropical Forestry and Biodiversity Analyses.[1],[2]

The Tropical Forest and Biodiversity Analysis for Sri Lanka was conducted by a three person team combining experience in tropical forestry, biodiversity conservation, natural resource management, environmental policy & legislation and related institutional issues. The analysis team included Mr. Richard Volk, Senior Coastal & Aquatic Resources Advisor, U.S. Agency for International Development, part-time international expert assigned by USAID/Sri Lanka, and two local consultants from IUCN. The IUCN consultants were Mr. H.M.Bandaratillake and Mr. Shamen P. Vidanage. This country analysis was commissioned in June 2011, and conducted during June and July 2011. Mr. Bandaratillake was the former Conservator General of Forests of the Forest Department of Sri Lanka and the Project Director of the Forest Resources Management Project who has worked over the past 35 years in the field of forestry and Protected Area Management in Sri Lanka and has wide experience in forestry planning and management including policy development. Mr. Vidanage is the Acting Country Representative of the IUCN in Sri Lanka who has a wide range experience in environment and natural resource management in Sri Lanka. Mr. Richard Volk, who is currently Senior Coastal and Aquatic Resources Adviser to USAID, has extensive experience in the field of coastal and aquatic resources management and served as the international expert who provided the necessary guidance to the team and inputs for finalizing the IUCN's final product. The Scope of Work (SOW) of this Tropical Forest and Biodiversity Analysis is presented in Appendix A.

[1] USAID, 2005, Tropical Forestry and Biodiversity (FAA 118 and 119) Analysis: Lessons Learned and Best Practices from Recent USAID experience (2005).
[2] USAID, 2005, Best Practices for Biodiversity and Tropical Forest Assessments, April 2005

The methodology adopted to conduct the Tropical Forest and Biodiversity Analysis included the following steps;

a) The literature review

b) Interviews and consultative meetings/workshops with relevant stakeholders

c) A field visit to KDN forest complex

d) Report writing and submission of the report to USAID/Sri Lanka

The country analysis was commissioned in June 2011 and conducted during June and July 2011. During the information gathering phase, a thorough literature review of available information including published and unpublished materials and information available on the Internet on biodiversity conservation, forest resources and forest management in Sri Lanka was carried out by consultants. In total, the team reviewed around 70 publications, papers and articles (Section 9: List of Reference).

The team visited the USAID/Sri Lanka Mission on 14th June 2011 and met Ms. Priyanka Dissanayake, Project Management Specialist (Natural Resources), who arranged meetings with other staff of the Mission. Meetings with USAID/Sri Lanka staff included Mr. Tim Ong, Director, Programme Office, Ms. Laura A. Gonzalez, Private Enterprise Officer, Ms. Tammie Harris, Director of Operations, Office of the Transition Initiatives, Mr. Daniel K. Lee, Acting Director, Office of Economic Growth, Ms. Salma S. Peris, Senior Program Management Specialist, Mr. Dinesha Fernando, Program Management Specialist and Ms. Sajani Ranathunga, Senior Program Officer, Humanitarian Assistance Office to familiarize the programme of the USAID/Sri Lanka Mission.

Interviews and consultations were held with over 30 people, representing a broad range of stakeholders including relevant government agencies, NGOs, donor organizations and Community Based Organizations (CBOs) A briefing on the Sri Lanka Tropical Forest and Biodiversity Analysis was held on 30th June 2011 with the participation of Mr. Richard Volk, the international expert and representatives of the key stakeholder institutions (Appendix B1, persons consulted). The purpose of this briefing was to explain the purpose & objective of the analysis, methodology and procedures to be adopted and also to present the identified threats to different ecosystems and to solicit feedback on these threats. A workshop was also held on 21st July 2011 to discuss the draft report which was circulated in advance to the participants. The workshop was also useful to better understand and exchange information and ideas on the current context for biodiversity conservation and forest resources management in Sri Lanka (Appendix B2, persons participated).

As a part of the analysis process, the team conducted a field visit to the Kanneliya-Dediyagala-Nakiyadeniya (KDN) forest complex (Biosphere Reserve) to supplement the information gathered through literature review and interviews. The main intention of this field visit was to meet with communities and other relevant stakeholders (Appendix C for a list of persons consulted), make further observations, and gather valuable insights into the challenges of conserving biodiversity and forest resources in Sri Lanka.

# 2. OVERVIEW OF THE STATUS OF BIODIVERSITY AND TROPICAL FORESTS IN SRI LANKA

## 2.1 Introduction to Sri Lanka's Biodiversity and Tropical Forests:

### Why are forests important for Biodiversity in Sri Lanka?

Forest conservation was an integral part of the ancient civilization of Sri Lanka and much evidence to this effect is available in ancient chronicles of Sri Lanka such as *Mahawamsa*[3]. Sri Lanka has a long history of wildlife conservation and sustainable use of forests, fostered by Buddhist philosophy that respects all forms of life. One of the world's earliest wildlife sanctuaries was established by King Devanampiyatissa during 247 to 207 BC, along with the advent of Buddhism to Sri Lanka[4]. Succeeding kings upheld these traditions. These noble traditions and attitudes changed with the onset of the colonial era, when the rulers were more bent on exploiting rather than conserving the natural resources.

The country is an island nation located at the southern point of the Indian sub-continent between $5^0$ 54' and $9^o$ 52' North Latitude and $79^o$ 39' and $81^o$ 53' East Longitude. Despite its small size of 6,570,134 ha, the country has a varied climate and topography which has resulted in a rich biodiversity, distributed within a wide range of ecosystems. Sri Lanka is one of the most biologically diverse countries in Asia. Much of the country's biodiversity is found in its forests, particularly those in the wet and intermediate zones of the southwest. The island is home to a remarkable array of species: considered to be the richest per unit area in the Asian region with regard to mammals, reptiles, amphibians, fish and flowering plants; overtaking several mega diversity countries in this regard such as Malaysia, Indonesia and India. The concentration of avian species per unit area in Sri Lanka is also second only to Malaysia in Asia[5].

The country's climate is tropical and maritime, varies with the seasonality of rainfall, and is influenced by two distinct monsoons and convectional and cyclonic effects. Three major climatic zones; the wet, intermediate and dry zone can be recognized based on the rainfall pattern. Wet zone rainforests are exceptionally rich in biodiversity and high in endemism, especially among the Dipterocarps which constitute the characteristic tree flora of both wet lowland and hill forests and dominate the structural and floristic composition of these ecosystems. All endemic genera and over 90 percent of the woody endemic species occur in these forests, as well as about 75 per cent of the endemic animals.

> As a continental island that was connected with the mega biodiversity land mass of the Indian sub-continent for a greater part of its geological history, Sri Lanka has a richer biodiversity than most small island nations in the world. The diversity of species in the island reflects that it was once part of Gondwanaland during the Tertiary period (Cooray, 1984) together with South America, Africa, Madagascar, Seychelles and peninsular India (MoENR, 2008). After its break up in the Cretaceous, the Deccan Plate carrying Sri Lanka and peninsular India was isolated for about 35 million years, enabling its fauna and flora to evolve under equatorial conditions. The isolation for over 30 million years has resulted in an exceptional degree of endemism among Sri Lanka's wild flora and fauna.
>
> MoENR, 2009, Fourth National Report to the Convention on Biological Diversity

[3] The great historical chronicle of Ceylon (Sri Lanka) composed in the late 5th or early 6th century.
[4] Forest Department Manual Sri Lanka (2008), Forest Department, Sri Lanka.
[5] NARESA 1991, Natural Resources of Sri Lanka: Conditions and Trends. Natural Resources, Energy and Science Authority of Sri Lanka, Sri Lanka

The region including the Western Ghats of India and Sri Lanka is considered as one of the 34 biodiversity "hot spots" identified in the world[6].The conservation of biological diversity is of special significance to Sri Lanka in the context of its predominantly agriculture-based economy and the high dependence on many plant species for food, medicines and domestic products. Over a third of the plant species in the country are used in indigenous medical practice, and many of these species are growing scarce due to habitat destruction and over-collection. The rich and diverse ecosystems of the country harbor many wild relatives of cultivated species, and the gene pools represented by these wild plants are a resource of considerable potential value that could be used for the genetic improvement of cultivated plants.

The Government of Sri Lanka imposed a complete logging ban in all natural forests in the country since 1990, with an objective of conservation of forest biodiversity, endemism, and watershed protection. This logging ban is still in place, and there is strong public support to maintain the ban to achieve conservation objectives. The Forest Department has a firm commitment to enforce the logging ban[7].

## 2.2 Definition and Elements of Biodiversity

Biodiversity as defined in the "Biodiversity Conservation: A Guide for USAID Staff and Partners" (USAID, 2005)[8] is *"Biodiversity is the variety and variability of living organisms. The Earth's biodiversity consists of genes, species, and ecological processes making up terrestrial, marine and other aquatic ecosystems that both support and result from this diversity. All of these elements of living systems interact with each other to produce the web of life on Earth—the biosphere—a whole much greater than the sum of its parts".*

Biodiversity is usually defined at three basic levels; namely genetic diversity, species diversity and ecosystem diversity. **Genetic diversity** indicates genetic variability within a species, and is the basis of difference between individuals of a single species. **Species diversity** refers to differences between species, and is the variety of life forms on earth, both domesticated and wild. **Ecosystem diversity** is the variety of different ecosystems, which comprises both living and non-living components, and the ecological complexes of which they are a part, in terrestrial, marine and other aquatic environments.

Biodiversity can also be comprehended at yet other levels, such as communities and populations, or at the level of biomes, bioregions, landscapes, habitats and niches. In addition, genetic diversity can be viewed at the level of nucleotides, going up to genes, chromosomes, individuals and even populations. Biodiversity is, thus, a very wide-ranging concept, and can be interpreted in a way that is most meaningful to the conservation efforts at hand[9].

## 2.3. Ecosystem Diversity

Despite its small size, Sri Lanka has rich ecosystem diversity because of its topographic and climatic heterogeneity as well as its coastal influence. Adding to this diversity is a series of anthropogenic systems which blend to provide a multiplicity of ecosystems. Among the terrestrial ecosystems are forests that contain much of the biodiversity in the country. The forest ecosystems range from

[6] Mittermeier et al, 2005. Hotspots revised: Earth's biologically richest and most threatened terrestrial ecoregions.
[7] Bandaratillake, 2001, Forests out of bounds: impacts and effectiveness of logging bans in natural forests, FAO, Regional Office for Asia and the Pacific
[8] Biodiversity Conservation: A Guide for USAID Staff and Partners" (USAID, 2005)
[9] Ministry of Environment and Natural Resources, State of the Environment in Sri Lanka, 2002.

lowland, sub-montane and montane rainforests in the wet zone, to moist evergreen forests of the intermediate zone, dry mixed evergreen forests of the dry zone, and thorn forests of the arid zone. In addition, there are several types of grasslands in the wet and dry zone areas in the country ranging from wet patanas, dry patanas, savannahs and villus. There are complex network of wetlands associated with rivers and freshwater bodies. Sri Lanka being an island nation, has a multitude of coastal and marine ecosystems such as sea-grass beds, coral reefs, estuaries and lagoons, coastal marshes and associated mangrove swamps, and all these constitute the panorama of natural ecosystems in the country.

In addition, there are many man-made/human-modified ecosystems such as forest plantations, agriculture lands, home gardens, tanks and reservoirs (wetlands areas) etc, which have a direct bearing on the conservation, sustenance and survival of biological resources. This array of ecosystems found in the country can also be grouped into four basic natural habitat classes: forests, grasslands, wetlands, coastal and marine ecosystems, and man-made or human modified ecosystems: forest plantations, agricultural lands including social and urban forestry areas, reservoirs etc (Table 2.1)[10].

**Table 2.1: Ecosystem Diversity in Sri Lanka**

| Ecosystem Type Tier I | Ecosystem Type Tier II | Ecosystem Type Tier III |
|---|---|---|
| **Natural Ecosystems** | **Forest ecosystems** | Tropical wet lowland evergreen forest (lowland rain forest) |
| | | Tropical moist evergreen forest |
| | | Tropical dry mixed evergreen (monsoon) forest |
| | | Tropical thorn forest (Arid Zone) |
| | | Riverine forest |
| | | Tropical sub montane forest |
| | | Tropical montane forest |
| | **Grassland ecosystems** | Wet patana |
| | | Dry patana* |
| | | Savannah* |
| | | Thalawas* |
| | | Damanas* |
| | | Villu*** |
| | **Inland wetland ecosystems** | Flood plains |
| | | Swamps / Fresh water marshes** |
| | | Streams and rivers |
| | | Reservoirs and ponds |
| | **Coastal and marine ecosystems** | Mangroves |
| | | Salt marshes |
| | | Sand dunes and beaches |
| | | Mudflats |
| | | Seagrass beds |

[10] MoFE, 1998, Biodiversity Conservation in Sri Lanka: A Framework for Action

| Ecosystem Type Tier I | Ecosystem Type Tier II | Ecosystem Type Tier III |
|---|---|---|
| | | Lagoons and estuaries |
| | | Coral reefs |
| | | Coastal seas |
| **Man-made/Human-modified Ecosystems** | **Forest Ecosystems** | Forest plantations |
| | | Agro-forestry systems |
| | **Agricultural ecosystems** | Paddy lands |
| | | Fruit cultivations / Horticultural farms |
| | | Small crop holdings or other field crops (pulses, sesame etc) |
| | | Vegetables (including, root and tuber crops) |
| | | Plantation crops (tea, rubber, coconut, coffee, cinnamon etc) |
| | | Home gardens (cultivated) |
| | | Chena lands (slash and burn cultivation) |
| | **Wetlands** | Tanks and reservoirs |
| | **Other areas** | Road side plantations & Urban forestry etc |

* Man-influenced ecosystems ** Also includes the villus *** Present in wetland environment
*Source: 1. MoENR, 2009:* Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity (Compiled by Jinie D S Dela)
Gunatilleke, Pethiyagoda & Gunatilleke, 2008; Biodiversity of Sri Lanka, National Science Foundation, Sri Lanka

### 2.3.1. Forest Ecosystems:

According to the forest cover survey carried out by the Forest Department in year 2010 based on the satellite imageries of 2008, the dense forest cover in Sri Lanka including forest plantations was (1.46 million ha) 22.2% of the land area of the country, though all forests including “sparse natural forests" (which cover 6.5% of the land area) brings the total forest cover in the country (excluding home gardens and other forms of tree vegetation) to 1.88 million ha representing 28.7% of the land area[11]. Of this total forest cover, the largest proportions are distributed in Northern (24.6%), North Central (20.9%) and Eastern (17.3%) provinces of Sri Lanka (Figure 2.1). (See section 2.3.2 and Figure 2.3 for Forest Plantations)

In addition to these natural forests and forest plantations, a wide range of non-forest tree resources are available in the form of home gardens, rubber plantations, coconut plantations, and shade trees in tea plantations, trees on farmlands etc. These non-forest tree resources provide more than 70% of the industrial timber requirement in the country. Of this production, over 45% is produced from home gardens[12].

[11] Forest Department - Forest Cover Map of Sri Lanka, 2010 (Unpublished)
[12] MoAL&F, 1995, Sri Lanka Forestry Sector Master Plan

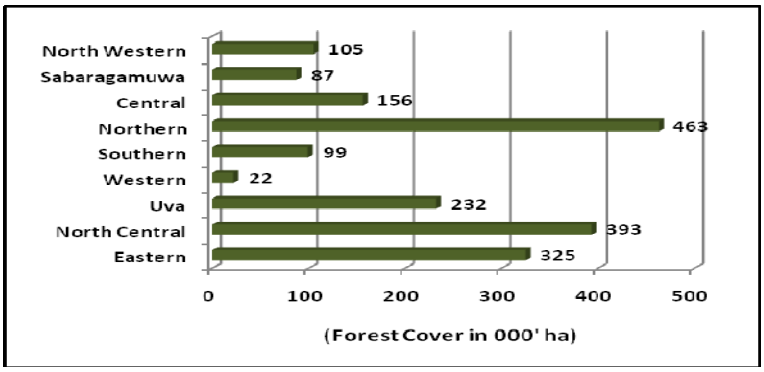



**Figure 2.1: Extent of Forest Cover in Different Provinces of Sri Lanka**

Sri Lanka has a striking variety of forest types brought about by spatial variations in rainfall, altitude and soil. Based on the patterns of distribution of the angiosperm flora and their endemicity, a total of 15 distinct floristic regions (Appendix D) have been recognized in Sri Lanka[13]. The forests that contain much of the biodiversity of Sri Lanka range from Tropical wet lowland evergreen forest (Lowland rain forests) in the wet zone, Tropical moist evergreen forest (Moist monsoon forests) in the intermediate zone and Tropical dry mixed evergreen forests (Dry monsoon forests) in the dry zone at elevations between below 1000 m; Tropical sub-montane forests (at elevations between 1000-1500 m in the wet zone); Tropical montane forests (at elevations of 1500-2500m in the wet zone); with Riverine forest along river banks; Tropical thorn forests in the arid areas; and Mangrove swamps in the coastal areas[14]. The percent composition of Sri Lanka's main natural forest categories in 2010 and the forest cover map of Sri Lanka (2010) are shown in Figure 2.1 and Figure 2.2 respectively.

**Table 2.2: Forest Cover by Forest Type in 2010**

| Forest Type | Total Forest Area (ha) 2010 | Percentage of the Land Area |
|---|---|---|
| **Montane forests** | 44, 787 | 0.68 |
| **Sub-montane forests** | 29,022 | 0.44 |
| **Lowland wet evergreen forests** | 124,032 | 1.89 |
| **Moist evergreen forests** | 117,674 | 1.79 |
| **Dry mixed evergreen forests** | 1,121,438 | 17.09 |
| **Riverine Dry forests** | 2,446 | 0.04 |
| **Mangroves** | 16,037 | 0.24 |
| **Scrubland*** | 317,708 | 4.84 |
| **Savannah*** | 68,044 | 1.04 |
| **Montane grassland*** | 46,988 | 0.72 |
| **Marsh** | 1,401 | 0.02 |
| **Forest Plantations** | 56,128 | 0.85 |
| **Total of Dense Forests** | **1,455,436** | **22.17** |
| **Total Spars forests** | 426,679 | 6.5 |
| **Total Forest Cover** | **1,882,115** | **28.68** |

*Source: Forest Department (2011) *- Included in Spars forests*

[13] Ashton and Gunatillake, 1987

### Tropical lowland wet evergreen forests or lowland rain forests:

Tropical lowland wet evergreen forests represent 6.4 % of the island's natural forest cover and 1.9% of its total land area of the country. This forest type is restricted to the wet zone in the southwest of the island, up to a mean elevation of 1000 m, and is at present highly fragmented. These forests are now represented mainly by isolated and very fragmented forest patches scattered over the wet zone. Most individual forests amount to less than 10,000 ha[2].These forests are of particular importance as they constitute the last remnants of the once widespread mid-miocene tropical rain forests of Sri Lanka and they are exceptionally rich in biodiversity and high in endemism (about 60 – 75 % of the tree species are endemic to Sri Lanka) especially among the Dipterocarps which constitute the characteristic tree flora and dominate the structural and floristic composition of this ecosystem. Lowland wet evergreen forests harbour nearly all the country's woody endemic flora, about 75 per cent of the endemic fauna and all the endemic genera. The level of endemism in these forests ranges from 37 - 64 % for woody plants and 14 - 52 % for animals, compared with 10-16% for species in the Dry Zone forests. All endemic genera and over 90 per cent of the woody endemic species and about 75 per cent of the endemic animals occur in these forests. In the lower slopes and valleys, these forests are characterized by a dense canopy of tree species reaching 30-40 m in height, with emergents rising to about 45 m, and woody lianas that form an intricate network[6.]

Lowland wet evergreen forests are dominated by the families Dipterocarpaceae, Clusiaceae, Sapotaceae, Bombacaceae and Myrtaceae. At the lower elevations (<100 m), *Dipterocarpus zeylanicus* and *D. hispidus,* and at higher elevations (>100 m) *Mesua ferrea* and *Shorea trapezifolia,* dominate the canopy of these forests. . In the sub-canopy, the common species are *Cullenia rosayroana, C. zeylanica* and *Myristica dactyloides,* and in the understorey tree layer *Xylopia championii* and *Garcinia hermonii. .* Large leaves, drip tips on leaves, buttresses, cauliflory, drooping young twigs, colourful young leaves and fewer lianas and epiphytes characterize its vegetation[15].

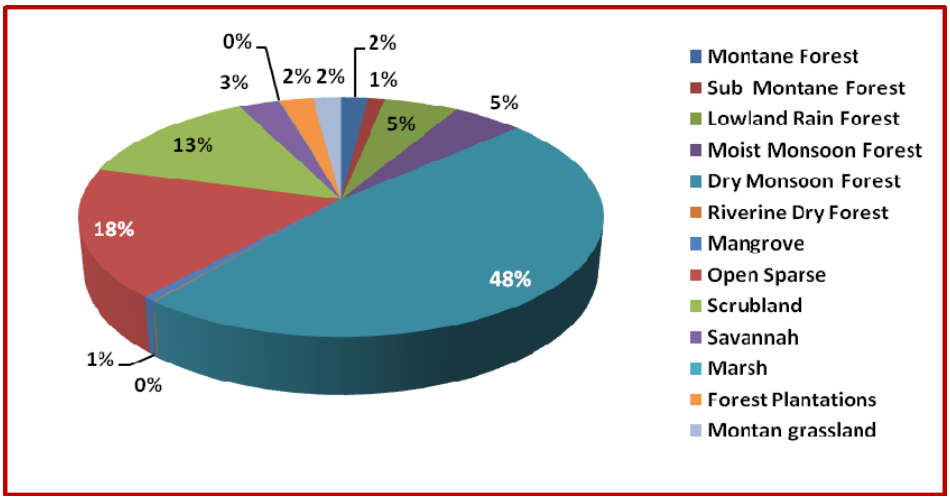



**Figure 2.2: Forest Types of Sri Lanka- 2010 (as a % of total forest cover)**

The southern lowland hills and plains extending from the east of Kalutara to the southeast are exceptionally rich in plant diversity, and this area is believed to be, floristically, the richest in South Asia[6]. Another interesting feature is that many endemics are restricted to a single forest or a single cluster of forest blocks.

[15] Gunatilleke, Pethiyagoda & Gunatilleke, 2008; Biodiversity of Sri Lanka, NSF

### Tropical moist evergreen forest or moist monsoon forests:

Tropical moist evergreen forests represent 11.4% of the island's natural forest cover and 3.4% of its total land area of the country. Tropical moist evergreen forests constitute a distinct group in the lowland intermediate zone. Trees in these forests are about 25-30 m tall; represent the transition or ecotone between forests in the aseasonal and seasonal climates. They bear similarities in species composition to both the tropical lowland wet evergreen forests and the tropical dry mixed evergreen forests and some species of their own. The dominant families here are Anacardiaceae, Sapindaceae, Euphorbiaceae and Moraceae. The dominant species are *Mangifera zeylanica, Canarium zeylanicum, Filicium decipiens, Dimorcarpus longan, Nothopegia beddomei* and *Gironniera parvifolia.* Lianas are abundant in this forest type. Only about 17 % of the tree species in them are endemic to Sri Lanka.

### Tropical dry mixed evergreen forest or dry monsoon forests:

Tropical dry mixed evergreen forests represent 53 % of the island's natural forest cover and 16 % of its total land area. These forests are the characteristic vegetation of the dry zone. Generally, the trees are about 25 m tall, but shorter in those towards the arid zone. About 13 % of the tree species in these forests are endemic to Sri Lanka[11].

> The national Conservation Review (NCR) revealed that 79 per cent of the woody plant diversity (including 88 per cent of endemic woody plant species) and 83 per cent of faunal diversity (including 85 per cent of endemic faunal species) are represented in just eight units of contiguous forests (IUCN/FAO/FD 1997). Six of these complexes are in the Lowland wet evergreen forests, while the Moist monsoon forests and Dry monsoon forests contain one complex each.
> *Source: MoFE/IUCN/WCMC, 1997, Designing an Optimum Protected Areas System for Sri Lanka's Natural Forests*

The families Euphorbiaceae, Sapindaceae, Ebenaceae, Sapotaceae, and Rutaceae dominate this forest type. The dominant canopy species are *Manilkara hexandra, Chloroxylon swietenia, Schleichera oleosa,* and *Pleurostylia opposita,* while those in the understorey tree layer are *Pterospermum suberifolium, Drypetes sepiaria* and *Dimorphocalyx glabellus*[11]*.* They comprise a mixture of evergreen and deciduous canopy species. In general, the latter are found in the canopy, shedding their leaves during the late dry period, allowing much light to filter to the forest floor. This enables grass and herbaceous species to flourish at the onset of the rainy season before new foliage on denuded canopy trees emerges

Although dry zone forests are less diverse than wet zone forests floristically, they are more extensive spatially, and they are important as habitats for large mammals (leopard, elephants, spotted deer, sambhur, wild pig, primates etc). Faunal groups such as carnivores, ungulates and primates show their highest species diversity in tropical dry mixed evergreen forests.

### Tropical thorn forests:

Tropical thorn forests are found in the arid zone in the southeast and Northwestern parts of the country, which have very long dry periods. Temperatures here are high being over 340C and the rainfall is below 1250 mm. As the name implies, thorny species are abundant in these forests and reach to about 5 m in height showing no species stratification. The thorny species have adaptations to store water and are able to live on very little water.

Its dominant families are Salvadoraceae, Mimosaceae, Euphorbiaceae and Rhamnaceae. The dominant species are *Salvadora persica, Acacia planifrons, Dichrostachys cinerea, Bauhinia racemosa, Eugenia bracteata, Phyllanthus polyphyllus,* and *Zizyphus oenoplia*. Endemic plant species are almost absent in these forests.[11]

**Riverine forests:**

Riverine forests are found along flood plains and river valleys in the dry and intermediate zones in elevations up to about 600 m.

**Tropical sub montane forests:**

The natural vegetation type of tropical sub montane forests represents a transitional biological belt between highlands and lowlands. Tropical sub montane forests are confined to middle elevations (1000–1500 m) in the wet zone. Their canopies are about 20–25 m high, dominated by the families Dipterocarpaceae, Clusiaceae and Myrtaceae, with the following soft and medium hardwood species being dominant: *Shorea gardneri, Calophyllum* spp. *Cryptocarya wightiana, Myristica dactyloides* and *Syzygium* spp. The proportion of endemic tree species here is about 50%. Most species of the endemic genus *Stemonoporus* show a localized distribution in these montane forests. The major forest areas of this category include Peak Wilderness, Knuckles (Dumbara hills), Namunukula and the Rakwana-Deniyaya ranges.

**Tropical montane forest:**

The montane forests, restricted to the uppermost elevations of the country (> 1500 m), are dominated by the Clusiaceae, Myrtaceae, Lauraceae, Symplocaceae and Rubiaceae. The common tree species in them are *Calophyllum walkeri, C. trapezifolium, Syzygium revolutum, S. rotundifolium, S. umbrosum, Symplocos cochinsinensis, Neolitsea fuscata, Cinnamomum ovalifolium, Litsea ovalifolia* and *Actinodaphne speciosa.*[11] The forest floor harbours many species of ferns. In most areas, the understory of the forest is dense and dominated by species of *Strobilanthes,* bamboo and *Coleus.*

These forests have about 8-10 m tall, short-statured trees with gnarled twisted branches, an abundance of epiphytes dominated by mosses, leafy liverworts, ferns and orchids, colourful young foliage, relatively small, thick, leathery leaves and absence of drip tips are distinguishing features of its vegetation. With increase in elevation and windy conditions the canopy species become quite stunted giving way to pygmy forests.

### 2.3.2. Forest Plantations

Forest plantation establishment was commenced in Sri Lanka as far back as 1870s. Over the past 100 years the Forest Department has established nearly 93,000 ha of forest plantations mainly with Teak, Eucalyptus, Pines and Mahogany[16].

The forest plantation establishment expanded with the policy to establish forest plantations for production of fuelwood and timber in order to alleviate the pressure on natural forests for timber and fuelwood. As a result large scale planting of Teak and Eucalypts in the dry zone and Pines in the wet zone was taken place. Currently the total area under productive forest plantations is around 93,000 ha including 16,440 ha of Conifers (mainly Pine species), 27,500 ha of Eucalypts & Acacias, 31,713 ha of Teak, 2,800 ha of Mahogany and 14,547 ha of Miscellaneous species[16]. Figure 1.3 shows the forest species in the FD forest plantations. Timber and fuelwood from these forest plantations are extracted on sustainable basis based on the management plans. These plantations produce 120,000 cubic meters of timber annually which account for over 8% of the national demand of timber.

[16] Ariyadasa, 2002, Assessment of Tree Resources in the Home Gardens of Sri Lanka, EC-FAO Partnership Programme (2000-2002), Project GCP/RAS/173/EC

### 2.3.3. Home gardens

Home gardens are perhaps the best developed agro-forestry system in Sri Lanka. This system of traditional perennial cropping has been practiced for centuries and it can be found all over Sri Lanka, as they are an essential part of the agricultural system in the island. A brief description about the home garden system in Sri Lanka and its diversity are provided under the agricultural biodiversity section of this document.

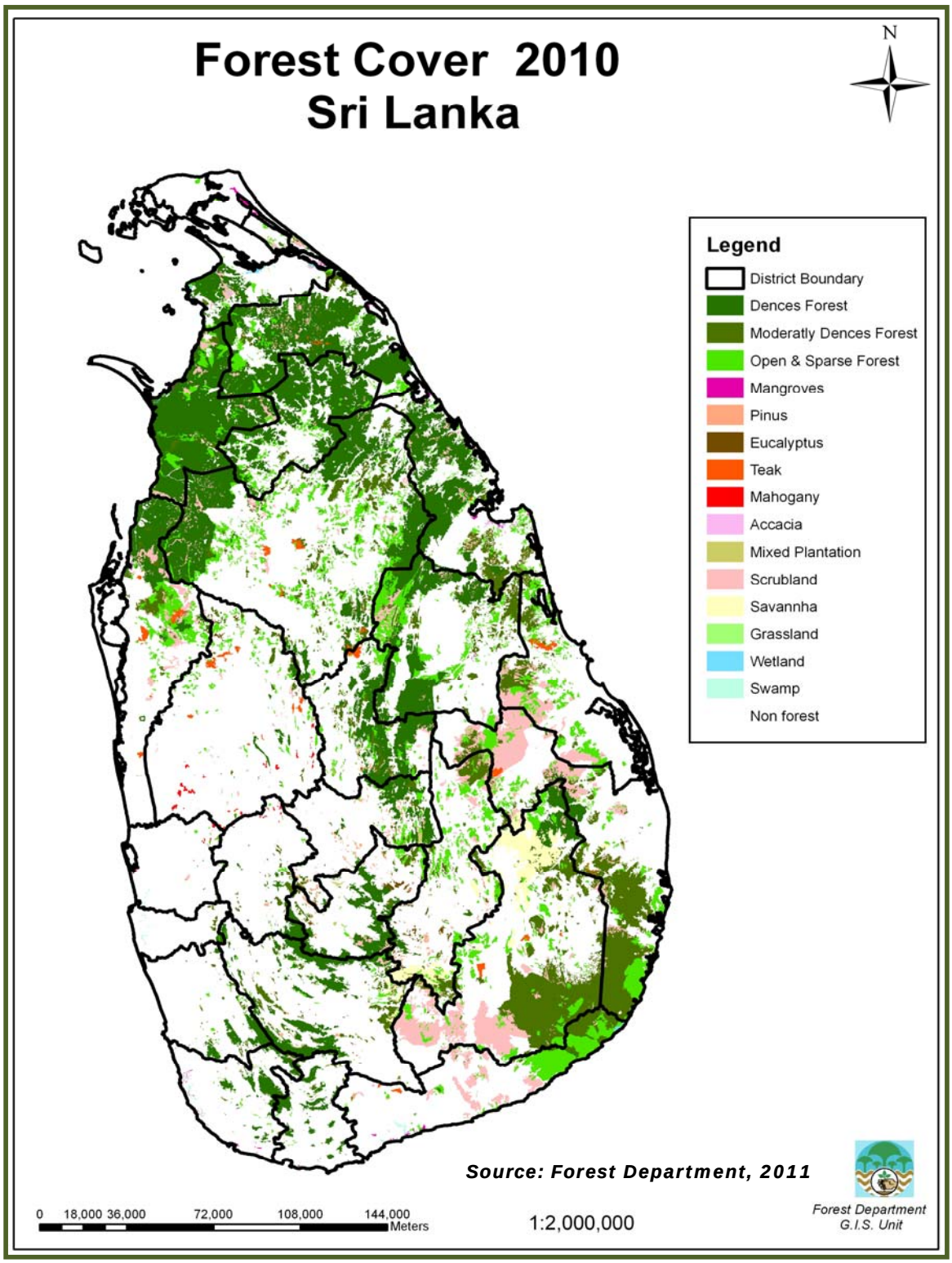



Figure 2.3: Forest Cover of Sri Lanka (2010)

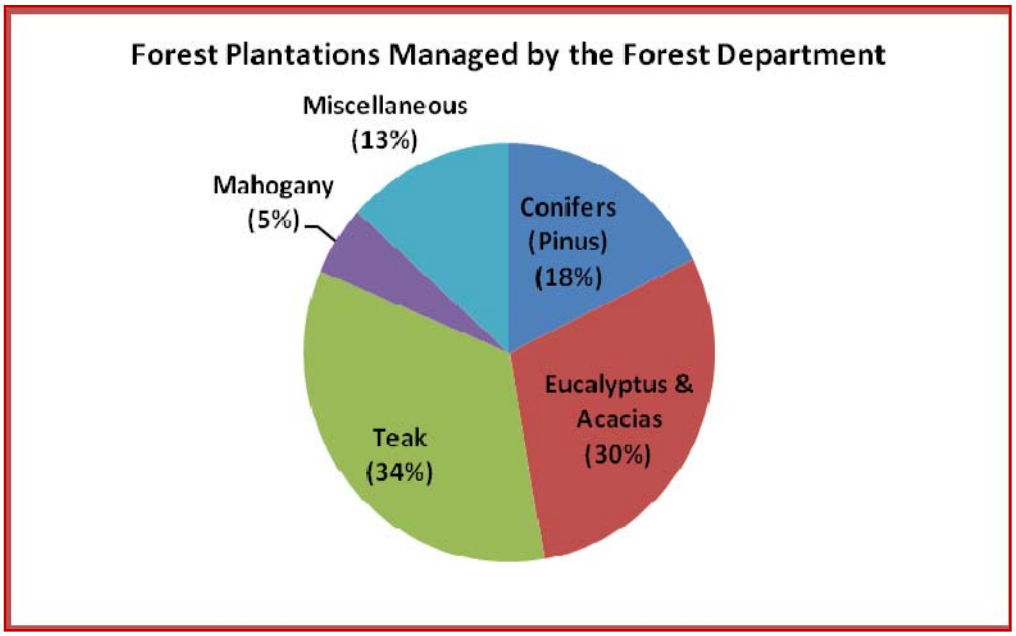



**Figure 2.4: Forest Plantations Managed by the Forest Department**

### 2.3.4. Grassland Ecosystems:

Generally, forests in Sri Lanka are associated with several different types of grasslands. Based on elevation, climate, plant composition and degree of disturbance, six types of grassland ecosystems have been recognized[11]. These include **Wet patana grasslands** that occur around and above 1800 m altitude in association with upper montane forests, and these grasslands are best seen in Horton Plains and around Nuwara Eliya. **Dry patana grasslands** are located between 500 – 1000 m altitudes, are relatively widespread, occurring in the Uva basin, and around Gampola, Nawalapitiya, Hantana and Rakwana. These grasslands have resulted from the removal of tree vegetation for shifting cultivation and subsequent abandonment. **Savanna grasslands** occur in the intermediate and dry zones, between 300–1000 m elevations. Those on the eastern slopes of the central massif and around the Uva basin are called upland savannas while those in Moneragala and Bibile and in the Gal Oya basin are known as lowland savannas. These grasslands resemble parkland, with scattered, fire-tolerant tree species with medicinal properties. Savannas are maintained by anthropogenic fires, mostly to facilitate the collection of fallen fruits of the medicinal species. **Damana grasslands** also known as dry low country parklands or grasslands occur in the Ampara and Batticoloa districts of the eastern dry zone. They are dominated by the tussock grass *Cymbopogon nardus.* Damana grasslands provide fodder to wild elephants and buffaloes. These animals are largely responsible for the maintenance of this vegetation.

**Talawa grasslands** occur in areas where the topsoil is eroded and reduced to some degree. These grasslands also dominated by tussock grass. These grasslands can be seen around Haldumulla area in Badulla district. **Villus grasslands** are found in wetland ecosystems also known as freshwater riverine marshes. These grasslands are found in the floodplains of the Mahaweli River in the eastern dry zone and in moist depressions with a perennially high fluctuating water table. The villu grasslands are important habitats for resident and migrant water birds which include different kinds of plovers, sandpipers, pipits, wag-tails, terns, gulls, geese, ducks, rails, eagles, harriers, cormorants, shags, jacanas etc.

### 2.3.5. Inland wetland ecosystems

Wetlands, both natural and man-made, currently make up about 15% of the land area of Sri Lanka. Rivers and streams, riverine floodplains, small isolated freshwater bodies, freshwater springs, seasonal ponds, and fresh water marshes comprise natural inland wetlands. The most important inland wetlands are associated with Sri Lanka's river system comprising of 103 rivers flowing from the central highlands and making up a total collective length of about 4560 km, plays a dominant role in shaping the wetland landscape.

This river system covers an area of about 59,245 sq km with their river basins which amounts to about 90 per cent of the island's total land area[17]. These rivers, associated streams and waterfalls provide special habitats such as marshes and swamps for certain plant species in the reverine and aquatic ecosystems. The marshes and swamps associated with the *Mahaweli* Ganga (river) and its tributaries cover about 10,000 ha and they are very rich in biodiversity and are highly productive.

Sri Lanka does not have large natural lakes. The man-made wetlands are the rice paddies, irrigation tanks, large reservoirs, canals, and aquaculture ponds. They together make up about two-thirds of the total area of all wetlands. Rice paddies consist of about 525**,**000 ha and are distributed throughout the country. Around 12,000 reservoirs constructed for agricultural purposes during the past two millennia, ranging in size from 1–6,500 ha, harbour a rich aquatic flora and fauna. Most of these tanks are located mainly in the Dry Zone covering a total area over 170,000 ha[7].

Three wetlands (Bundala National Park, Anaiwilundawa tank, Kumana lagoon & tank, Madu Ganga estuary & mangrove and Venkala sanctuary-mud flat) have been recognized internationally as Ramsar sites. The Wetland Directory of Sri Lanka lists 62 sites of which 24 are listed as moderately threatened and 18 are listed as highly threatened.

### 2.3.6. Coastal and marine ecosystems

Sri Lanka's coastal zone is defined by statute as a 02 km wide band of ocean, and an adjoining strip of land extending 300 m inland; except that where a water body connected to the sea occurs, the zone extends 02 km inwards from the mouth of the water body[18]. Sri Lanka's varied coastal habitats include estuaries and lagoons (126,989 ha), mangroves (16,037 ha), sea grass beds, salt marshes (23,797 ha), coral reefs and large extents of beaches including barrier beaches, spits (5621 ha) and dunes (15,546 ha)[19]. These habitats contain a rich component of the

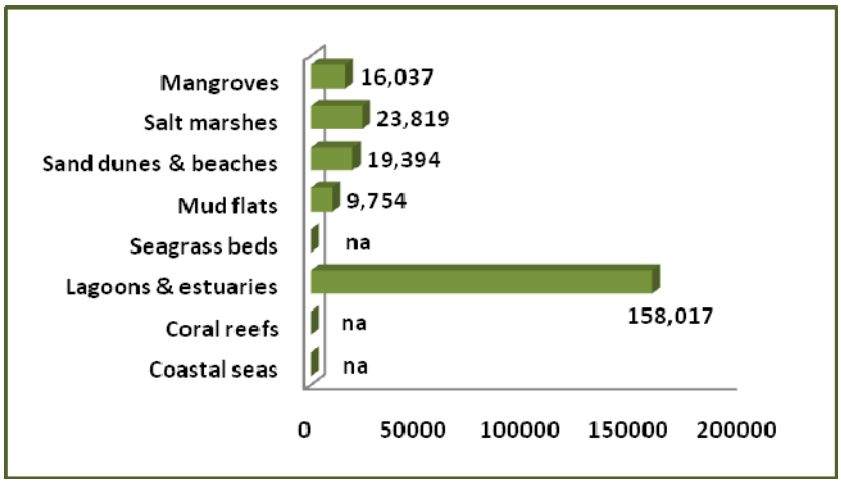



**Figure 2.5: Extents of Coastal and marine ecosystems[19]**

[17] *MoENR, 2009:* Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity.
[18] MoENR, 1998, Bidiversity Conservation in Sri Lanka, A Framework for Action
[19] Joseph. L, National Report of Sri Lanka on the Formulation of a Transboundary Diagnostic Analysis and Strategic Action Plan for the Bay of Bengal Large Marine Ecosystem Programme, Ministry of Fisheries and Ocean Resources

country's biodiversity. Many coastal and inshore resources associated with the coastal habitats support a thriving export industry based on export of shrimp, lobster, chank, ornamental fish, etc. (See Appendix L for locations of Mangroves and Coral reefs)

**Coral reefs:** Coral reefs are rich in biodiversity and are important as habitats for flora and fauna, for containing coastal erosion, and for sustaining the coastal fishery. Coral reefs are among Sri Lanka's most valuable shallow water marine ecosystems. Three types of reefs comprising coral, sandstone, and rocky reefs have been identified around the island, occurring separately or mixed together. Fringing coral reefs are found along 2% of the coastline. The most extensive coral reefs in Sri Lankan waters are the patchy coral reefs in the northwestern coastal and offshore waters, occurring within the Gulf of Mannar and west of the Kalpitiya Peninsula[20]. A total of 68 indigenous coral genera and 183 species have been recorded in the country. Invertebrates that occur among reefs consist mainly of molluscs, sea anemones and sea cucumbers.

Coral reefs may also support around 350 species of reef fishes, such as groupers, snappers, sweetlips, emperor fish, parrot fish, rabbit fish, surgeon fish, butterfly fish, and damsel fish[7]. Together these reefs support around 72 reef fishes some of which are important in the ornamental as well as the food fishery[12].

Reefs in Sri Lanka are now degraded at many sites, due to both natural causes and human impacts. Especially near shore coral reefs are severely degraded, mainly in the western and southern region, due to coral mining in the past for production of lime.

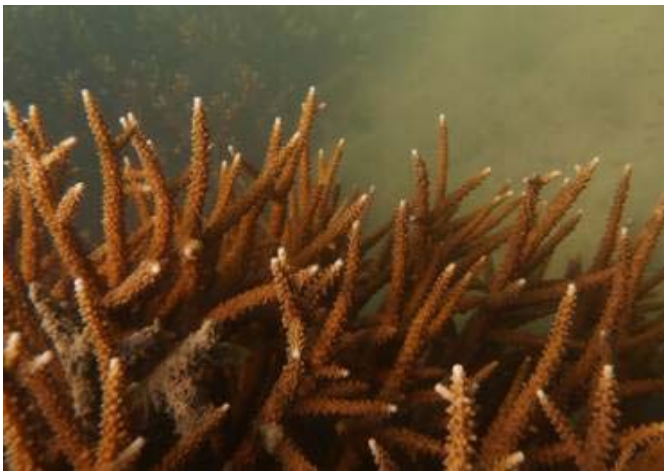


**Figure 2.6: Table Coral in Hikkaduwa NP ©DrTerney Pradeep Kumara**

**Sand dunes:** Sand dunes are of three types: the low, flat to slightly undulating, isolated platforms of sand less than 1m in height; the transverse primary dunes, consisting of ridges of undulating sand masses associated with stable beaches and exceeding 5 m in height, and the secondary transgressive dunes; usually exceeding 3 m in height[12]. The most prominent sand dunes are found along the northeastern, northwestern and southeastern coasts of Sri Lanka. The dunes in the southeast coast extending from Ambalantota (Godawaya) in the Hambantota district to Sangamankande Point in the Ampara district is the longest stretch of dunes in the world close to the equator. Many animal species are associated with dunes; including the wild donkeys of Kalpitiya and Mannar. It is believed that areas on the southern beaches with extensive dunes, such as the Bundala National Park, were relatively little damaged from the tsunami of 2004[21].

**Seagrass beds:** The shoreline and near shore areas contain extensive seagrass beds that often occur in association with coral reef ecosystems or within estuaries and lagoons such as the basin estuaries and lagoons of Puttalam, Negombo, Mawella, Koggala, Kokilai, Jaffna and Batticaloa. Very extensive seagrass beds are reported from the Dutch Bay (in Kalpitiya) to the western end of the

[20] Rajasuriya et al., 2000 Status of coral reefs in South Asia: Bangladesh, India, Maldives and Sri Lanka. In status of coral reefs of the world:2000 A GCRMN publication Edited by C. Wilkinson.

[21] MoENR, 2009, Fourth National Report to the Convention on Biological Diversity

Jaffna Peninsula, and from Mannar to the northwest across the Palk Bay to Rameswaram Island on the Indian coast[22].

Around 12 species of seagrasses have been recorded in Sri Lankan waters. These habitats are very productive and support a rich diversity of commercially important fish species as well as a large number of other marine organisms. Among the invertebrate fauna are 201 species of crabs. These ecosystems are of particular interest as they are believed to be the main habitat of the endangered dugong (*Dugong dugone*) and are valuable habitats for the globally threatened sea turtles[12].

**Estuaries and lagoons:** Sri Lanka's coastline has many picturesque and economically important estuaries and lagoons. These complex systems contain a diversity of species and a variety of coastal habitats including, mangroves, salt marshes, seagrass beds and mud flats. Sri Lanka's estuaries have been defined in the Coastal Zone Management Plan (CZMP) (2003) as natural systems that are transitional between rivers/ streams and the sea, and within which the salinity of the water is measurably different from the salinity in the open ocean. All estuaries have free connection with the open sea, either continuously or intermittently.

There are two different types of estuaries; Riverine estuaries where the rivers or streams discharges directly into the sea through relatively narrow channels (e.g. the Kelani Ganga, Maha Oya, Kalu Ganga and Nilwala Ganga estuaries) and, Basin estuaries where the river or stream first discharges into a relatively shallow basin before entering the sea. A total area of 88,850ha for basin estuaries, and about 2,113 ha for riverine estuaries together with 89 lagoons have been recorded in the Coastal Habitat Survey of 2002[12].

Sri Lanka's lagoons are defined in the CZMP as coastal bodies of water that may be brackish, fresh or hyper saline, and are separated from the sea over a very long period of time by any of several types of barriers that restrict water circulation. The recorded 89 lagoons range from 3 ha to 7,589 ha in extent covering a total extent of 36,364 ha. Lagoons are more abundant along the southern, southeastern and eastern coasts where the littoral drift causes an accumulation of sand to form barriers and spits at river mouths through which the freshwater discharge is low[16].

**Mangroves:** The mangrove swamps in Sri Lanka are not extensive as they occur as a narrow inter-tidal belt that extends less than 1 km landward from the mean low water tidal level. According to the forestry cover inventory of 2010, the total mangrove vegetation in the country covers around 16,037 ha in extent. The mangrove areas are discontinuous, but are important breeding grounds for marine organisms. The main mangrove habitats can be seen along the west, northeast and east coasts, but they are most extensive in the Puttalam district[23]. Mangrove vegetation comprises around 40 different species of trees, bushes, herbs and vines, of which about 25 are true mangroves. Occurring within the mangrove habitats are many species of fish, birds and reptiles.

**Figure 2.7: Mangrove in Sri Lanka © Dr Ranjith Mahindapala**

[22] Samarakoon and Pinto, 1988 – Synthesis report for information on critical habitats in the coastal zone: Workshop on Critical Habitats in the Coastal Zone, CCD/US AID/URI
[23] MoENR, 2002, State of the Environment in Sri Lanka, Ministry of Environment and Natural Resources

Some relatively undisturbed mangroves have been recorded in the Kala Oya estuary, islands in the Puttalam estuary and Dutch Bay, Kokkilai estuary, Nai Aru estuary, Panama lagoon, the Uppar (Panichchankerni) estuary, Nanthikadal lagoon, Yan Oya estuary and in some areas of the Batticaloa estuary[24].

**Salt marshes:** There are about 23,797 ha of salt marshes in the arid areas of the country which are subject to long dry periods[20]. The conditions under which salt marshes occur vary, but more often they are found close to the landward margin of the inter-tidal zone where the soil salinity is relatively high due to insufficient freshwater runoff to flush out the accumulated salts. These ecosystems contain herbaceous, salt tolerant, plants growing in tidal flats or areas periodically inundated by sea water. Extensive salt marshes occur along the coast in Mannar district where tidal flats contain about 56 species of marsh vegetation. Patchy salt marshes occur mainly in sediment lagoon/estuarine areas such as Hambantota, Puttalam, Kalpitiya and Mundel[25].

## 2.4. Species Diversity:

The high diversity of ecosystems in the country has provided habitats for rich species diversity and climatic and edaphic variants of individual species, particularly among the plants. In the island's flora, the highest species diversity is recorded among the flowering plants, followed in decreasing order by the fungi, bryophytes (mosses and liverworts), freshwater algae and ferns. Among animals, the diversity of vertebrates is well known compared to that of invertebrates, where only a few groups have been studied in depth[11].

The wet zone rainforests provide habitats for nearly all of the country's woody endemic plants and for about three-quarters of the endemic animals. Similarly, the country supports a high faunal diversity due to the varied climatic and topographic conditions prevailing in the island. The inland waters provide aquatic habitats for a large number of freshwater species, particularly the fish fauna and also invertebrate fauna. Inland wetlands, both natural and man-made, are also the habitats of many species of birds, mammals and plants[7].

**Table 2.3: Species diversity among selected flora and fauna and the number of endemics in each group**

| Taxonomic group | Total no. of species | Endemics (%) | Taxonomic group | Total no. of species | Endemics (%) |
|---|---|---|---|---|---|
| **Flora** | | | **Invertebrate Fauna** | | |
| Flowering plants | 3771 | 927 (24.6) | Bees | 148 | 21 (14.2) |
| Gymnosperms | 1 | 0 (0) | Ants | 181 | NA |
| Pteridophytes (Ferns only) | 348 | 48 (13.8) | Butterflies | 243 | 20 (8.2) |
| Mosses | 561 | 63 (11.2) | Spiders | 501 | NA |

[24] Joseph. L, 2003, National Report of Sri Lanka on the Formulation of a Transboundary Diagnostic Analysis and Strategic Action Plan for the Bay of Bengal Large Marine Ecosystem Programme
[25] Samarakoon and Pinto, 1988, Synthesis report for information on critical habitats in the coastal zone: Workshop on Critical Habitats in the Coastal Zone

| Taxonomic group | Total no. of species | Endemics (%) | Taxonomic group | Total no. of species | Endemics (%) |
|---|---|---|---|---|---|
| Liverworts | 303 | NA | Land snails | 246 | 204 (82.9) |
| Freshwater algae | 560+ | NA | Dragon flies | 120 | 57 (47.5) |
| Fungi | 2260+ | NA | Freshwater crabs | 51 | 51 (100) |
| Lichens | 661 | NA | Freshwater shrimps | 23 | 07 (30.4) |
| **Marine Fauna** | | | **Vertebrate Fauna** | | |
| Echinoderms | 213 | NA | Mammals | 91 | 16 (17.6) |
| Marine Molluscs | 228 | NA | Birds | 482* | 33 (6.8) |
| Sharks | 61 | NA | Reptiles | 183 | 92 (50.3) |
| Rays | 31 | NA | Amphibians | 106+ | 90+ (84.9) |
| Marine Reptiles | 18 | NA | Freshwater fishes | 82 | 44 (53.6) |
| Marine Mammals | 28 | NA | | | |

*****Including migrants; NA – Not available

*Source: Gunatilleke, Pethiyagoda & Gunatilleke, 2008; MoENR, 2009; MoENR, 2007; IUCN, 2007*

## Floral Diversity:

In terms of floral diversity, the vegetation supports over 3771 species of flowering plants (angiosperms) from 214 families and 1522 genera (of which 24.6% are endemic)[26], and 314 species of ferns and fern allies (of which 13.8% are endemic). Species diversity is also high among mosses (561), liverworts (303), algae (896) and fungi (2260)[7;14]. Of the island's moss flora, 11% are reported to be endemic. In the lichen family Thelotremataceae, as much as 32% of the species are endemic to the island and all of them are confined to the rain forests[11]. It is very interesting to note that all 58 species of Dipterocarps in Sri Lanka, which form the dominant structural and floristic component in Wet Zone rainforests, are endemic (MoENR, 2008).

## Faunal Diversity:

The country supports a high faunal diversity due to the varied climatic and topographic conditions prevailing in the island. Overall Sri Lanka has 746 indigenous vertebrate species (excluding marine forms), of which 43% are endemic, and a further 260 species of migrant birds. Endemism among vertebrates is highest among amphibians (86%), freshwater fishes (55%) and reptiles (58%)[27]. In addition, there are 24 species of introduced fish which are consumed for food. There are also about 350 species of marine fish which include ornamental fishes and food species such as seer, tuna and skipjack[11]. Sri Lanka is one of the richest countries for amphibian

**Figure 2.8: Junglefowl (*Gallus lafayetii*) © Sampath Goonatilake**

[26] Senaratne L K (2001). *A Checklist of the Flowering Plants of Sri Lanka*, National Science Foundation, Sri Lanka
[27] *MoENR, 2009:* Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity.

diversity with 3.9 species per 1000 sq km[28]. The amphibian fauna number 112 species from 18 genera (of which 86% are endemic). A majority of the amphibian species has very restricted geographic ranges and is found mainly in specific ecological niches of wet zone forests.

The reptilian fauna of Sri Lanka show considerable diversity, with 02 species of crocodiles, 05 species of marine turtles, 03 species of tortoises, 92 species of snakes (of which approximately 58% are endemic), 42 species of geckoes (of which 33 are endemic), 18 species of agamid lizards (of which 15 are endemic), two species of monitor lizards, and 33 species of skinks (all rare, and 24 endemic). The rich avifauna of the country is reflected by the presence of 493 species of birds which include about 260 migrants (6.8% are endemic). Total number of 106 terrestrial mammal species and 28 marine mammals were recorded from Sri Lanka. Among the terrestrial mammals 20 species endemic and 12 species consider as introduced.

Among the invertebrates, a high percentage of endemism is evident among the freshwater crabs (100%) land snails (83%) and dragon flies (41%) with many of them being point endemics. Most of this endemic fauna are restricted to the wet zone of the island.

## 2.5. Genetic diversity

Sri Lanka is expected to have a very high genetic diversity in view of its varied climate, high species diversity and many other environmental variations. However, almost all the available information on genetic diversity is confined to economically important agricultural crops and their wild relatives. Information on genetic diversity of the natural flora and fauna of Sri Lanka is extremely limited. However, among the few studies carried out on natural flora and fauna, are reports that the Sri Lankan leopard is a distinct subspecies, one of ten in the world. The Sri Lanka elephant population consists of three distinct genetic stocks representing the northern, mid-latitude and southern regions of the island. High genetic diversity has also been reported among freshwater fishes and amphibians[29].

Among the plants, phylogenetic and population genetic studies have been carried out on some members of Dipterocarpaceae. The proportion of the total genetic diversity among populations of some of the Dipterocarp species resulting from higher rates of out-crossing is shown to be similar to the average reported in literature for tropical woody species. Lower within-population genetic variation for these species have been reported in logged-over forest fragments, suggesting that forest degradation, fragmentation and habitat size reduction have lead to their genetic erosion.

**Figure 2.9: Binara Flower (*Exacum trinervium*) © Sampath Goonatilake**

[28] Goonewardena, et al, 2006 Goonewardene, S., Drake, J., and De Silva, A. (2006) *The herperofauna of the Knuckles Range*, Project Knuckles 2004 &2005. University of Edinburgh research Expedition and Amphibian and Reptile Research organization of Sri Lanka (ARROS)

[29] MoENR/UNEP, 2009, Sri Lanka Environment Outlook, Ministry of Environment and Natural Resources, UNEP

The genetic diversity of wild relatives, traditional cultivars and land races of crop species are being estimated for both *in-situ* and *ex-situ* conservation in both within and outside protected areas, in farmlands and home gardens and gene banks, primarily through the initiatives of the Department of Agriculture, Department of Export Agriculture, research institutes for plantation crops and the Plant Genetic Resource Centre (PGRC) at Gannoruwa. In addition to these institutions, Department of National Museums and National Herbarium at Peradeniya, and the National Herbarium at Hakgala Botanic Gardens maintain a taxonomic collection of fauna and flora of the island. The diversity of crop genetic resources in different agro-ecological regions of the island is quite high. About 645 species of crop wild relatives of Sri Lanka have been catalogued in the National Herbarium at Peradeniya[11].

## 2.6. Threatened and Endangered Species

Among the total inland indigenous vertebrate species recorded in Sri Lanka, 223 (30%) species are nationally threatened. Among the threatened vertebrate species, 138 (62%) are endemic to the island. Twenty one species of endemic amphibians have been considered as extinct. Of the surviving total inland vertebrates, 57 species are Critically Endangered (CR) and among the endemic vertebrate species, 34 (12%) are Critically Endangered, 68 (25%) are Endangered (EN) and 36 (14%) are Vulnerable (VU). Among the vertebrate fauna, the highest number of threatened species has been recorded among reptiles (56), followed by amphibians (52), birds (46), mammals (41) and fresh water fish (28). It has been reported that 50% of mammals and amphibians, 30% of reptiles and fresh water fish, and 20% of birds in the island are currently facing the risk of becoming extinct[30].

Among the inland invertebrates, the highest number of threatened species has been recorded among the butterflies (66), followed by freshwater crabs (37), land snails (33), dragonflies (20) and theraphosid spiders (01). Among inland invertebrates, the highest proportion of threatened species is among freshwater crabs where 50% of the species is currently facing extremely high risk of extinction (CR).

**Table 2.4: Summary of threatened inland indigenous fauna in Sri Lanka**

| Taxon | No. of Indigenous Species | Endemic Species | Total Threatened | Endemic Threatened |
|---|---|---|---|---|
| ***Vertebrates*** | | | | |
| Mammals | 94 | 20 (21%) | 41 (43%) | 14 |
| Birds | 233 | 33 (14%) | 46 (20%) | 16 |
| Reptiles | 209 | 122 (58%) | 56 (27%) | 37 |
| Amphibians | 112 | 96 (86%) | 52 (46%) | 51 |
| Freshwater Fish | 87 | 48 (55%) | 28 (32%) | 20 |
| **Total** | **735** | **319 (43%)** | **223 (30%)** | **138** |
| ***Invertebrates*** | | | | |
| Butterflies | 245 | 25 (10%) | 66 (27%) | 13 |
| Dragonflies | 121 | 50 (41%) | 20 (16.5%) | 20 |
| Freshwater Crabs | 51 | 51(100%) | 37 (73%) | 37 |
| Theraphosid spiders | 7 | 5 (71%) | 1 (14%) | 1 |
| Land snails | 256 | 206 (80%) | 33 (13%) | 32 |
| **Total** | **780** | **337 (43%)** | **157 (20%)** | **103** |

(Note: The percentage of threatened species are shown in parenthesis)
*Source: IUCN, 2007, The 2007 Red List of Threatened Fauna and Flora of Sri Lanka; IUCN Sri Lanka data base 2011.*

[30] IUCN, 2007, The 2007 Red List of Threatened Fauna and Flora of Sri Lanka, Updated by IUCN data base, 2011

According to the IUCN Red List of Threatened Fauna and Flora of Sri Lanka (2007), 6.5% of the angiosperm flora has been assessed as extinct, while 61% were threatened. Among the extinct plant species, nearly 60% are endemic, while among the threatened plant species, 61% are endemic to the island. It has been reported that about 37% of the threatened plants are Critically Endangered (CR). They are under considerable risk of extinction in the near future, especially if habitat degradation is not reversed. Fifty three (53%) of the endemic ferns species are nationally threatened. The family Orchidaceae had the highest number of threatened species (18%), followed by Rubiaceae (14.6%), Acanthaceae (7.5%), Dipterocarpaceae (6.2%) and Phyllanthaceae (4.6%). According to IUCN study, these five families harbor more than 50% of the threatened species identified[15].

## 2.7. Agricultural Biodiversity

The agricultural landscape of the country consists mainly of rice fields, covering 780,000 ha of cultivated land, and the plantation sector amounting to about 772,000 ha. The main plantation crops are tea, rubber, coconut and sugarcane, whilst on smaller scale, coffee, cocoa, cinnamon, pepper, clove and other spices are cultivated. Paddy cultivation receives the highest attention in the agricultural sector. Rice constitutes the staple food of the population and is the backbone of Sri Lanka's agriculture and its ancient culture. Other crops in the agriculture sector include over 100 species of food crops. Many of these, such as onion, potato and vegetables, remain a small farmer activity, and most fruit species are grown in home gardens. A few crops, such as chilli and cashew etc, are grown on a semi-commercial cultivations and shifting (slash and Burn) cultivation areas.

**Home gardens:** Home gardens also make a substantial contribution to agricultural production, and it is estimated that there are now a total of around 1 million ha of home gardens distributed all over in Sri Lanka. Home gardens constitute a traditional system of perennial cropping for a wide range of valuable crops such as food, fruits, timber, medicine, and spices, and are considered important sites for in-situ conservation of crop germplasm. Kandyan Home Gardens or Kandyan Forest Gardens are found in some parts of the wet zone, especially in districts like Matale, Kandy, Kegalle, Ratnapura, and Nuwara Eliya, and are essentially a luxuriant system of mixed cropping with a variety of economically valuable tree crops which form an essential component of land use in these areas. These home gardens are like forests in many respects. They provide shelter to birds and other wildlife; they conserve soil and water almost as well as the natural forest; and they produce timber, fuelwood, and non timber forest products. Moreover, they are much more biologically diverse than forest plantations. The “Sri Lanka Forestry Master Plan” says “it makes more sense to put more efforts into promoting home gardens than into promoting forest plantations.

> *Every peasant’s home garden plot was set so thick with Jak and bread fruit trees and coconut palms that it seemed as though nothing else could grow there: yet where there was space in the yard, vegetables were grown, and flowers also found place.*
> *Martin Wickramasinghe, Ape Gama (Our village)*

According to a recent study, a total of 640 species have been identified in 158 home gardens surveyed in the central province of Sri Lanka. The species richness varied from 22 to 170 species of trees, shrubs and herbs per garden with a mean of 53 species. Out of 640 species, 480 more common species and a total of 105 families have been identified[31].

**Crop Biodiversity:** In terms of crop biodiversity, the long history of rice cultivation and the wide range of eco- edaphic conditions present in Sri Lanka have resulted in having a wide varietal diversity of rice *(Oryza sativa).* The country also has considerable biodiversity in terms of other crops such as cereals, field and cash crops. Agricultural plant diversity in the island includes rice with its 2,800 varieties/land

[31] Hochegger, 1995, Farming Like the Forest, *Traditional Home Garden System in Sri Lanka*, Tropical Agro-ecology 191

races and five wild relatives, 7 coarse-grain species and their traditional cultivars of maize and sorghum; 14 grain legume species; 8 cucurbitaceous; 2 solonaceous and 4 other vegetable (bean, okra, amaranth, chilli) species; 17 root and tuber crop species. The economically useful spices are 8 species of Cinnamon *(Cinnamomum spp);* Cardamom (*Elettaria cardamomum)*; 3 Pepper species (*Piper nigrum)* with 7 wild relatives, clove; 3 species of nutmeg (*Myristica spp*), betel nut, vanilla; 2 species of chilli (*Capsicum annum and C. frutescens*), and one species each of ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*). Others of importance include three major beverage species (tea, coffee and cocoa), sugarcane, *kitul* plam, arecanut, tamarind, citronella; 3 species of oil crops and 2 fibre crops[11].

The horticultural species include banana *(Musa spp)* with nine cultivars and two wild relatives. Interestingly, *M. acuminate* and *M. balbisiana*, the parent species of the cultivated banana are both present in Sri Lanka. There is also considerable genetic variation among a wide range of fruit crops, such as citrus, mango, avacado and jak, which are grown mainly in home gardens. Other fruit crops such as durian, pomegranate, *rambutan*, guava and papaw have also been in cultivation for a long time and exhibit a wide range of genetic diversity.

**Ex-situ Conservation Methods in Sri Lanka**

| Method | Species Groups | Organizations |
|---|---|---|
| Botanical Gardens | Wild and exotic trees, Shrubs, Herbs etc | DNBG |
| Zoological Gardens | Native and exotic Mammals, reptiles, amphibians, birds, fish etc | NZG |
| Field Gene Bank | Vegetatively propagated crops, tree crops, plants that produce recalcitrant seeds, medicinal plants, spices etc | PGRC,HORDI, BMARI, CRI, RRI, DEA, DNBG |
| Arboreta | Forest trees | FD |
| Seed Gene Bank | Crop plants and wild relatives that produce orthodox seeds | PGRC |
| *In vitro* Gene Bank | Vegetatively propagated crop plants | PGRC |

*Source: Addendum to the Biodiversity Conservation in Sri Lanka, Chapter – 03, Ex-situ Conservation*

Sri Lanka has a large number of vegetables, including both temperate and tropical species, cultivated throughout the country. Among these, cucurbits, tomato and eggplant exhibit high genetic diversity. There is also a fair number of root and tuber crops, of which cassava, dioscorea and *innala* show considerable genetic variation. Sweet potato, although introduced to this country, is naturalized and has high genetic variability.

The germplasm accessions of these wide ranges of crops are kept in the seed gene bank and the field gene banks of the Plant Genetic Resource Centre (PGRC) and also *ex situ*, in village home gardens and in field gene banks of Horticultural Crops Research and Development Institute (for fruit and vegetable species, root and tuber crops), the Rice Research and Development Institute (for rice genes), and the Field Crop Research and Development Institute (coarse grains, grain legumes and condiments) which are under the Department of Agriculture. The Department of Export Agriculture also maintains germ plasm of coffee, cocoa, cardamom and cloves.

In addition, there are many wild strains (crop wild relatives) of important domestic crop species in forests. Crop Wild Relatives (CWR) are essential components of forest and agricultural eco-systems, their conservation and sustainable use is very important for improving agricultural production, increasing food security, and maintaining a healthy environment. Sri Lanka has 410 species of food crop wild relatives from 47 families and 122 genera. Of these species 289 are indigenous and 77 are endemic to Sri Lanka[32]. Among these wild relatives of various crops are the two parent species of the cultivated banana (*M. acuminata* and *M. balbisiana);* five species of wild rice and one species of

[32] Fonseka and Fonseka, 2010, Conservation and Utilization of Crop Wild Relatives of Sri Lanka, Department of Agriculture and MoENR, Colombo

weedy rice; one species of wild arecanut (endemic to Sri Lanka and listed as endangered) and 2 wild relatives of jak. Among the wild relatives of vegetables and fruits there are 10 species of wild *Vigna,* 12 species of wild okra, 16 wild relatives of cucurbits, 07 wild relatives of orange and related crops and 07 wild species of *Passiflora*. Among the wild relatives of other species, there are 05 species of wild pepper; 08 species of wild Cinnamon that occur in the natural forests of the Wet Zone; and 13, 7 and 4 wild relatives of ginger, cardamom and nutmeg respectively[33]

Although Sri Lanka is an important centre for CWR diversity, populations of crop wild relatives are under threat due habitat destruction and other human activities. So far very little attention has been paid for conserving and utilizing this important biological resource. According to the records of the National Herbarium there are over 400 species of CWR in Sri Lanka. The Crop Wild Relatives Conservation Project implemented by the Department of Agriculture has selected five priority crops of which wild species will be conserved *in-situ* as a first step of conserving this valuable plant genetic resource[34]. These crops are Rice (*5 wild relatives*), Pepper (*10 wild relatives), Grams (6 wild relatives),* Banana (2 *wild relatives),* Cinnamomum *(8 wild relatives).* Agricultural scientists are now cross breeding these wild strains of forest crops with domestic strains in order to improve yields, resistance to parasites and other physical characteristics.

With regard to livestock, local varieties of cattle that show high resistance to disease and tolerance of internal parasites still exist, as do some local breeds of poultry that are resistant to tropical diseases. However, their use is limited due to low productivity and the greater popularity of imported high yielding breeds. For example, 90% of chicken in the country are imported breeds, with indigenous breeds used only by subsistence farmers. Among the extant indigenous breeds are a type of locally adapted native cattle (*Bos indic*us var *ceylonicus*) or "*Batu Harak*" and the white cattle of Thamankaduwa which are reared for draught and milk, an indigenous hardy breed of goats, and village chicken that are poor egg producers but are highly adapted to a harsh environment[35]**.**

[33] Ilankoon and Wijesekara, 2008, Crop Wild Relatives of Sri Lanka and their Conservation, MoENR, Colombo
[34] Crop Wild Relatives Conservation Project, Department of Agriculture
[35] Silva and Himali, 2005, Status of the farm animal genetic resources in Sri Lanka, University of Peradeniya and Department of Animal Production and Health

# 3. ECOSYSTEM SERVICES AND VALUES

## 3.1. Ecosystem Services

Rainforests provide a range of important ecosystem services, as well as many more localized goods and services, such as watershed protection, preventing flooding and soil erosion, preserving biodiversity, ecotourism, carbon sequestration, regulating rainfall, limiting the prevalence of disease, and providing livelihoods for local people.

Sri Lanka has a natural forest cover of 1.88 million ha representing 28.7% of the land area of the island. Details of these forests are provided in the section 2.3.1 of this report. Around 25-30% of the forests in the island are located in the wet and intermediate zones with steep terrain where high intensity erosive rains occur. The forest cover in the dry zone where the terrain is relatively flat and rainfall is less erosive is around 70-75% (section 2.3.1).

### Watershed Protection and Soil Erosion

Forests play an important role in the conservation of soil and water resources primarily by protecting the soil against erosion, and maintaining the quantity and quality of water. Natural forest vegetation protects the soil from splash erosion by intercepting rainfall, dissipating droplet energy, and protecting the surface with a covering of leaf litter. Due to forest vegetation, rainfall infiltration is increased and surface runoff and soil erosion reduced. Natural forests stabilize ground water levels and stream flows. The relative importance of forests in watershed protection, soil and water conservation and minimizing flood hazard, differs between the dry and wet zones of Sri Lanka due to differences in rainfall intensity and the steepness of the terrain.

Studies carried out in Sri Lanka showed that forested slopes lost 0.3 t of soil per year per hectare, whereas soil loss in tobacco and vegetable gardens exceeded 75 t/year/ha and bare slopes lost over 100 t per hectare[36]. The main impacts of deforestation and forest degradation on the watershed include: increased soil erosion, increased flood hazard, siltation of reservoirs, adverse impacts on water yields and water quality, and adverse impacts on headwaters.

A total of 103 watersheds have been identified in Sri Lanka. These watersheds cover over 90% of the land area of the country[37]. In addition to supply of water for domestic use for both rural communities and urban areas, watersheds provide essential services to several key sectors of the Sri Lankan economy. Sri Lanka's quest for prosperity remains heavily dependent on a healthy agricultural sector. Agriculture in turn depends on the efficient utilization of available soil and water resources, and its further expansion is severely constrained by the limited availability of reliable water supplies. Water is the main limiting factor for productive agriculture especially in the dry zone. Watershed management is also important for the energy sector. Hydropower is the main source of electricity in Sri Lanka. Hydropower provides 40% of the electricity generated in the country. There are several hydropower reservoirs, including those in the Mahaweli basin in the hill country wet zone (i.e. Victoria, Randenigala, Rantambe, Minipe, Samanalawewa, Upper Kotmale etc). The watersheds of these reservoirs are under severe population pressure, which has already caused severe deforestation and forest degradation. In the long term, sedimentation of reservoirs may substantially reduce their capacity to store water for hydropower and irrigation, jeopardizing the agro-industrial base of the economy. A study carried out by the forest/land use mapping project, indicated 44% sedimentation of the Polgolla Barrage and siltation of the Rantambe reservoir at a rate of 4-6% per annum. This

[36] Bandaratillake, 1999, Optimal Land Use in the Hill Country of Sri Lanka, Land Degradation and Forestry, Occasional Paper No. 28, La Trobe University, School of Agriculture, Australia.
[37] Arjuna's Atlas of Sri Lanka, Arjuna Consulting Co Ltd, 1997

indicates the magnitude of the problem caused due to depletion of the permanent vegetative cover in the watershed areas.

IUCN, in collaboration with the Forest Department and World Conservation and Monitoring Centre (WCMC) carried out a study in 1997 (National Conservation Review)[38] to assess the importance of natural forests in Sri Lanka for soil conservation and hydrological characteristics. This study confirmed that the forests in the wet and intermediate zones are more important for soil conservation, floods and watershed protection than the forests in the dry zone.

In addition to ecosystem services provided by the forests as discussed above, coastal and marine environments also provide very important ecosystem services. Some of these include fisheries production for food, crustaceans and other fishery products, ornamental fish and salt, mitigation of storm surge and coastal erosion (by mangrove vegetation and coral reefs), and protection of coastal aquifers from salinization.

#### Recycling of nutrients and soil fertility

It is generally accepted that the forest ecosystem has an efficient mechanism for nutrient recycling. Nutrients from the soil and decaying litter are rapidly taken up by plants and then returned back to the soil through litter fall. A considerable amount of the nutrients present in the system are also tied up in the forest biomass. The characteristics of forest vegetation can gradually improve the physical and chemical properties of soil.

The best indicator of overall soil fertility is the organic matter content of the soil. The studies carried out by the Forest Department under various cover types indicated significantly high soil fertility status under forest vegetation due to efficient nutrient cycling by forest ecosytems[17].

### 3.2 Biodiversity

It is believed that tropical rainforests are home to over half of the world's species of plants and animals; they appear to be the most diverse expressions of life ever to have evolved.

Sri Lanka is one of the smallest but biologically most diverse countries in Asia. Hence, the economic value of this biodiversity is inestimable. There are many products harvested from forests which provide food and livelihood necessities to local populations, often at low or zero prices. Some of these products enter more formal markets, and some, such as edible items (i.e. yams, fruits, nuts, spices, leaf vegetables, *kitul* products (products of *Caryota urens*) etc), medicinal herbs, rattan, bamboo, gums and resins are used by the villagers for domestic uses. Almost all the medicinal plants used in the traditional Arurvedic medicine are forest products and they make up a very significant component of forest biodiversity. A traditional crafts manufacturing industry based on rattan and bamboo extracted from forests is an important income source for some villagers in Sri Lanka.

The economic value of most of these products harvested from the forest has not been estimated. Agronomic information, extraction patterns and values are still inadequately studied for most of the species that exist in forests. Therefore, their potential value to the humankind, and to the maintenance of environmental sustainability is not well known.

[38] MoFE/IUCN/WCMC, 1997, Designing an Optimum Protected Areas System for Sri Lanka's Natural Forests

### 3.3. Ecotourism/Nature tourism

Ecotourism is considered a growing segment in the tourism industry worldwide. In Sri Lanka ecotourism has been recognized as a high priority area capable of effectively driving the country's economic development. Accordingly, there is target of 2 million tourists to be achieved in 2016, with tourism becoming a major foreign exchange earner for the country. Sri Lanka's high biodiversity and endemism offers very high potential for nature-based tourism development as promoted by the current tourism development policies and plans. Currently, nature-based tourism focuses mainly on Protected Areas (PAs) and National Parks (terrestrial and marine), Botanic and Zoological Gardens, and Elephant Orphanages and Transit Centres. Sri Lanka's wide sandy beaches are also particularly famous tourist attractions. These biologically valuable sites attract increasing numbers of local and foreign visitors for recreation purposes and to enjoy nature. Thus, nature-based tourism is seen as an effective way of deriving income from nature (due to high biodiversity and the extensive network of PAs covering a variety of ecosystems) with less impact than many traditional extractive forest management systems.

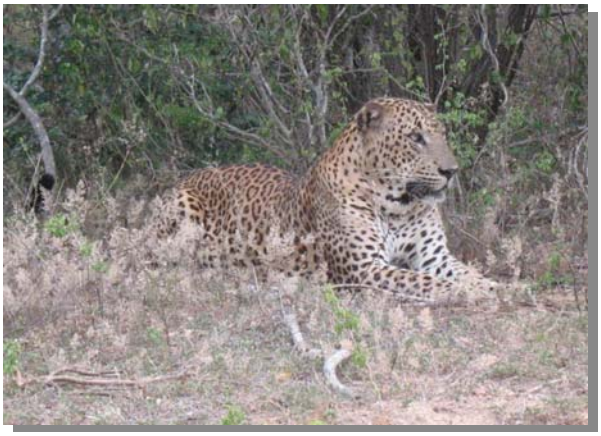


**Figure 3.1: Yala National Park © Sampath Goonatilake**

Nature-based tourism activities at present in Sri Lanka are mainly confined to 02 natural World Heritage Sites, 21 National Parks (terrestrial and marine), 04 Biosphere Reserves, 02 Conservation Forests, 03 Forest Reserves, 01 Elephant Orphanages (Pinnawala), 01 Elephant Transit Centre (Udawalawe), 05 Botanic Gardens (Peradeniya, Hakgala, Awissawella, Henarathgoda-Gampaha, and Hambantota) and one (01) Zoological Garden. The two World Heritage Sites include Sinharaja National Heritage and Wilderness Area and Central Highland World Heritage Site. The Central Highland World Heritage Site includes, Horton Plains National Park, Peak Wilderness Sanctuary and Knuckles Conservation Forest[39]. All these sites are exclusively managed for nature-based tourism purposes, apart from their conservation objectives. These forest and wildlife areas provide facilities such as eco-lodges, camping sites, nature trails, interpretation centers, guided excursions etc. Coastal areas, particularly beaches and areas with fringing reefs provide facilities such as swimming, snorkeling, scuba diving and viewing corals through glass bottom boats etc. Appendix E provides a list of PAs widely used for nature tourism purposes in Sri Lanka.

### 3.4. Values and Economics of Biodiversity and Forests

The diversity of flora and fauna impacts almost all social and economic sectors in the country, including forestry, wildlife, fisheries, agriculture, indigenous medicine, and tourism.

The economic values of biodiversity and forests as discussed in the "Economic Value of Biodiversity" published by the IUCN Biodiversity Programme comprise; the *total economic values* (TEV) of environmental resources, including its *use value* (UV) and *non-use value* (NUV). The use value (UV) is the value arising from the actual use of a given resource such as use of forests for timber, fuelwood, non-timber forest products, wetlands for fishing and ecosystem functions such as soil

[39] World Heritage Sites and Biosphere Reserves have been declared by UNESCO.

conservation. The use values (UV) are further divided in to *direct use values* (DUV), which refer to actual uses such as timber extraction, fishing etc; and *indirect use values* (IUV), which refer to the benefits derived from ecosystem functions such as soil erosion control and the watershed protection function of forests; and *option values* (OV), which is the value approximating an individual's willingness to pay to safeguard an asset for the option of using it at a future date. This is similar to insurance value[40]. NUV represents the value people place on forests based on altruistic reasoning.

Consequently, the Total Economic Value (TEV) of biodiversity and forest resources (without consideration of non-use values) includes direct uses such as timber & fuelwood extraction, use of medicinal plants, fishing etc., and indirect uses such as ecosystem functions (e.g. soil and water conservation, conservation of environment, and carbon assimilation & mitigation of climate change).

In addition to the direct, indirect and option values of biodiversity and forests as discussed above, there are non-use values such as the *existence value* of biodiversity and forests. Existence value is not derived from the use of a resource; it refers to the benefit people recieve from the knowledge that a particular resource exists. Non-use values are reflected in the idea that humans have a responsibility to protect the other organisms on earth, from which they receive a great deal of satisfaction and esthetic pleasure. In Sri Lanka which has a long history of nature conservation, these values are fostered by the Buddhist philosophy that respects all forms of life. In this context, ethical issues cannot be given an economic value as they relate to a sustainable environment.

Some attempts have been made by researchers to place economic values on some of the components discussed above. However, proper economic valuation of biodiversity and forests is a very complex task which has not been completed in Sri Lanka to date.

[40] The Economic Value of Biodiversity, IUCN Biodiversity Programme

# 4. OVERVIEW OF THE SOCIAL, ECONOMIC AND POLITICAL CONTEXT

## 4.1. Social and Economic Environment

Sri Lanka is one of the most densely populated countries in the world. It is also the second most heavily populated nation among the countries of South Asia. Estimates for 2010 indicate a total population of 20.65 million as opposed to 7.2 million in 1948[41]. The density of persons per sq. km has risen from 103 in 1946 to 320 in 2010. The current rate of population growth shows a rate of increase of 1.3% per year[42]. According to current trends in fertility, mortality and migration, population projections indicate that the population size will stabilize in Sri Lanka around 22.9 million by 2030[43]. However, despite the declining trend in population growth, the overall increase in population is expected to create considerable pressure on the environment and natural resources in terms of the growing need for land water, infrastructure, goods and services, and employment[28]. Intensive development accompanied by expansion of the land area under urban, agricultural, industrial development continues to contribute to the loss of natural ecosystems and their inherent species and genetic diversity. This pressure on the environment and natural resources is a cause for serious concern, especially because of the progressive decrease in the land:human ratio which tends to exert erosive forces on environmentally sensitive ecosystems.

Apart from the decline in the land:human ratio, growth and uneven distribution of population exert pressure on natural ecosystems such as forests and wetlands. The wet zone with its favorable climate for agriculture and living, comprises only a third of the land area of the country, but contains about two thirds of the country's population. The wet zone districts thus have very high population densities with Colombo district having the highest population density of about 3,642 persons/ sq km. The greatest urban population aggregation is in the Western Province which includes Colombo, Gampaha and Kalutara districts.

In terms of economic environment, Sri Lanka's per capita GNP at market prices has increased from USD 899 in 2000, to USD 2,399 in 2010[44] which makes Sri Lanka rank one of the highest amongst the South Asian countries in per capita GNP. However, according to household income surveys carried out recently, shows considerable disparities and skewed nature of income distribution. Such extreme disparities in income and high levels of poverty lead to competition for natural resources from critical and environmentally sensitive sources leading to their unsustainable exploitation. Poverty-related social issues dominate the economic landscape in Sri Lanka. Poverty levels in rural and agricultural areas are substantially higher than areas which depend mainly on industry and services. For example, the highest level of poverty is in the estate sector, which consists of the plantations in the central highlands and the surrounding areas. About 30% of the population in estate areas is poor. This is followed by the rural sector, where about 25% of the population lives below the poverty line. In the urban sector, by contrast, poverty levels are considerably lower, around 8%[45]. Although poverty and deprivation continue to prevail in the rural economy, important transformations affecting rural life such as the spread of infrastructure facilities like roads, electricity, and social services like education and health have taken place, expanding the structure of employment opportunities to the rural labour force.

[41] MoENR, 2002, State of the Environment in Sri Lanka
[42] Department of Census and Statistics (2010), Sri Lanka
[43] Abeykoon, 2000, Population Profile. In: Natural Resources of Sri Lanka, 2000. National Science Foundation
[44] Central Bank of Sri Lanka, Annual Report, 2010
[45] D/C&S, 2010, Agriculture and Environment Statistics Division, Department of Census and Statistics, Sri Lanka, 2010

## 4.2. Institutions, Policies and Laws affecting Conservation

Sri Lanka's vision of sustainable development is an advanced, prosperous, stable, equitable, peaceful, healthy and environmentally sound nation that will be durable and resilient. Following the Sri Lankan tradition of the middle path, the island is working towards a people-friendly and open economic system, which is based on democratic and pluralistic institutions and policies able to protect the unique values and heritage of the nation[46]. The country has made significant progress over the past three decades with regard to the establishment of an institutional, legal, and policy framework that is supportive of conservation of biodiversity and forest resources. This evolution is deeply rooted in the recognition of the direct link between the country's diverse biological resources, the livelihoods of people and the economic development of the country.

The firm commitment of the state for environment and natural resources conservation is shown in the 1978 (current) Constitution of the Democratic Socialist Republic of Sri Lanka, through Article 27 (14), which decrees *"The State shall protect, preserve and improve the environment for the benefit of the community".* Article 28f also states "*The exercise and engagement of rights and freedom is inseparable from the performance of duties and obligations, and accordingly, it is the duty of every person in Sri Lanka to protect nature and conserve its riches"*.

More than 30 state institutions are involved with some aspect of management and protection of biodiversity and forest resources in Sri Lanka. This includes 9 Ministries and 21 departments/agencies. The key stakeholder organizations involved in biodiversity and conservation of forest resources and their primary responsibilities are given in Appendix F. Those with greatest responsibility for biodiversity conservation are the Ministry of Environment, which is the focal point for the Convention on Biological Diversity and its line agencies; the Forest Department (FD); the Central Environmental Authority (CEA); and the Marine Environment Protection Authority (MEPA). The Department of Wildlife Conservation (DWC) operated under the Ministry of Agrarian Services and Wildlife Conservation, and the Coast Conservation Department (CCD), operated under the Ministry of Ports and Aviation, are also key institutions.

In addition, there are number of research institutions involved in conducting biodiversity and forestry related research. Universities & other academic/research institutes play a lead role in these research activities. Among the universities, the University of Peradeniya (Department of Botany) and the University of Sri Jayawardenapura (Dept. of Environmental Science & Forestry) play a significant role in conducting research activities. Among the other research institutions, the National Aquatic Resources Research and Development Agency (NARA), Council for Agricultural Research Policy (CARP), and Bandaranaike Memorial Ayurvedic Research Institute (BMARI) are key players.

There are also several environmental NGOs, both national and international, that focus specifically on the environment and natural resource sectors of the country. Their involvement is primarily in research, generation and dissemination of information to the public for the promotion of conservation of biodiversity and forest resources in the country. Among these, IUCN (International Union for Conservation of Nature) is the lead agency in this field. The key local NGOs are; Wildlife and Nature Protection Society of Sri Lanka (WNPSL), Green Movement of Sri Lanka (GMSL), Environment Foundation Ltd (EFL), Sewalanka Foundation, Sarvodaya Movement, Sri Lanka Environment Journalist Forum (SLEJF) and Young Zoologists Association (YZA).

[46] MoENR, 2002, Sri Lanka's Middle Path to Sustainable Development in the 21st Century, National Report of Sri Lanka, to the World Summit on Sustainable Development

## Main Policies and Laws affecting Conservation

Table 4.1 provides the main policies, legislation and plans relating to the conservation and management of biodiversity and forest resources in Sri Lanka. Although Sri Lanka possesses some of the finest legislative enactments in the South Asian region, a major weakness is enforcement of the law by responsible state agencies.

**Table 4.1: Key Policies/Plans and Legislation relating to Conservation of Biodiversity and Forest Resources**

| Policies | Legislation |
|---|---|
| The National Environmental Policy of 2003 | The Forest Ordinance No. 16 of 1907, and its subsequent amendments, including Act No. 23 of 1995 as amended by Act No. 65 of 2009 |
| The National Wildlife Policy of 2000 | The Fauna and Flora Protection Ordinance No. 2 of 1937, and subsequent amendments including Act No. 49 of 1993 as amended by Act No. 22 of 2009 |
| National Policy on Elephant Conservation of 2006 | The National Environmental Act No. 47 of 1980 and the amendment Act No. 56 of 1988 as amended by Act No 53 of 2000 |
| The National Forest Policy of 1995 | The National Heritage Wilderness Area Act No. 3 of 1988 |
| The National Watershed Management Policy of 2004 | The Coast Conservation Act No. 57 of 1981 as amended by Act No.64 of 1988 |
| The National Wetlands Policy and Strategy of 2006 | Plant Protection Act No. 35 of 1999 (replacing Plant Protection Ordinance No.10 of 1924). Legislation is being drafted for implementation of the Protocol on Biosafety. |
| The National Policy on Agriculture of 2007 (deals with conservation of traditional varieties of crops) | The National Zoological Gardens Act no.14 of 1982. |
| | Crown Lands Ordinance of 1929 |
| The National Fisheries and aquaculture Policy of 2006 | The Botanic Gardens Ordinance No. 31 of 1928. *(This Act is being amended)* |
| The National Land Use Policy of 2009 | Fisheries Ordinance No. 24 of 1940 and the revised Fisheries and Aquatic Resources Act No. 2 of 1996 as amended by Act no. 4 of 2001 |
| National Policy on Biotechnology of 2010 | The Marine Pollution Prevention Act No.59 of 1981 as amended by the Marine Pollution Prevention Act No.35 of 2008 |
| National Policy on Biosafety of 2004 | |
| National Policy on Climate Change of 2011 | |
| **Plans& Strategies** | The Northwestern Environmental statue No 12 of 1990. |
| | Customs Ordinance |
| National Action Plan for *Haritha* (Green) Lanka Programme (2009) | Ayurveda Act No. 31 (1961) & Amendment Acts No. 5 (1962) & No. 9 (1969), No. 7 (1977), No. 6 (1978) |
| | Water Hyacinth Act (1909) |
| Caring for the Environment, Path to Sustainable Development (2008) | |
| National Biodiversity Conservation Action Plan (1998) | |

| | |
|---|---|
| National Biodiversity Conservation Action Plan, Addendum (2007) | |
| The Forestry Sector Master Plan (1995) | |
| The Coastal Zone Management Plan which is updated periodically (1991, 1997 and 2006). | |
| The National Action Plan for Protection of Marine and Coastal Environment from Land based activities (1999) | |
| National Wetland Conservation Plan (2004) | |
| National Bio safety Action Plan (2004) | |
| National Action Plan on Alien Invasive Plants (2004) | |
| National Plan on Conservation of Agro-biodiversity | |
| The National fishery development plans | |
| National Agriculture development plans | |
| The Solid Waste Management Strategy (2000) | |
| National Strategy for Sri Lanka Tourism | |

*Source: MoE, 2010, Sector Vulnerability Profile: Biodiversity and Ecosystem Services;* MoENR, 2009: Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity; MoENR, 2009, Sri Lanka Environment Outlook, 2009

### 4.3. National Protected Area System

According to the IUCN definition of Protected Areas (PAs), a "protected area is an area of land (and/or sea) especially dedicated to the protection and maintenance of biological diversity, and of natural and cultural resources, and managed through legal or other effective means"[47]. In practice, protected areas are managed for a wide variety of purposes which may include[48]: scientific research, wilderness protection, preservation of species and ecosystems, maintenance of environmental services, protection of specific natural and cultural features, tourism and recreation, education, sustainable use of resources from natural ecosystems, and the maintenance of cultural and traditional attributes.

Six (06) distinct categories of PAs are recognized by IUCN. In the case of Forest Reserves (FRs), Proposed Reserves (PRs) and Other State Forests (OSFs) (with protected forest vegetation) currently administrated by the Forest Department (FD), those which are predominantly in natural condition (at least two-thirds) and managed for long-term protection of biodiversity meet the criteria of Category VI – managed Resource Protected Area. Commercial forest plantations do not qualify under the criteria for PA categories of IUCN[49]. Except for the forest category of "Other State Forests" all other forests administrated by the FD are surveyed, demarcated and gazetted. The OSFs will be demarcated and gazetted under an appropriate category within next 2 years.

In Sri Lanka, over 28% of the total land area is legally protected and administered by either the Forest Department or Department of Wildlife Conservation: 16.1% and 13.2%, respectively. The Forest Department (FD) manages about 1.01 million ha of forest land which amounts to nearly 54% of the island's natural forest habitats. The Department of Wildlife Conservation (DWC) administers around 0.87 million ha of forests or approximately 44% of the total forest area and all these areas are designated as wildlife protected areas. Legally protected forest areas/landscapes which are predominantly in natural condition and managed for protection and maintenance of biological diversity are eligible to be included in the PA system. All the PAs under DWC are legally protected under the

[47] IUCN(1994), Guidelines for protected area management categories. IUCN Commission on National Parks and Protected Areas, IUCN/WCMC
[48] MoENR/EML, 2006, Portfolio of Strategic Conservation Sites / Protected Area Gap Analysis in Sri Lanka, EML Consultants, Sri Lanka
[49] MoALF, 1995, Sri Lanka Forestry Sector Master Plan, Ministry of Agriculture, Lands and Forestry

*Fauna and Flora Protection Ordinance* and the legal protection for PAs under FD is provided under *National Heritage and Wilderness Areas Act* and different sections of the *Forest Ordinance*. The forest areas administered by the FD generally tend to be small and confined to the wet zone, whereas those under the authority of the DWC tend to be larger and occur mainly in the dry zone (Appendix G). Table 4.3 provides national designations of these PAs.

**Table 4.2: Extent of Protected Areas Administered by FD and DWC**

| National Designation | No | Management Authority | IUCN Category | Extent (ha) | % of total land area |
|---|---|---|---|---|---|
| National Heritage Wilderness Area | 01 | FD | Ia | 11,187 | 0.17 |
| Conservation Forests | 55* | FD | II | 76,822* | 1.17 |
| Forest Reserves | 360 | FD | VI | 575,228 | 8.77 |
| Other State Forests | NA | FD | VI | 430,750♣ | 7.88 |
| ***Sub Total*** | ***416*** | ***FD*** | | ***1,093,987♣*** | ***17.99*** |
| Strict Natural Reserves | 03 | DWC | Ia | 31,574 | 0.48 |
| National Parks | 21* | DWC | II | 535,393* | 8.16 |
| Nature Reserves | 05 | DWC | II | 57,058 | 0.87 |
| Sanctuaries | 62 | DWC | VI | 264,101 | 4.0 |
| ***Sub Total*** | ***91*** | ***DWC*** | | ***888,126♠*** | ***13.67♠*** |
| **Total** | **507** | | | **1,982,113♠** | **31.66♠** |

* - *Updated up to 2010;* ♣- Estimates based on satellite imagery data; NA- Not available
♠- Extent under DWC *includes wetlands, coastal & marine PAs*
*Source: FD, 2008, Forest Department Manual, Sri Lanka; MoE, 2010, Sector Vulnerability Profile: Biodiversity and Ecosystem Services; Information from FD & DWC, 2010*

There are few PAs (i.e. Udawattakele and Kurulukele) gazetted under both departments, as wildlife reserves and forest reserves. This overlapping requires a correction to the total extent of PAs.

In addition to the national designations given in the table above, there are two (02) World Heritage Sites including four (04) forest reserves, namely Sinharaja National Heritage and Wilderness Area, Knuckles Conservation forest (managed by the Forest Department), and Horton Plains National Park and Peak Wilderness Sanctuary (managed by the Department of Wild Life Conservation). There are four (04) Biosphere Reserves namely Sinharaja National Heritage and Wilderness Area, Hurulu Forest Reserve, and KDN forest complex managed by the FD, and Bundala National Park managed by the DWC. Furthermore, Bundala National Park is a Ramsar Site declared as a Wetland of International Importance for protection of waterfowl habitats.

**Figure 4.1: Bundala National Park** ©Sampath Goonatilake

**Figure 4.2: Pigeon Island National Park** © Shamen Vidanage

**Marine Protected Areas (MPAS*)*** in Sri Lanka are declared under the Fauna and Flora Protection Ordinance (FFPO) and managed by the Department of Wildlife Conservation (DWC).

There are 04 National Parks adjoining coastal waters and a total of 17 other protected areas designated as marine sanctuaries[54].

The Bay of Bengal Large Marine Ecosystem (BOBLME) Project laid the foundation for a coordinated programme of action designed to improve the lives of the coastal populations through improved regional management of the Bay of Bengal environment and its fisheries. This project aims to enhance and sustain fisheries productivity and maintain marine biodiversity in related countries through effective management of Marine Protected Areas. Sri Lanka is one of the 08 countries participating in this programme, and the project is scheduled to be implemented over the next five years.

In addition, under the NOAA/IUCN (National Oceanic and Atmospheric Administration of U.S. and the World Conservation Union) project on "World Heritage Biodiversity", two sites from Sri Lanka have been identified as 'High Regional Priority Areas' within the Central Indian Ocean region[55].
The two areas are:

- Trincomalee Bay and Pigeon Island
- The Gulf of Mannar cluster (Palk Bay – Mannar Island – Adams Bridge – Dhanuskodi - Rameshwaram of Sri Lanka and India).

Besides the PA categories managed by FD and DWC discussed above, there are two new categories of PAs administrated by the Central Environmental Authority (CEA) termed **Environmental Protection Areas (EPAs)** and PAs administrated by the Department of Fisheries and Aquatic Resources (DFAR) termed **Fisheries Management Areas (FMAs).**
The EPAs are gazetted under the provisions of the National Environmental Act and FMAs are gazetted under the provisions of Fisheries and Aquatic Resources Act**.** There are currently 07 EPAs of which 05 are Wetlands. In addition, there are 04 proposed EPAs of which 03 are wetlands (Appendix H). There are 06 FMAs including Negombo & Rekawa Lagoons, Udukiriwela Reservoir, Madiha Polhena Coral Reef Ecosystem, the coastal waters off Yala, and Parakrama Samudraya.

The National Conservation Review (NCR) has revealed that Sri Lanka's PA system has critical gaps in the context of conserving biodiversity and hydrological features. This is because the present network of PAs lies largely in the dry zone where biodiversity is relatively low when compared with the wet zone forests. The biologically rich wet zone forests are much less represented in the network. While over 1.8 million ha of natural forests and scrublands amounting to around 28.7% of the land area of the island lie within the PAs system, a major concern is that only about 15% of the system falls within the biologically rich Wet Zone.

Further, out of 71 designated Important Bird Areas (IBAs) in the country, only 58 (80%) occur within the current PA network[50]. This issue need to be resolved by declaring already identified IBAs under appropriate legislation to be incorporated in the PA system.

Around 40% of the forest areas managed by the FD (OSFs) are still not demarcated and gazetted. Although legal protection for these forests is currently available under the Forest Ordinance, declaration by a gazette notification is a requirement to ensure maximum legal protection to these forests. This situation is a significant gap within the current forest management system of the FD.

[50] Weerakoon, 2011, Important Bird Areas (IBA) Programme, Sustainable Biodiversity and Economic Development, University of Colombo

Further, whilst the FD, DWC and CEA are responsible for managing the country's PAs, mostly biologically rich forest and wetland habitats, the FD and CEA fall within the purview of the Ministry of Environment whilst the DWC falls within the purview of the Ministry of Agrarian Services and Wildlife Conservation. This arrangement of having these institutions under two different Ministries warrants a sound institutional arrangement to achieve effective coordination for protection and management of PAs.

**Figure 4.3: The Misty Horton Plains National Park © Sampath Goonatilake**

## 4.4. Laws affecting the Protection of Endangered Species

A list of Threatened and Endangered species in Sri Lanka has been published by IUCN in collaboration with Ministry of Environment and Natural Resources in 2007. The laws affecting protection of these endangered and threatened species are given in Table 4.4.

**Table 4.3: The laws affecting protection of endangered and threatened species**

| Laws affecting the Protection of Endangered Species | |
|---|---|
| **Direct Impacts** | **Indirect Impact** |
| 1. The Fauna and Flora Protection Ordinance No. 2 of 1937, and subsequent amendments including Act No. 49 of 1993 as amended by Act No. 22 of 2009 | 1. The National Environmental Act No. 47 of 1980 and the amendment Act No. 56 of 1988 as amended by Act No 53 of 2000 |
| 2. National Heritage and Wilderness Areas Act No. 3 (1988) | 2. Coast Conservation Act No. 57 (1981) and Amendment Act No. 64 (1988) |
| 3. The Forest Ordinance No. 16 of 1907, and its subsequent amendments, including Act No. 23 of 1995 as amended by Act No. 65 of 2009 | 3. National Aquatic Resources Research and Development Agency Act No. 54 (1981) and Amendment Act No.32 (1996) |
| 4. Fisheries Ordinance No. 24 of 1940 and the revised Fisheries and Aquatic Resources Act No. 2 of 1996 as amended by Act no. 4 of 2001 | 4. Ayurveda Act No. 31 (1961) & Amendment Acts No. 5 (1962) & No. 9 (1969), No. 7 (1977), No. 6 (1978) |

| Laws affecting the Protection of Endangered Species | |
|---|---|
| **Direct Impacts** | **Indirect Impact** |
| 5. Plant Protection Act No. 35 (1999) | 5. The Marine Pollution Prevention Act No.59 of 1981 as amended by the Marine Pollution Prevention Act No.35 of 2008 |
| 6. Botanic Gardens Ordinance 3 (1961) | 6. The Northwestern Environmental statue No 12 of 1990. |
| 7. National Zoological Gardens Act 41 (1982) | |
| 8. Water Hyacinth Act (1909) | |

Amongst the many steps taken recently to arrest loss of biological diversity and protect threatened and endangered species, the revision of some policies and legislation is very significant. For example, the revision of the Marine Pollution Prevention Act in 2008, the Forest Ordinance (FD) & the Flora & Fauna Protection Ordinance (DWC) in 2009 are very significant achievements in this respect.

In addition to the national legislation cited above, threatened and endangered species are protected under several International Agreements and Conventions relating to the conservation of biodiversity. These agreements are discussed further in Section 4.5.

## 4.5 Participation in International Treaties/Agreements

Multilateral international agreements are measures internationally agreed upon to protect the environment and/or to promote sustainable development, and they require the engagement of stakeholders at all levels to make them truly effective. Sri Lanka has entered into a number of international agreements relating to the conservation of biodiversity, the details of which are summarized in Appendix K. They are: International Plant Protection Convention, 1951, UNESCO Man and Biosphere Programme, 1970 (MAB), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973 Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention), 1972, Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Wetland Convention), 1971, Non-legally binding authoritative statement of Principles for a global consensus on the management, conservation and sustainable development of all types of forests, UNCED 1992 (Forest Principles) and Convention on Biological Diversity (CBD), 1992 Convention on Conservation of Migratory species (CMS or Bonn Convention), 1979, UN Convention to Combat Desertification (UNCCD), 1994, and Cartagena Protocol on Biosafety , 2000[51].

The MAB Programme, Ramsar Convention and World Heritage Convention are concerned specifically with protecting internationally important properties for conservation, but also include more general measures for the wise use of all wetlands (Ramsar Convention) or protection of all cultural and natural heritage (World Heritage Convention), 1972. The Convention on Biological Diversity (CBD), 1992 provides *inter alia* for the conservation of biodiversity both within and outside protected areas, and the maintenance of viable populations of species within their natural surroundings. Under the Forest Principles, which are not legally binding, the importance of forests as storehouses of biodiversity is recognized and the State is encouraged to protect ecologically viable representative or unique examples of its forests.

[51] MoENR, 2008, Hand Book on MEAs *(Multilateral Environmental Agreements),* Sri Lanka

# 5. ASSESSMENT OF THREATS TO BIODIVERSITY AND FORESTS

Sri Lanka's unique biodiversity is currently under serious threat due to increasing population pressure on ecosystems, degradation, fragmentation and loss of habitats, unplanned development activities, unauthorized encroachments, pollution, over-exploitation of species, and the spread of alien and invasive species. As a result, Sri Lanka and theWestern Ghats of India have been designated as one of 34 global biodiversity hotspots in the world based on the fact that these regions harbor at least 1,500 species of vascular plants as endemics, and have lost at least 70% of their original habitat. The main threats to different types of ecosystems are highlighted below.

## 5.1 Terrestrial Ecosystems:

At the beginning of the last century Sri Lanka had a dense natural forest cover of about 70% of land area[52]. This has been reduced to 22.4% of the total land area by 1999, though all forests including "sparse forests" (mainly scrub jungles), brings the total forest cover in the country (excluding forest plantations and other forms of tree vegetation) to 29.6% of the land area[53]. Forest fragmentation to establish plantation agriculture (cinnamon, rubber, coconut and tea) and human settlements over several decades, particularly in the wet zone, has resulted in isolation of plant and animal populations in relatively small forest patches restricting their natural dispersal, and consequently increasing their vulnerability to genetic erosion and local extinction.

The most serious problem related to habitat loss and fragmentation during recent times has been loss of forests through clearing forests for conversion to non-forest land uses. Additional threats include illegal slash and burn (shifting) cultivation in the dry and intermediate zones, conversion to monoculture plantations in the recent past, encroachment for settlement and cultivation of cash crops in the wet zone, illegal gem mining, illegal harvesting of timber, sand mining, over-harvesting of timber and non-timber forest products, over-visitation in some ecotourism sites, forest fires, inappropriate land use trends, prawn farming in some parts of the country, the spread of alien and invasive species, and the removal of wild species. The table 5.1 shows the depletion of forest habitats in the country during the last century

**Table 5.1: Depletion of Forest Cover in Sri Lanka since 1900[54]**

| Year | Population Density (persons/sq. km) | Dense Natural Forest Cover (million ha.) | Dense Natural Forest Cover (% of land area) | Per capita Forest Area (ha. Per person) |
|---|---|---|---|---|
| 1900 | 54 | 4.50 | 70 | 1.30 |
| 1956 | 131 | 2.90 | 44 | 0.32 |
| 1983 | 230 | 1.76 | 27 | 0.12 |
| 1992 | 269 | 1.56 | 24 | 0.09 |
| 1999 | 300 | 1.47 | 22 | 0.07 |
| 2010 | 315 | 1.46 | 22 | 0.07 |

*Source: Nanayakkara, 1996; Bandaratillake, 2001; Forest Department, 2011*

The last National Forest Cover assessment was completed in 1999 using 1996 satellite images. The most recent forest cover assessment is currently being carried out by the Forest Department using

[52] Nanayakkara, 1996, Forests and Forestry in Sri Lanka: An Historical Perspective, Commonwealth Forestry Initiative, Commonwealth Secretariat, Britain
[53] FD, 2001, Administration Report of the Conservator General of Forests, Forest Department, Sri Lanka
[54] Comparison of forest cover information acquired during successive inventories may not be quite rational as each survey has adopted an own technique for data acquisition and posses different levels of accuracies.

2008 satellite imageries. The almost ten year interval between these two assessments is too long to allow for effective monitoring, planning and managment of forest resources.Thus, the lack of current forest data is a gap which impedes effective planning and management of forest resources. .

In addition, the over extraction of medicinal plants from the wild is also a serious threat to forest biodiversity degradation. As an alternative, domestication of medicinal plants by cultivating in home gardens maybe considered as an option to minimize the over-exploitation.

Finally, the lack of effective and time-sensitive mechanisms to resolve acquisition of private and Land Reform Commission (LRC) lands in the buffer zones of PAs is also a serious gap in the management of the PA system in the country.

## 5.2 Fresh Water Ecosystems

Agricultural expansion, urbanization and industrialization exert major pressure on fresh water wetlands and wetland water quality. These threats are as follows:

- Release of industrial effluents and dumping of solid wastes near waterways causing unintentional pressures
- Discharge of wastewater containing untreated sewage
- Urbanization which has increased the loads of domestic waste and sewage dumped into rivers.
- Agricultural expansion, which has resulted in excessive use of agrochemicals and fertilizer
- Over-exploitation of water for irrigation purposes

These threats collectively interact and produce multiple impacts on wetlands. In addition, exploitation of forests for timber, plantation agriculture and human settlements has caused accelerated soil erosion, contributing to the destabilization of rivers.

Reclamation of wetlands in urban areas for to landfills for residential, commercial, and industrial development has been prolific, especially in the Western Province. Pollution and siltation of wetland habitats have made them unusable for many freshwater species that need clean, clear water, including many of endemic freshwater fish.

Using beach seines to catch fish in irrigation tanks and reservoirs, though banned, continues in some of the larger reservoirs to the detriment of wetland biodiversity. Over-fishing and poaching (mainly of birds) and the uncontrolled collection of ornamental freshwater fish and water plants for export have also compounded the threat status of many aquatic species.

## 5.3 Coastal and Marine Ecosystems:

**Mangrove habitats:** Loss of habitats is a serious threat in Coastal and Marine habitats such as mangroves and coral reefs. Extensive mangrove areas have been cleared for urban development, housing construction, shrimp culture and lowland agriculture (North Western province). It has been reported that between 1986 and 2002, over 2,730 ha of mangrove have been lost in the Puttalam district, mainly due to shrimp farming[55]. Erosion of banks (due to operation of high speed boats) of

[55] CZMP, 2003 – Revised Coastal Zone Management Plan, Sri Lanka, 2003. Coast Conservation Department, Colombo, Sri Lanka

estuaries/lagoons destroys mangroves adjoining the water edges (e.g. Madu ganga, Kaluwamodara). Another threat to mangrove areas is the change of water regimes (eg. in Kalametiya, the mangroves are dying as a result of salinity reductions). There is also a threat from the over-extraction of mangrove resources such as poles and fuel wood for domestic use, and twigs for brush pile fishery. Mangrove ecosystems are also degraded by water pollution and siltation.

Overall, there has been about a 50% reduction of the mangrove cover between 1986 and 2003. The most significant change in the extent of mangroves over the last 17 years has been recorded in Puttalam, Mannar, Jaffna and Kilinochchi districts. Figure 5.1.

**Coral Reefs:** The main causes of coral reef degradation are: coral mining, coral damage by ramming glass bottom boats and fishing boats against reefs and anchoring boats on reefs (Hikkaduwa, anchor damage by fishing boats at Weligama in Matata), high visitor pressure causing damage by trampling and removing corals (Hikkaduwa, Polhena, Pigeon Island), destructive collection techniques for ornamental fish and lobsters such as bottom set nets and moxy nets (Rumassala, Hikkaduwa and Weligama), increased levels of sedimentation due to coastal erosion, coral bleaching, urban pollution, high visitor pressure, over-harvesting of resources and other invasive organisms such as tunicates, corallimorphs (coral anemones/ false corals) and algae (Halimeda, Caulerpa and filamentous algae).

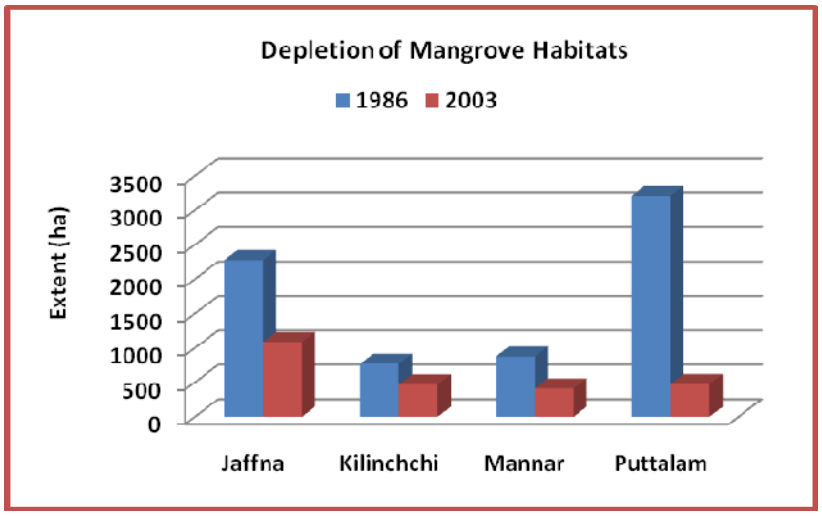



**Figure 5.1: Depletion of Mangrove Habitats between 1986 and 2003**
*Source: Joseph. L (2003)*

**Lagoons and Estuaries**: Threats to Lagoon and Estuarine habitats are urban pollution such as industrial effluents and urban waste (Negombo, Kelani, Walawe, Valaichchenai, Madu ganga (river) estuaries, Lunawa lagoon), effluents from shrimp farms, introduction of excessive nutrients or pesticides, oil from fishing crafts, sewage disposal (Kelani and Negombo estuaries and the Lunawa Lagoon), solid waste disposal (Bentota, Negombo estuary, Lunawa lagoon), sand mining (Kelani estuary, Maha Oya, Deduru Oya), siltation due to upstream development activities and clearance of mangroves (Negombo estuary), unauthorized encroachment and land reclamation (Negombo estuary, Bolgoda Lake estuary), over extracting food fish, ornamental fish and other species, use of destructive fishing methods (Negombo estuary, Batticaloa lagoon) and changes in salinity regimes

due to upstream development activities such as irrigation (Malala, Ambilikala, Kalametiya and Puttalam lagoons)[56].

**Seagrass beds:** Major threats to seagrass beds includes sedimentation and pollution due to land based activities, destructive fishing practices, introduction of excessive nutrients or pesticides, destructive collecting techniques (digging) for polychaete worms, urban pollution, coastal development activities, excessive algal blooms occurring as a result of high levels of nutrient inputs from upstream agricultural and aquaculture activities and invasive organisms such as algae.

**Salt marshes:** Threats to salt marshes includes sedimentation and urban pollution, introduction of excessive nutrients or pesticides, coastal development activities etc. The present estimates of salt marshes in the country show a 20% reduction over a period of 16 years**.** Over 85% reduction is reported from Puttalam district, from 3461 ha in 1986 to 499 ha in 2002.

**Climate Change induced threats on Coastal and Marine ecosystems:** Climate change is a key, emerging threat to ecosystems in Sri Lanka. Climate change will exert significant pressure on terrestrial, freshwater, and coastal ecosystems. Some of the key climate change-induced threats to coastal ecosystems include:

- salinization of low lying areas and loss of coastal land due to sea level rise;
- increased coastal erosion due to more frequent and intense storm surges;
- landward migration of coastal wetlands, resulting in the loss of freshwater and brackish habitats;
- changes in the salinity of lagoons and estuaries, which will impact fish, crustaceans, and other species and thus negatively impact ecosystem services including fisheries;
- changes in current patterns due to climate change may affect the commercial fishery;
- rising ocean temperatures and El Nino events will systematically bleach and impoverish coral reef systems, including reef dwelling species of commercial and environmental values; and
- increased spread of marine invasive species due to climate change, especially in degraded reef systems[57].

**5.4 Summary of Direct and Indirect Threats:** Summary of direct and indirect threats to biodiversity is presented in Table 5.2 & Table 5.3.

[56] Joseph, 2003, National Report of Sri Lanka on the Formulation of a Transboundary Diagnostic Analysis and Strategic Action Plan for the Bay of Bengal Large Marine Ecosystem Programme, Ministry of Fisheries and Ocean Resources, Sri Lanka

[57] MoE, 2010, Sector Vulnerability Profile: Biodiversity and Ecosystem Services

**Table 5.2: Summary of Direct Threats to Biodiversity**

| Direct Threats | |
|---|---|
| **Terrestrial and Freshwater** | **Coastal and Marine** |
| Habitat loss & Fragmentation due to conversion to other land uses | Loss of habitats of Mangroves, Coral reefs etc, due to land reclamation and clearing of vegetation |
| Habitat degradation, Unplanned irrigation structures, Regulation of water flows (Dams) | Siltation & Sedimentation; sewage and solid waste disposal; discharge of ballast water to coastal waters |
| Shifting Cultivation | Development of aquaculture (shrimp culture) |
| Over Exploitation of Biological Resources i.e. Medicinal plants | Illegal & overfishing |
| Illicit Gemming; Illicit Felling of timber | Improper fishing techniques |
| Forest fires; Sand mining | Sand/coral mining |
| Removal of wild species; Poaching; Export of forest products in other forms (nax-vomica) | Exploitation of species, Poaching, Ornamental fish and plant Trade, |
| Spread of Alien and Invasive species | Spread of Alien and Invasive species due to introduction of exotic aquatic animal and plant species |
| Activities Detrimental to Biodiversity such as Cardamom cultivation | Pollution - Organic pollution, Chemical effluents, oil and tar from ships & boats |
| Pollution-Specially in aquatic systems, Sewage disposal (Beira lake), Garbage disposal (Muthurajawela) | Introduction of excessive nutrients or pesticides |
| Elephant and cattle damage | Encroachment and land reclamation; Industrial effluents and urban waste |
| Over Visitation of PAs | Over Visitation of PAs - Hikkaduwa |
| Over extraction of fresh water for irrigation | Over extracting food fish; Destructive fishing practices |
| Introduction of excessive nutrients or pesticides | ramming glass bottom boats and fishing boats against reefs |

**Table 5.3: Summary of Indirect Threats to Biodiversity**

| Indirect Threats | |
|---|---|
| **Terrestrial and Freshwater** | **Coastal and Marine** |
| Population pressure on land | Population pressure on habitats |
| Poverty & landlessness | Poverty & landlessness |
| Lack of Understanding of Scientific Management | Lack of Understanding of Scientific Management |
| Inequity in ownership, management and flow of Benefits to Community | Inequity in ownership, management and flow of Benefits to Community |
| Inappropriate land use trends | Inappropriate land use trends |
| Natural disasters- droughts, landslides, floods etc | Natural disasters - droughts - drying of tanks, streams, salt marshes and lagoons etc, Tsunami |
| Climate change – spread of pest & diseases, | Climate change - rise of seawater temperature - bleaching of coral reefs, Hikkaduwa |
| Inadequate law enforcement | Inadequate law enforcement |
| Lack of proper management | Lack of proper management |

| Indirect Threats | |
|---|---|
| **Terrestrial and Freshwater** | **Coastal and Marine** |
| Inadequate resources | Inadequate resources |
| Lack of appreciation of the value of nature | Lack of appreciation of the value of nature |
| Lack of Environmental /Green Valuation System | Lack of Environmental /Green Valuation System |
| Lack of widely accepted guidelines to incorporate BD into development planning | Lack of widely guidelines to incorporate BD into development planning |
| Pest and diseases | Pest and diseases |
| Threats due to Globalization | Threats due to Globalization |
| Inadequate resources for management agencies | Inadequate resources for management agencies |
| Lack of proper guidelines in reporting projects for national planning approval | |

**Impact of Indian Ocean Tsunami (2004) on Coastal Ecosystems of Sri Lanka**

In Sri Lanka, the Indian Ocean Tsunami that struck on the morning of December 26, 2004 left behind widespread destruction, killed over 31,000 people, destroyed over 99,000 homes, displaced 443,000 people and damaged natural ecosystems, and coastal infrastructure.

The entire coastal belt of Sri Lanka was extremely affected by the tsunami. This region harbors many key marine and coastal ecosystems such as coral reefs, mangroves, sea-grass beds, coastal sand dunes, mudflats, salt marshes, backwaters and lagoons, environmentally sensitive areas declared as national parks and sanctuaries, which includes a Ramsar wetland site, all of which play a vital role in sustaining living natural resources on which many people in the affected region depend. In addition, the tsunami has created serious problems arising from adverse impacts to environmental capital or assets which are ecosystems that provide society and economies with environmental goods and services.

While there has been no documented loss of fauna in the protected areas affected by the tsunami, there have been significant impacts on flora and biodiversity. The greatest ecological impacts are on freshwater bodies and fishery breeding grounds in protected areas that have been contaminated with saline water. Eighteen (18) coastal protected areas were affected by the tsunami to varying degrees. Some of these protected areas, in particular Yala East, Yala, Bundala, Kalametiya and Pigeon Island, have suffered significant ecological damage, albeit in a relatively narrow strip.

It has been estimated that the damage to intertidal and sub-tidal areas were extensive, and this could result in drastic changes in the coastal marine ecosystems, with potentially irreversible destruction of some areas, as well as immediate loss of living coastal resources such as fish, lobsters and crabs. This will have serious implications on fisheries, as many of Sri Lanka's fishermen are dependent on near shore resources.

*Sri Lanka 2005 Post-Tsunami Recovery Program, ADB/JBIC/WB, January 2005*

# 6. REVIEW AND SUMMARY OF GOVERNMENT, NGO, AND DONOR PROGRAMS AND ACTIVITIES

## 6.1. Government Programs with Donor Assistance:

### 6.1.1. Programmes Implemented in the Past

A number of projects and programmes have been implemented in the recent past for conservation of forest resources and biodiversity in Sri Lanka. The key programmes implemented during the last 10 years are shown in Appendix I. (See Appendix J for more details of key projects) These projects include Conservation of Forest Resources; Conservation of Medicinal Plants; Conservation of Crop Wild Relatives; Conservation of Wildlife; Conservation of Coastal Resources; Conservation and Use of Agro-ecosystems; Control the Introduction and Spread of Alien Invasive Species; Capacity building for Climate Change Adaptation; and Biosafety.

In addition to the projects and institutional programmes stated above, the Ministry of Environment and Natural Resources (MoENR), Forest Department (FD), Department of Wildlife Conservation (DWC), Coast Conservation Department (CCD), Central Environmental Authority (CEA), and Marine Pollution Prevention Authority (MEPA), implemented their regular programmes for protection/conservation and management of the relevant resources.

### 6.1.2. Programmes Implemented at Present

#### A) Ministry of Environment

Programmes related to forest and biodiversity conservation implemented by the Ministry of Environment are given below:

**a) Donor funded projects:**

The Capacity Development on Clean Development Mechanism (CDM) Promotion in Sri Lanka, with the financial assistance of Japan International Cooperation Agency (JICA) program aims to strengthen institutional mechanisms of CDM promotion in Sri Lanka through capacity development of the Climate Change Secretariat (CCS), Ministry of Environment, and other relevant government authorities.

**b) Programmes with financial provisions from the treasury under the government budget:**

The programmes implemented at present by the Natural Resources Management and Biodiversity Conservation Division are listed below;

- In-situ Conservation:-
  a. Establishment of Protected Area for Wild Rice Relatives
  b. Facilitate the implementation of in-situ conservation- - Establishment of Butterfly Garden
- Ex-situ Conservation:-
  a. Establishment of Nature Parks for Conservation of Important plant species through ex-situ conservation (*Atavisibodhi* Programme)
  b. Establishment of Tree Sanctuaries and Gardens; Tree Gardens for Threatened tree species;
- Conservation of Traditional Knowledge
- Bio-Safety Programmes
- Biodiversity Survey and Conservation

- Implementation of Bio-safety Clearing House (BCH) Mechanism
- Carry out Biodiversity related Research and Assessments
- Identification of species diversity in Marine Shell deposits in Southern Province of Sri Lanka
- Habitat enrichment and assessment of the present status of Bandula barb (*Puntius bandula*)
- Programmes implemented by the Promotion Division: Environmental Education and Training programme with special emphasis on Biodiversity Conservation.

### B) Forest Department (FD)

The Forest Department gets its legal authority under the National Heritage and Wilderness Areas Act and the Forest Ordinance. It does not operate any donor assisted projects at present. The UN-REDD project is in the pipeline at present, and its implementation is expected from October 2011. All the current programmes are implemented with the funds allocated from the treasury under the annual government budget. Financial provisions allocated for 2011 is Rs. 1,130 million. These programmes include the following;

- *Reforestation and Management of Forest plantations:* FD annually reforests around 350 ha to 500 ha of forest plantations harvested by the State Timber Corporation with economically valuable timber species to meet the timber requirement of the country and manage 3,000 ha – 4,000 ha ha of young and old forest plantations; Establish and manage Farmer's Woodlots in the dry zone with the participation of village communities; Establish village home gardens in private lands with the *participation of village communities;* Maintain tree nurseries for production of tree seedlings used for the reforestation and tree planting programmes.

- *Environmental Management:* Forest biodiversity conservation, PA management and forest-related Environmental Impact Assessment (EIA) activities are carried out under this programme.

- *Education, Extension and Public Awareness:* Public awareness programmes on forest and biodiversity conservation are carried out under this programme. The programmes such as exhibitions, video shows, competitions, seminars and workshops, and tree planting campaigns are carried out to enhance the public awareness on conservation.

- *Research Programme:* Research is an essential part of the conservation and management of forest resources. This programme includes research activities on biodiversity conservation, silviculture of forest trees, research on pest and diseases etc.

- *Forest protection and law enforcement:* Implementation of legal provisions in the Forest Ordinance and National Heritage and Wilderness Areas Act is the main function of this programme. The objective of the programme is to protect and conserve biodiversity including forest habitats from degradation and fragmentation. This programme is implemented at the national and district level.

### C) Department of Wildlife Conservation (DWC)

The DWC gets its legal authority under the Fauna and Flora Protection Ordinance. DWC does not operate any donor assisted projects at present. All the current programmes are implemented with the funds allocated from the treasury under the annual government budget. The current programmes of the DWC include the following;

- *Establishment of Protected Areas:* This includes establishment and upgrading of the PA system under DWC. The objective of the programme is to protect representative samples of all eco-systems, including sites of special scientific interest; expand and link protected areas wherever necessary to ensure the survival of viable populations of wildlife.

- *Tourism Promotion:* Facilitate eco-tourism in PAs, with due consideration to the conservation of the ecosystems concerned

- *Training and Capacity Building:* Strengthen the capabilities of the staff of the DWC through the provision of training, encouragement and motivation

- *Education and Public Awareness:* Promote conservation through public education and awareness programmes

- *Wildlife Management:* Identify, classify and manage all protected areas, based on appropriate scientific research and regulations, and then monitor the status of each protected area.

- *Elephant Conservation and Management:* Elephant Management in order to minimize human-elephant conflict. This includes the management of Elephant Transit Home at Udawalawe.

- *Wildlife Health Management:* Management of health of all wildlife species by providing necessary veterinary facilities.

- *Wildlife Research:* Encourage scientific research relevant to the management of the wildlife resources in Sri Lanka.

- *Habitat enrichment:* Improve all wildlife habitats by providing food and water for wildlife. This programme includes providing sufficient water holes, fodder and grass for animals. Removal of alien and invasive species from the habitats is one of the activities under this programme.

- *Participatory Management:* Encourage public participation in conservation activities and assist the communities living around PAs to improve their socio- economic conditions, in order to reduce their dependency on PA resources.

- *Law Enforcement;* Implement the Fauna and Flora Protection Ordinance and other regulations effectively, to minimize illegal exploitation of wildlife resources, within and outside WLPAs.

### D) Central Environmental Authority (CEA)

Central Environmental Authority (CEA) gets its legal authority under the National Environmental Act. As the authority to implement the National Environmental Act, CEA carries out the following activities in order to prevent any adverse impacts on conservation of biodiversity;

- Implantation of Environmental Impact assessment (EIA) and Environemtnal Protection License (EPL) regulations

- Declaration, Management and Monitoring of Environmental Protection Areas.

- Preparation of Management plans for EPA and Implementation

- Implementation of Wetland Management Action plan.

- Implementation of Waste Management regulations.

- Setting up of effluent discharge standards
- Preparation of Guidelines for Natural Resources Management Introduction
- Introducing of SEA on spatial plans.
- Environmental Education and awareness.
- Law enforcement – Implementation of legal provisions in the NEA

**E) Marine Environment Protection Authority (MEPA)**

The key function of the MEPA on protection and conservation of Costal and Marine biodiversity is the implementation of the provisions of Marine Pollution Prevention Act.

### 6.1.3. Effectiveness, Strengths and Weaknesses

The key projects implemented in the past can be categorized into two categories.

A. Forest and wildlife projects
B. Capacity building and institutional strengthening

The strengths and weaknesses of the projects implemented during the recent past can be generalized as follows:

**A) Forest and Wildlife Projects:**

Strengths**:** Both the Forest Department (FD) and the Department of Wildlife Conservation (DWC) are well-established government institutions with a good network of field staff in the Provincial, District and Range level. This well-established institutional network had a sufficient capacity to facilitate the implementation of field-level activities effectively; further, officers attached to these two departments are adequately trained and knowledgeable on the relevant subject for effective implementation of the programmes. The current policy framework for the forestry and wildlife sectors is very sound and supportive for implementation of participatory and resource conservation programmes. The attitudinal change of forest and wildlife managers and local communities towards participatory forest and wildlife management is a very significant development in these sectors in the recent past. This has been more apparent in the forestry sector than in the wildlife sector. Projects were able to get people to participate to some extent by providing various types of incentives which show a substantial achievement, particularly for large-scale projects.

Weaknesses**:** Forest resources in Asia have traditionally been managed by government agencies. Generally, government institutions like the FD and DWC in Sri Lanka have a long history of top-down implementation and management of resources. During the last three decades, Participatory Forest Management (PFM) has expanded to almost all of the countries in Asia including Sri Lanka. In Sri Lanka, since the 1980's the Forest Department has made considerable progress in moving toward a participatory culture, and many senior and middle managers have come to fully accept the benefits of and need for PFM. The National Forest Policy of 1995 and National Wildlife Policy of 2000 have given an adequate emphasis on the need for PFM for conservation and sustainable management of forest and wildlife resources in the country. However, the shifting towards participatory culture in DWC had been rather slow. In addition to community participation, collaboration with other agencies such as universities, NGOs and the private sector, by the FD and DWLD had been low.

All of the forest and wildlife projects implemented in the recent past had significant components for community participation (Items 3, 4, 5 & 6 of Appendix I). Ideally, participatory processes should be

applied to all stages of the project cycle, from design to implementation, including monitoring and evaluation. However, the implementation processes in most of these projects were not highly participatory (except items 3 & 4). Instead, the participation had been mostly passive. This may have been caused by inadequate involvement of local communities at the time of project design. This was especially apparent in the project implemented by the DWC.

Both pieces of legislation (Forest Ordinance and Fauna and Flora protection Ordinance) need further improvements for more effective implementation of the relevant national policies particularly in PFM aspects.

Effectiveness: Apart from those minor weaknesses, generally all the forest and wildlife projects can be rated as significantly effective in order to meet the project objectives.

#### B) Capacity building and institutional strengthening projects

Strengths**:** Most of these projects were implemented by the Ministry of Environment in collaboration with other relevant agencies. The National Environment Policy and other related sector policies and international conventions stated in this document provided the necessary background and authority to execute those projects successfully.

Officers attached to the Ministry of Environment are adequately exposed, trained and knowledgeable on the relevant subject areas for effective implementation of the programmes.

Weaknesses**:** There are no significant weaknesses identified in those projects.

Effectiveness: Outputs of the projects have been achieved and relevant policies and legislations have been developed as expected. Hence, the projects can be rated as effective in order to meet the project objectives.

### 6.2 Donor Programmes in the sphere of forest and biodiversity conservation:

During the last several years several Multilateral and Bilateral Donors have funded number of projects in the sphere of forest and biodiversity conservation in Sri Lanka. Asian Development Bank (ADB), World Bank, Aus AID, United Nations Development Program, Japanese International Assistance (JAICA) and Netherlands have assisted the GOSL in number of forestry, biodiversity and wildlife conservation projects, including wetland conservation. Details of these projects are provided in Section 6.1 of this report.

### 6.3 Programmes implemented by Non-Governmental Organizations (NGOs):

The GEF/Small Grants Programme (SGP) implemented by UNDP which was launched in 1995 in Sri Lanka, has to date funded 179 NGO/CBO initiatives in the focal area of forest and biodiversity conservation. This focal area mainly concentrated on the following four operational programmes. (i) Coastal, Marine and Freshwater Ecosystems, (ii) Forest Ecosystems, (iii) Mountain Ecosystems and (iv) Sustainable use of Biological Diversity important to agriculture. In general, more than 50% of the biodiversity projects had fallen in to the categories of forest ecosystems and the sustainable use of biodiversity important to agriculture.

# 7. DESCRIPTION OF FURTHER ACTIONS NECESSARY

As discussed in previous sections of this report, Sri Lanka's rich natural heritage of tropical forests and biological diversity is under increasing pressure. It can be expected that natural ecosystems and habitats are moving toward greater degradation while rare and endangered species are becoming more vulnerable. Threats to conservation of these resources (see section 6) have been widely acknowledged by the authorities and several important steps have been taken to protect forests and biodiversity in the country, most notably, the development of a supportive legal and policy framework, action plans, and projects and programmes which were discussed in sections 4 and 5 of this report. This section provides a summary of the actions necessary to address the issues and threats in order to improve the sustainable management of these resources.

### Further actions needed to conserve forests and biodiversity in Sri Lanka

In view of the actions already taken for conservation of forest resources and biodiversity in Sri Lanka, the following actions are still needed to support the conservation of these resources. Most of these actions have been identified in the Biodiversity Action Plan and Addendum, Caring for the Environment Path to Sustainable Development Action Plan 2008-2012 and National Action Plan for *Haritha* (Green) Lanka Programme prepared by the Ministry of Environment and Natural Resources in 2009[58]. (Appendix L)

***Summary of Actions Identified***

*1. Strengthen the policy, legal and institutional framework for biodiversity and forest conservation*

*2. Establishment of a database and monitoring of biodiversity*

*3. Establish an optimum Protected Areas (PA) system, prepare management plans and ensure recovery of important threatened species*

4. *Strengthen the ex-situ conservation of threatened species of flora and restoration of ecologically important habitats*

*5. Establish biodiversity conservation financing mechanisms and biodiversity valuation system*

*6. Regulate/control over-exploitation of biological resources and improve resource management*

*7. Ensure management and control of invasive and alien species*

*8. Enhance the public awareness on the values of biodiversity and forest resources.*

*9. Biodiversity valuation & mainstreaming the economics of biodiversity conservation*

[58] MoENR, 2009, National Action Plan for *Haritha* (Green) Lanka Programme

***1. Strengthen the policy, legal and institutional framework for biodiversity and forest conservation:***

1.1 Formulate a national policy on biodiversity conservation, including information sharing and networking.

1.2 Review the National Forest Policy (1995), National Wildlife Policy (2000), Forest Ordinance (FO), National Heritage and Wilderness Areas Act (NHWAA), and the Fauna and Flora Protection Ordinance (FFPO) in order to ensure that necessary provisions for effective conservation are included.

1.3 Strengthen the enforcement of FO, NHWAA and FFPO by building up the capacities of relevant divisions of FD and DWC.

1.4 Strengthen the protection of indigenous crop and domesticated animal genetic resources.

1.5 Establish a suitable mechanism to ensure effective co-ordination between FD and DWC in management of PAs and conservation of biodiversity.

***2. Establishment of a database and monitoring of biodiversity:***

2.1 Establish and institutionalize a biodiversity information management network; upgrade the Environmental Information Management System (EIMS) in the FD; and review the information dissemination policy for EMIS data. Awareness needs to be created on the EIMS and its usefulness. Data should be provided in a user-friendly manner**.**

2.2 Initiate an island-wide survey of biodiversity in managed landscapes, including home gardens, urban areas and agricultural systems and include the data in the information management network in order to facilitate a system for the regular monitoring of biodiversity in the country. The data gathered from the NCR (data in the EMIS) should be used to supplement this information.

2.3 Strengthen the forest inventory and GIS information system in the FD and DWC to provide more accurate information to support regular monitoring of biodiversity, particularly different habitat types and their status etc.

2.4 Carry out studies to decide on sustainable harvesting levels of medicinal plants, aquatic ornamentals etc, and other important Non Timber Forest Products (NTFP) and develop a database.

***3. Establish optimum Protected Areas (PA) system, prepare management plans and ensure recovery of important threatened species***

3.1 Identify critically important habitats (terrestrial, wetland, coastal & marine) with high biodiversity in the county outside the already declared (gazetted) PA system; and survey, demarcate and declare these under appropriate legislation, to facilitate their incorporation into the national PA system. The biodiversity information available from the NCR and Important Bird Areas (IBA) programme should be used in this exercise, paying special attention to conservation of endemic and threatened species of plants and animals.

3.2 Develop innovative systems for habitat management for critical landscapes with high biodiversity particularly under non state sector ownership. These landscapes could continue

to be managed for conservation objectives under private or other non state sector ownership under innovative management approaches (i.e. providing incentives for preserving these habitats, analog forestry linked with ecotourism etc)

3.3 Study the status and trends in wildlife areas and identify the needs for wildlife corridors and linkages as an option for species conservation. Include these linkages in the list of landscapes identified under 2.1 above to declare under appropriate legislation.

3.4 Prepare and implement management plans for all PAs including landscapes identified under 3.1 above; ensure that these plans adequately address conservation and sustainable management, while recognizing the participatory role of communities living in proximity to the area. Management plans should have provisions for long term monitoring, particularly for IBAs, and livelihood development opportunities for surrounding communities in order to ensure effective participation in management and reduce their dependency on resources from PAs causing detrimental impacts.

3.5 Prepare and implement recovery plans for in-situ and ex-situ conservation for threatened species that need special conservation actions.

3.5 Determine best practices to mitigate animal-human conflicts and implement them (elephant-human, crocodile-human and monkey-human).

### *4. Strengthen the ex-situ conservation of threatened species of flora and restoration of ecologically important habitats*

4.1 Strengthen the ex-situ conservation activities currently available in the country for conservation of flora (i.e, Botanic gardens, Field gene banks, Arboreta etc) and mandate them to undertake ex-situ conservation of biodiversity in all bioclimatic regions of Sri Lanka.

4.2 Expand programmes of aforestation, reforestation and forest rehabilitation paying attention to the use of indigenous tree species as far as possible; identify and rehabilitate/restore degraded critical habitats.

4.3 Expand the homegarden development programme and other social forestry activities to ensure ex-situ conservation of indigenous medicinal plants, threatened and endangered species and enrichment of tree cover in the country.

### *5. Establish biodiversity conservation financing mechanisms and biodiversity valuation system*

5.1. Develop appropriate mechanisms for biodiversity valuation in consideration of all the tangible and intangible values (*commodity, amenity, and* moral *values including ecosystem values)*[59,60]

5.2. Develop and maintain a database on values of biodiversity; undertake valuation studies and quantify the biodiversity contribution to GDP.

5.3. Develop innovative financing mechanisms to generate sustainable self-financing for biodiversity conservation including management of PAs by relevant agencies.

[59] David, W.P, 1997, The economic value of biodiversity, IUCN Biodiversity Programme.
[60] Bryan Norton, 1988, Commodity, Amenity and Morality: The Limits of Quantification in Valuing Biodiversity, P200, in Biodiversity by Wilson, E.O, Peter, F.M, National Academy of Sciences (U.S.), Smithsonian Institution, 1988.

### 6. *Regulate/control the over-exploitation of biological resources and improve resource management*

6.1 Prevent over-exploitation and regulate harvesting of native freshwater organisms by introducing a suitable mechanism.

6.2 Prevent over-exploitation and regulate harvesting of Non-Timber Forest Products (NTFP). Participatory management of forest resources need to be taken as the best option for regulating the harvesting of NTFPs. Promote cultivation of NTFP in home gardens to minimize the threats to biodiversity and forests.

6.3 Improved resource management of the coastal/marine environment. All development activities in the coastal zone need to be done environmental friendly manner, under the guidelines provided in the Coastal Zone Management Plan (CZMP) and other relevant policies and procedures. Integrated coastal zone management need to be encouraged in consultation with all stakeholders.

### 7. *Ensure management and control of invasive and alien species*

7.1. Plan Develop a National Strategy/Action Plan for prevention of the introduction, and eradication and mitigation of the impacts of alien/invasive species; and establish and maintain a complete national level database on alien/invasive species.[61].

7.2. Establish and maintain a complete national level database on Invasive and Alien species including a proper and well coordinated data sharing mechanism, information on their impacts and management.[62]

### 8. *Enhance the public awareness on the values of biodiversity and forest resources.*

8.1. Implement effective awareness programme to enhance the public awareness on the importance of biodiversity through mass media, publication of materials (manuals, brochures, booklets etc) and formal and informal education systems for all stakeholders. Public awareness programme should cover conservation of biodiversity in terrestrial, wetland, coastal and marine ecosystems.

8.2. Integrate agenda on biodiversity in to curricular of primary, secondary and tertiary education systems as appropriate.

### 9. *Biodiversity valuation & mainstreaming economics of biodiversity conservation*

9.1 Creation of national awareness on economic valuation of biodiversity

Introduce environmental economics into the school curriculum on economics at GCE (A/L). The emphasis of the curriculum should be to impart the message that the cause of biodiversity degradation is based on human behavior. The module should introduce an indication of possible economic damage due to destruction of biodiversity and related resources.

9.2 Capacity building on Environmental Economics

[61] MoENR, Proceedings of the workshop on Alien/invasive species in CBD Thematic Report on Alien Species
[62] Manawadu, 2010, Review of Databases on Invasive Alien Species in Marambe, B et al, 2010, Invasive and Alien Species: Strengthening Capacity to Control Introduction and Spread in Sri Lanka, MoE/UNDP.

Currently, environmental economics research at the university-level is not adequate. More emphasis should be given to biodiversity economics research by universities and research organizations and these programmes need to be supported by relevant organizations.

9.3 Strengthening institutions on the application of Environmental Economics in biodiversity conservation

- *Strengthening analysis on policy and economic incentives for biodiversity conservation:*

  This should include carrying out studies on the impact of sectoral policies on biodiversity conservation; studies on the impact of incentives on biodiversity conservation; and identification of appropriate economic instruments for biodiversity conservation.

- *Biodiversity valuation and use in national income accounts and project evaluation:*

  This should include the following: compile all national and international studies on biodiversity valuation and maintain a biodiversity value database that could be used in policy and project evaluation; publish national statistics on biodiversity valuation; estimate the contribution of biodiversity to GDP and include in an annual national report.

- *Financing biodiversity conservation:*

  Promote biodiversity conservation based on objective/scientific reasoning; develop a biodiversity financing strategy; and financial provisions should be provided in the budget estimates of relevant ministries.

9.4 Implement sector-specific training and awareness programmes on biodiversity conservation.

9.5 Develop and implement biodiversity conservation awareness programmes for decision makers to ensure that future investment/economic plans are biodiversity-friendly.

# 8. REVIEW OF THE PROPOSED USAID/SRI LANKA STRATEGY AND PROGRAMME

## 8.1 Review of Existing Programmes

USAID/Sri Lanka recently completed the preparation of a three-year Country Development Cooperation Strategy (CDCS) (2011-2013). This new strategy is designed to contribute to a comprehensive development framework to ***"accelerate reconciliation and economic growth equitably and sustainably"***. The primary focus of USAID/Sri Lanka's new three-year country strategy is on stabilization, equitable economic growth, and other related support for people living in communities in the Northern and Eastern provinces.

This three-year strategy has been designed to focus on two key sectors, represented by the following two development objectives:

*Development Objective 1:* Strengthened Partnership between the State and its Citizens to Establish a Foundation for Reconciliation.

*Development Objective 2*: Increased and More Equitable Economic Growth in Conflict Affected Areas.

Through its programming under Development Objective 1, USAID/Sri Lanka seeks to achieve the following:

- Improved Protection of Citizens' Rights (IR 1.1)
- Strengthened Participatory Governance in Conflict Affected Areas (IR 1.2)
- Increased Stabilization of Conflict Affected Communities (IR 1.3)

Through its programming under Development Objective 2, USAID/Sri Lanka seeks to achieve the following:

- Increased Private Sector Investment in Conflict Affected Areas (IR 2.1)
- Increased Enterprise Development in Conflict Affected Areas (IR 2.2)

USAID/Sri Lanka is currently implementing the following programmes in order to achieve above objectives.

Existing USAID Programmes:

- Supporting Regional Governance (SURG)
- Connecting Regional Economics (CORE)
- Volunteers for Economic Growth (VEGA)
- Public Private Alliances (PPAs)
- Reintegration and Stabilization of the East and North (RISEN)
- Information, Counseling, and Referral Service (ICRS)
- Special Programmes to Address Needs of Survivors (SPANS)
- Re-establishing Agricultural Livelihood for IDPs (FAO)
- Humanitarian Infrastructure Assistance (PACOM)
- Humanitarian Demining Assistance (FMF)

New USAID Programmes:

- Increased Responsiveness of the Legal System Programme (Justice)
- Increased Jobs and Income Generation through Enterprise Development (Biz Plus)
- Forensics Capacity Building Programme (DOJ)
- Development Grants Programme (DGP)

Sri Lanka emerged in 2009 from a civil conflict that lasted for nearly three decades in the Northern and Eastern provinces. The conflict left these two provinces, which covered 30% of the country's land area and 57% of the coastline, completely devastated, with respect to both the people's lives and the physical infrastructure. A large number of houses were damaged and townships, particularly in the North, were destroyed[63]. The government's highest priority now is to focus on rebuilding both the Northern and Eastern provinces and bringing them in line with the development efforts of the rest of the island. Accordingly, the government primarily aims at resettlement of displaced people and rehabilitation and reconstruction of economic infrastructure to restore livelihoods and basic needs such as permanent shelter, water supply, sanitation, electricity, health and education facilities, and the creation of income generating activities in the provinces. The resettlement of persons internally displaced due to the conflict is now progressing as areas are opened to resettlement after de-mining.

Based on the government's priority for reconstruction of economic infrastructure and development of the Northern and Eastern provinces, conservation work must take place along with other development work. Due to the conflict situation that has prevailed in this region, little or no conservation work had been undertaken during the last several decades. Priority is now being given to re-build these areas and re-integrate them into the country's economic development trajectory. The sustainability of all these efforts will depend heavily on careful integration of environmental safeguards into these development programmes. Thus, adequate attention must be placed on conservation of biodiversity and forest resources in these areas.

The activities of USAID/Sri Lanka's new country programme are primarily confined to the urgent needs of the conflict-affected communities in the Northern and Eastern provinces. Therefore, the conservation of tropical forests and biodiversity is not currently at the forefront of the agenda of the USAID/Sri Lanka programme. In addition, USAID/Sri Lanka is not a recipient of funding under the congressional biodiversity earmark. However, several of USAID/Sri Lanka's current programs support improved democratic governance and economic growth objectives, which indirectly contribute to biodiversity conservation and improved capacity to manage natural resources. In addition, attention has been placed on environmental compliance and other related components in order to ensure sustainability of these development programs.

In this context, the following section of the report describes the extent to which current and proposed USAID/Sri Lanka programs meet the needs identified in Section 7.

## 8.2 Extent to which current and proposed USAID/Sri Lanka programs meet the needs identified

### 8.2.1 Development Objective (DO) 1: *Strengthened Partnership between the State and its Citizens to Establish a Foundation for Reconciliation.*

Through this programme it is expected to achieve:

[63] CBSL, 2009, Annual Report of the Central Bank of Sri Lanka

- Improved protection of citizen's rights
- Strengthened participatory governance in conflict-affected areas
- Improved capacity of local governments and public sector to deliver services.
- Increased public engagement by civic associations in former conflict-affected areas.
- Improved partnerships between communities and provincial councils including public sector officials
- Increased access to justice for marginalized groups.

There are important linkages between good governance and biodiversity conservation. In particular, the following elements of effective democratic governance system can indirectly support biodiversity conservation: access to information, participation, transparency, decentralization, and policy. Secure tenure and access to resources allow people and communities to more effectively partner and participate in conservation and development programs, and invest in and optimize their property[64]. Similarly, when people have access to information about natural resources, biodiversity, and the environment they can more effectively manage resources and plan for the future. With improved access to information, people can also take advantage of new opportunities and participate in training and assistance programs. Appropriate environmental legislation and accountable and transparent mechanisms for policymaking are also necessary to ensure resources are managed sustainably.

Addressing issues of good governance and livelihoods improvement are absolute necessities if conservation is to succeed in Sri Lanka. The need to improve forest governance for sustainable forest management and to improve local livelihoods has been identified in a study carried out by IUCN in Knuckles Range of forests in Sri Lanka. The need for community participation for conservation and sustainable management of forest and wildlife resources has also been clearly emphasized in the current national policies of these two sectors (i.e. National Forest Policy and National Wildlife Policy).

USAID/Sri Lanka's democracy and governance programming under Development Objective 1 indirectly contributes to conservation through activities that focus on assisting communities and individuals to participate in decision-making, supporting decentralization, strengthening the capacity of civic associations for public engagement, and improving the transparency and responsiveness of local government service delivery. USAID/Sri Lanka should also continue to utilize USAID's environmental compliance procedures (22 CFR 216) to identify entry points for mitigating actions that support biodiversity conservation, and to monitor programs to ensure sustainability of democracy and governance investments.

### 8.2.2 Development Objective (DO) 2: *Increased and More Equitable Economic Growth in Conflict Affected Areas*

Through this program is is expected to achieve:

- Increased Enterprise Development in Conflict Affected Areas
- Increased Private Sector Development in Conflict Affected Areas
- Increased Enterprise Productivity

Economic growth activities can also contribute indirectly to the identified biodiversity and forest conservation needs by intensifying and diversifying agricultural productivity, improving natural resource management, extending and improving value chains, and providing rural finance. These activities reduce pressure on protected areas and natural habitats and provide opportunities for

[64] United States Agency for International Development (USAID), 2006. Issues in Poverty Reduction and Natural Resource Management.

sustainable natural resource-based enterprises in rural communtities (e.g. aquaculture, crafts, beekeeping, carpentry, non-timber forest products). Intensifying agriculture, improving yields, and expanding networks can reduce the extension of lands under cultivation, avoiding shifts of cultivation into forest and woodlands.

In addition to these indirect contributions to biodiversity conservation, activities under this development objective on increased and more equitable economic growth are currently addressing the following priority conservation actions identified under Section 7 (Description of Further Actions Necessary), primarily through livelihood development activities. These activities also provide an entry point for an expanded focus on conservation needs:

- ***4.3 Expand home garden development in the Northern and Eastern Provinces:***

USAID/Sri Lanka's agricultural economic growth activities are currently supporting home garden development, agricultural diversification, and increased productivity. In addition, USAID/Sri Lanka's humanitarian affairs programming supports home garden development through the provision of high value, diversified vegetable seed packets and the provision of irrigation inputs (such as pumps) or the refurbishment of history irrigation structures such as tertiary tanks, canals and wells. Home gardens play a major role in preserving crop biodiversity with respect to many species and can also help ensure conservation of medicinal plants and enrichment of tree cover. These activities could be expanded to include agro-forestry and social forestry activities to ensure ex-situ conservation of indigenous medicinal plants, threatened and endangered species and enrichment of tree cover in the country. Increasing tree cover in the country is one of the objectives of the current National Forest Policy. The policy on management of private forest and tree resources of the national policy stares "*Tree growing on home gardens and other agro-forestry will be promoted as a main strategy to supply wood and other forest products for meeting the household and market needs*". Improving the tree cover in the country will also help in increasing carbon storage which has a direct impact on the mitigation of climate change impacts. These activities should be implemented with the assistance of local CBOs and NGOs with the support of the Forest Department.

- ***Enhance public awareness on the values of biodiversity and forest resources:***

It is important to enhance public awareness and understanding of the value of forests and biodiversity and other associated values in order to sensitize the communities and the society at large in the Northern and Eastern Provinces to the need for protecting the forests and biodiversity in the country. Currently USAID programming in areas such as aquaculture and horticulture support increased awareness of the value of natural resources within the private sector and at the individual and community level. However, aquaculture and agriculture activities must be appropriately managed and monitored to ensure positive environmental impacts, particularly with respect to biodiversity conservation. An expanded focus on innovative and environmentally sound aquaculture and agruiculture techniques could further enhance both the economic and environmental sustainability of these programs. Additional emphasis on conservation awareness for private sector actors, public officers, teachers, school children, religious leaders, and other decision-makers in the communities would also help support synergies between economic growth objectives and biodiversity conservation. USAID/Sri Lanka can futher assist in meeting these needs by providing additional capacity building and institutional strengthening of the private sector, local communities, CBOs, and relevant officers, related to sustainable agriculture, agro-forestry, and sustainable management of aquaculture systems. In addition, USAID/Sri Lanka should continue to utilize USAID's environmental compliance procedures (22 CFR 216) to identify entry points for mitigating actions that support biodiversity conservation, and to monitor programs to ensure sustainability of economic growth investments.

### 8.2.3 Remaining Opportunities:

Based on the analysis of threats, conservation needs, and present and past programmes, several opportunities exist to improve conservation of forest and biodiversity resources in Sri Lanka. This analysis concludes with five priority activities that run through many of the needed themes and should be highlighted as remaining opportunities for potential support by USAID/Sri Lanka.

**1) Institutional strengthening of key management agencies**

The Forest Department and Department of Wildlife Conservation currently do not have sufficient office facilities, staff, or resources to implement the activities necessary for the conservation of biodiversity and tropical forests in the Northern and Eastern provinces, due in part to the situation that prevailed over the past several decades. Therefore, additional institutional strengthening and capacity building activities for these key management agencies will be required to achieve sustainable management of forest and biodiversity resources.

**2) Determine best practices to mitigate animal-human conflicts and implement them (elephant-human conflict) in Northern and Eastern Provinces**

Elephant-human conflict is a major issue in the dry zone of Sri Lanka including the Northern and Eastern provinces. According to recent estimates by the Department of the Wildlife Conservation, the total number of elephants in the wild is over 4,000[65]. The natural habitats of these wild elephants are dry and intermediate zone forests; for this reason elephant-human conflict in the dry zone areas of the country is very critical and warrants urgent solutions. As a result of the elephant-human conflict, it has been recorded that on average the country looses elephants at a rate of 150 animals per year and human lives at about 50 per year, in addition to eceonomic costs of damage to property and crops due to these conflicts[66].

Data on elephant-human conflict in Northern and Eastern Provinces is not available due to the situation that prevailed during the last several decades. However, it is likely that elephant-human conflict may be the same as in the other dry zone areas of the country.

Addressing human-elephant conflict will support stabilization of communities in the conflict affected areas, and allow for sustainable and equitable economic growth in communities in the Northern and Eastern Provinces. Best practices to mitigate animal-human conflicts (elephant-human conflict) should be developed through consultation with relevant authorities and stakeholders and implemented effectively with the participation of communities and other relevant organizations in the area. Once developed, best practices should be taken into account in USAID/Sri Lanka activities through the appropriate environmental compliance mechanisms to ensure sustainability of all development programs.

**3) Declaration and preparation of participatory management plans for all PAs**

Identification, survey, and demarcation of critically important habitats (terrestrial, wetland, coastal & marine) with high biodiversity outside the already gazetted PA system in the Northern and Eastern Provinces, with appropriate community participation, is required in order to declare these areas for protection under the appropriate legislation. Other critical areas include Important Bird Areas (IBA) (currently there are 10 IBAs in the N/E provinces) and landscapes with non-state sector ownership.

[65] MoENR, 2006, National Elephant Conservation Policy, DWC

[66] MoENR, 2008, Caring for the Environment- Path to Sustainable Development, Action Plan 2008 – 2012, Ministry of Environment & Natural Resources, Sri Lanka

Appropriate participatory management plans should be developed for these protected areas to ensure effective and sustainable in Northern and Eastern provinces.

Management plans should include adequate emphasis on improvement of livelihoods in surrounding communities to reduce their undesirable dependency on resources from PAs. Involvement in participatory management of PAs will provide surrounding communities with increased livelihood development opportunities. Some of these livelihood development opportunities could include establishment of plant nurseries by communities, development of forest and biodiversity-based cottage industries such as rattan and bamboo, and other suitable non timber forest products. Nature based tourism with sharing of benefits with local communities will also be an important option in management plans. A strong and effective social mobilization programme should be one of the key components of the plans.

Community based organizations and the public and private sectors need to be involved throughout the management planning process and implementation of the plans, including monitoring and evaluation.

### 4) Improved participatory resource management in all Protected Areas

Participatory management plans prepared under item (3) must be implemented effectively with the participation of all the relevant stakeholders. One of the main features of these plans and their implementation needs to be improvement of livelihoods in surrounding communities. Livelihood improvement encourages people to participate and develop a sense of ownership of the programme, thereby reducing the detrimental use of resources from PAs.

### 5) Improved resource management of the coastal/marine environment

All development activities in the coastal zone should be planned and implemented in an environmentally sound manner, under the guidelines provided in the Coastal Zone Management Plan (CZMP) and other relevant policies and procedures. Integrated coastal zone management should also be encouraged in consultation with all stakeholders for development activities that have the potential to impact the coastal zone. The implementation of CZMP and EIA procedures should be strengthened to reduce inappropriate coastal zone development and habitat degradation through capacity building of relevant government institutions, and other stakeholders including the private sector and communities. USAID/Sri Lanka should continue to utilize USAID's environmental compliance procedures (22 CFR 216) to identify entry points for mitigating actions that support improved management of the marine and coastal environment, and to monitor all programs to ensure sustainability of investements in coastal regions.

# 9. LIST OF REFERENCES:


1. Abeykoon, A.T.P.L, 2000, Population Profile. In: Natural Resources of Sri Lanka, 2000. National Science Foundation, Sri Lanka

2. ABD/JBIC/WB, 2005, Sri Lanka 2005 Post-Tsunami Recovery Program, Preliminary Damage and Needs Assessment, January 10-28, 2005, Colombo, Sri Lanka.

3. Ariyadasa, K.P, 2002, Assessment of Tree Resources in the Home Gardens of Sri Lanka, EC-FAO Partnership Programme (2000-2002), Project GCP/RAS/173/EC.

4. Arjuna's Atlas of Sri Lanka, 1997. Arjuna Consulting Co Ltd, Sri Lanka.

5. Ashton, P.S, and C.V.S. Gunatilleke 1987. New light on the plant geography of Ceylon, I: Historical plant geography. *J. Biogeogr*, 14.

6. Bandaratillake, H.M, 2001, Forests out of bounds: impacts and effectiveness of logging bans in natural forests in Asia and Pacific, FAO, Regional Office for Asia and the Pacific, Bangkok.

7. Bandaratillake, H.M, 2008, Saving Forests Saving Livelihoods, Contributing to the Conservation of the Unique Biodiversity of the Threatened Rainforests of Southwest Sri Lanka, M/E&NR, FD & UNDP

8. Bandaratillake, H.M. 1999, Optimal Land Use in the Hill Country of Sri Lanka, Economic Policy Reforms and the Environment: Land Degradation in Sri Lanka, La Trobe University, Australia.

9. Bryan Norton, 1988, Commodity, Amenity and Morality: The Limits of Quantification in Valuing Biodiversity, P200, in Biodiversity by Wilson, E.O, Peter, F.M, National Academy of Sciences (U.S.), Smithsonian Institution, 1988.

10. C. Legg & N.Jewell, Forest Map of Sri Lanka; Sri Lanka Forester, Volume XX, Nos. 3&4, Forest Department, Sri Lanka, (1995).

11. CBSL, 2009, Annual Report of the Central Bank of Sri Lanka.

12. CBSL, 2010, Central Bank of Sri Lanka, Annual Report- 2010

13. Cooray, 1984, An Introduction to the Geology of Sri Lanka (Ceylon), (2 ed.). Colombo: National Museums of Sri Lanka.

14. CZMP, 2003 – Revised Coastal Zone Management Plan, Sri Lanka, 2003. Coast Conservation Department, Colombo, Sri Lanka, in Joseph. L, National Report of Sri Lanka on the Formulation of a Transboundary Diagnostic Analysis and Strategic Action Plan for the Bay of Bengal Large Marine Ecosystem Programme, Ministry of Fisheries and Ocean Resources, Sri Lanka

15. D/C&S, 2010. Agriculture and Environment Statistics Division, Department of Census and Statistics, Sri Lanka, 2010

16. DCS, 2010, Department of Census and Statistics (2010), Sri Lanka

17. FAO, 2001, Forests out of bounds: Impacts and effectiveness of logging bans in natural forests in Asia-Pacific, FAO Regional Office, Bangkok.

18. FD, 2001, Administration Report of the Conservator General of Forests, Forest Department, Sri Lanka, 2001

19. Fonseka, H.H and Fonseka, R.M, 2010, *Problems and prospects of using CWR in National Crop Improvement Programmes*, Conservation and Utilization of Crop Wild Relatives of Sri Lanka, Department of Agriculture and MoENR, Colombo

20. Forest Department Manual- Sri Lanka, Forest Department, Sri Lanka (2008).

21. Gunatilleke, N, Pethiyagoda, R & Gunatilleke, S, 2008; Biodiversity of Sri Lanka, Journal of the National Science Foundation, 36 Special issue, Sri Lanka.

22. Hochegger.K, 1995,Farming Like the Forest, *Traditional Home Garden System in Sri Lanka,* Tropical Agro-ecology 191, Margraf Verlag

23. Ilankoon, J and Wijesekara, A. 2008, Crop Wild Relatives of Sri Lanka and their Conservation, MoENR, Colombo.

24. IUCN & WCMC (1997). Designing an optimum protected areas system for Sri Lanka's natural forests, Vol. 1 & 2. Forest Department, Ministry of Forestry and Environment, Battaramulla

25. IUCN, 1993, Biological Conservation in Sri Lanka, A National Status Report, Revised version, 1993, IUCN Sri Lanka Country Office.

26. IUCN, 1994, Guidelines for protected area management categories. IUCN Commission on National Parks and Protected Areas with the assistance of the World Conservation Monitoring Centre. IUCN-The World Conservation Union, Gland, Switzerland and Cambridge, UK.

27. IUCN, 1997, David William Pearce, Dominic Moran, The economic value of biodiversity, IUCN Biodiversity Programme, 1997, *(http://books.google.com/books?id=RdH6DRZY0KIC&source=gbs_similarbooks)*

28. IUCN, 2007, The 2007 Red List of Threatened Fauna and Flora of Sri Lanka.

29. IUCN, 2009, Improving Forest Governance in Knuckles: Dialogue and development of better outcomes, The World Conservation Union, Colombo, Sri Lanka

30. Joseph. L, 2003, National Report of Sri Lanka on the Formulation of a Transboundary Diagnostic Analysis and Strategic Action Plan for the Bay of Bengal Large Marine Ecosystem Programme, Ministry of Fisheries and Ocean Resources, Sri Lanka

31. Knox, R, 1681, An historical relation of Ceylon, New edition, The Ceylon Historical Journal, Vol. VI (1-4), In Nanayakkara V.R. Forests and Forestry in Sri Lanka: *An Historical Perspective*, Commonwealth Forestry Initiative, Commonwealth Secretariat.

32. Manawadu, L, 2010, Review of Databases on Invasive Alien Species in Marambe, B et al, 2010, Invasive and Alien Species: Strengthening Capacity to Control Introduction and Spread in Sri Lanka, MoE/UNDP.

33. Mittermeier, R.A, P.R.Gill, M.Hoffman, J.Pilgrim, T.Brooks, C.G. Mittermeier, J.Lamoreux, and de Fonseca G.A.B, 2005. Hotspots revised: Earth's biologically richest and most threatened terrestrial ecoregions. Conservation International, Washington D.C, USA.

34. MoAL&F, 1995, Sri Lanka Forestry Sector Master Plan, Ministry of Agriculture, Lands and Forestry, Sri Lanka

35. MoALF, 1995, Sri Lanka Forestry Sector Master Plan, Ministry of Agriculture, Lands and Forestry

36. MoE&NR, 2003, National Environmental Policy**,** Ministry of Environment and Natural Resources, Sri Lanka.

37. MoE&NR, 2007, Biodiversity Conservation in Sri Lanka: A Framework for Action. ADDENDUM, Ministry of Environment and Natural Resources, Biodiversity Secretariat.

38. MoE&NR, 2007, Thematic Assessment Report on Climate Change, National Capacity Needs Self Assessment for Global Environmental Management, Ministry of Environment and Natural Resources, Sri Lanka.

39. MoE&NR, 2008, Hand Book on MEAs, Ministry of Environment and Natural Resources, Sri Lanka

40. MoE&NR/FD/UNDP, 2000, Conservation of the Unique Biodiversity of the Threatened Rainforests of Southwest Sri Lanka, M/E&NR, FD & UNDP

41. MoE,2010, Sector Vulnerability Profile: Biodiversity and Ecosystem Services, Ministry of Environment

42. MoENR, 2002, Sri Lanka's Middle Path to Sustainable Development in the 21st Century, National Report of Sri Lanka, to the World Summit on Sustainable Development

43. MoENR, 2002, State of the Environment in Sri Lanka, Ministry of Environment and Natural Resources, Sri Lanka.

44. MoENR, 2002, State of the Environment in Sri Lanka, Ministry of Environment & Natural Resources, Sri Lanka.

45. MoENR, 2002, State of the Environment in Sri Lanka, Ministry of Environment and Natural Resources

46. MoENR, 2006, National Elephant Conservation Policy, Department of Wildlife Conservation, Sri Lanka.

47. MoENR, 2008, Caring for the Environment- Path to Sustainable Development, Action Plan 2008 – 2012, Ministry of Environment & Natural Resources, Sri Lanka.

48. MoENR, 2008, Hand Book on MEAs *(Multilateral Environmental Agreements),* Ministry of Environment and Natural Resources, Sri Lanka

49. MoENR, 2008. The nomination of the Central Highlands of Sri Lanka: Its cultural and Natural Heritage. Submitted to UNESCO by the Government of the Democratic Socialist Republic of Sri Lanka

50. MoENR, 2009, Sri Lanka Environmental Outlook, Ministry of Environment & Natural Resources, Sri Lanka.

51. MoENR, 2009: Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity, Ministry of Environment and Natural Resources, Sri Lanka.
52. MoENR, 2009: Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity. Ministry of Environment and Natural Resources, Sri Lanka.

53. MoENR, 2009: National Action Plan for Haritha Lanka Programme, National Council for Sustainable Development, Presidential Secretariat. Ministry of Environment and Natural Resources.

54. MoENR, Proceedings of the workshop on Alien/invasive species in CBD Thematic Report on Alien Species

55. MoENR/EML, 2006, Portfolio of Strategic Conservation Sites / Protected Area Gap Analysis in Sri Lanka, EML Consultants, Sri Lanka

56. MoF&E, 2000, National Wildlife Policy, Department of Wildlife Conservation, Sri Lanka.

57. MoFE, 1998, Biodiversity Conservation in Sri Lanka: A Framework for Action, Ministry of Forestry and Environment, Sri Lanka.
58. MoFE/IUCN/WCMC, 1997, Designing an Optimum Protected Areas System for Sri Lanka's Natural Forests

59. Nanayakkara, V.R, 1996, Forests and Forestry in Sri Lanka: An Historical Perspective, Commonwealth Forestry Initiative, Commonwealth Secretariat, Britain.

60. NARESA 1991, Natural Resources of Sri Lanka: Conditions and Trends. Natural Resources, Energy and Science Authority of Sri Lanka, Sri Lanka

61. National Environmental Policy**,** Ministry of Environment and Natural Resources, Sri Lanka

62. Norman M, Russell A, et.al (2005). Biodiversity hotspots for Conservation Priorities.

63. Rajasuriya et al., 2000 Status of coral reefs in South Asia: Bangladesh, India, Maldives and Sri Lanka. In status of coral reefs of the world: 2000 A GCRMN publication Edited by C. Wilkinson, in MoENR, 2009: Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity.

64. Samarakoon, J. I. and L. Pinto, 1988 – Synthesis report for information on critical habitats in the coastal zone: Workshop on Critical Habitats in the Coastal Zone, CCD/US AID/URI, in Joseph. L, National Report of Sri Lanka on the Formulation of a Transboundary Diagnostic Analysis and Strategic Action Plan for the Bay of Bengal Large Marine Ecosystem Programme, Ministry of Fisheries and Ocean Resources, Sri Lanka

65. Silva, G L L P and Himali, S M C, 2005, Status of the farm animal genetic resources in Sri Lanka, University of Peradeniya and Department of Animal Production and Health, in Sector Vulnerable Profile: Biodiversity and Ecosystem Services, The National Climate Change Aduptation Strategy for Sri Lanka. MoE, 2010.

66. Sri Lanka Forestry Outlook Study, Asia-Pacific Forestry Sector Outlook Study II, Working Paper No: APFSOS II/WP/2009/29, Forest Department, Government of Sri Lanka, FAO, Bangkok (2009).

67. Tropical Forestry and Biodiversity (FAA 118 and 119) Analysis: Lessons Learned and Best Practices from Recent USAID experience (1995).

68. USAID, 2005, Best Practices for Biodiversity and Tropical Forest Assessments, April 2005.

69. USAID, 2005, Biodiversity Conservation: A Guide for USAID Staff and Partner, September 2005.

70. USAID, 2006. Issues in Poverty Reduction and Natural Resource Management.

71. USAID, 2005, Tropical Forestry and Biodiversity (FAA 118 and 119) Analyses: Lessons learned and best practices from recent USAID experience, September 2005.

72. Weerakoon, D.K, 2011, Important Bird Areas (IBA) Programme, Sustainable Biodiversity and Economic Development, Department of Zoology, University of Colombo (Presentation made on 21th July 2011-Un published)

# APPENDICES

## Appendix A

### The Scope of Work (SOW) for the Sri Lanka Topical Forest and Biodiversity Analysis

**Purpose and Objective:**

The purpose of this contract is to conduct an assessment of biodiversity conservation needs in order to comply with sections 118 and 119 of the Foreign Assistance Act of 1961, as amended, and country strategy guidelines under ADS 201.3.4.11 and ADS 204.5. Based on this assessment, the Mission shall define how its new three-year country program strategy contributes to conservation needs in Sri Lanka, as required by agency regulations. The assessment recommendations will also serve as a planning tool to assist USAID/Sri Lanka in better integrating environment concerns into its overall program.

**Background:**

USAID/Sri Lanka has recently developed a new country strategic plan for Sri Lanka. The U. S. Foreign Assistance Act of 1961 Section 119 requires USAID to analyze national needs for conserving biological diversity and potential USAID contributions to these needs in all country strategy plans. Specifically, FAA Section 119(d), Country Analysis Requirements requires that: "Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of: (1) the actions necessary in that country to conserve biological diversity, and (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified. (FAA, Sec. 119(d)."

**Statement of Work:**

The Contractor shall evaluate biodiversity concerns in Sri Lanka. The focus of all activities and products under this assignment is twofold: 1) to identify actions necessary to conserve biodiversity, and 2) to describe how and to what extent actions proposed in the Mission's country strategic plan meet, or could meet, the biodiversity needs thus identified. The Contractor shall carry out the following activities and deliver the following products:

**Data Collection**:

1. The Contractor shall meet with USAID/Sri Lanka to get an understanding of the Mission's ongoing sectoral assessments, program goals and objectives under its new three-year strategy. The Mission also may provide the Contractor with advice and protocol on approaching USAID partners and host country organizations with respect to this assignment. The Contractor shall be aware of sensitivities related to an assessment exercise (e.g., the potential for raising expectations, and the need to be clear as to the purpose of the assessment) and respect Mission guidance. The Contractor will discuss organizations to be contacted and any planned site visits with the Mission and coordinate as required.

2. The Mission Environment Officer will facilitate meetings with the Mission Director and Office Directors at USAID to allow the Contractor to gain a full understanding of the country program and strategy. The Mission Environmental Officer will help facilitate interaction and information exchange with any other assessment teams in the field as necessary.

4. The Contractor shall obtain, review and analyze existing documentation on biodiversity conservation and tropical forest conservation in Sri Lanka, such as that prepared by government

agencies, bilateral donors, and national and international NGOs. Examples of such documentation may include the National Biodiversity Conservation Strategies and Action Plan (NBSAP), National Environmental Action Plan (NEAP); Global Environment Fund (GEF) project reports; reports by FAO, UNESCO, UNEP, or UNDP; reports by conservation NGOs, etc.

5. The Contractor shall, in coordination with the Mission Environment Officer, hold meetings with relevant ministries and agencies, donor organizations, NGOs, and other organizations which are involved in forest and biodiversity conservation, cross-cutting issues, or which are implementing noteworthy projects, and gather relevant information.

6. The Contractor shall conduct one to three priority site visits, if necessary to supplement the understanding gained from interviews, literature, and other second-hand sources.

**Analysis**:

The Contractor shall: summarize the status of biodiversity and tropical forests in Sri Lanka; Summarize the social, economic, institutional, legal, and policy context for their use and conservation, including actions currently being taken by government, other donors, NGOs, and the private sector; Identify the key direct and indirect threats to biodiversity and tropical forests; Identify the actions necessary to conserve and sustainably manage natural resources and biodiversity and tropical forests in Sri Lanka in the current context, based on analysis of country donor and NGO responses to meet these needs; and Prepare a draft report for review and comments by USAID/Sri Lanka on the status of biodiversity conservation efforts in Sri Lanka and implications for USAID or other donor programming and environmental monitoring which shall define the actions necessary for conservation.

**Report**:

The Contractor shall prepare and deliver a final report describing the analysis and conclusions. This report shall meet the legal requirement of FAA Sec 118 and 119 by:

1) Clearly articulating the actions necessary to conserve biodiversity and tropical forests in Sri Lanka; and
2) Clearly describing the extent to which actions proposed in the USAID/Sri Lanka strategic plan meet the needs identified. FAA Sections 118 and 119 do not require USAID to invest in conserving biological diversity or tropical forests, although it is encouraged more broadly to do so under these sections of the FAA.

The report, of between 30 and 60 pages in length (excluding attachments and appendices), shall include sections covering the following topics:

- **Title Page**, including the date of completion of the analysis report
- **Table of Contents**
- **Introduction**, describing the purpose of the analysis and methods used in conducting it, including the timing of the analysis in relation to the timing of USAID strategy development.
- **An overview of the status of biodiversity in Sri Lanka**, including ecosystem diversity, species diversity, threatened & endangered species, genetic diversity, agricultural biodiversity, ecological processes and ecosystem services, and values and economics of biodiversity and forests. A map of potential natural vegetation and of land use or land/forest cover should be provided if available.
- **An overview of the social, economic, and political context** for sustainable natural resources management and the conservation of biodiversity and forests in Sri Lanka, including the social and economic environment; institutions, policies, and laws affecting conservation; the national protected area system including all IUCN categories of protected

areas; laws affecting the protection of endangered species; and participation in international treaties. A map of the protected areas system should be provided if available.

- **A review and summary of government, NGO, and donor programs and activities** that contribute to conservation and sustainable natural resources management, and an assessment of their effectiveness, strengths, and weaknesses.
- **An assessment of the threats to biodiversity**, including direct threats and indirect threats or root causes of the direct threats.
- **A list or description of the actions necessary** to conserve biodiversity and forests in Sri Lanka, logically flowing from the review of the threats, and what is currently being done by government, NGO, and donor programs that address those threats.
- **A review of the proposed USAID/Sri Lanka strategy and program**, as well as a review of existing programs as they fit with the proposed strategy. This shall be followed by an analysis of the extent to which USAID current and planned programs help meet the needs identified in Section F. This section should also point out any threats to biodiversity and forests from activities proposed for USAID support, and suggest mitigating actions. It should also identify opportunities for cross-cutting, cross-sectoral linkages with proposed activities especially those that would be low cost and/or would enhance the effectiveness of the proposed activities.
- **All references** used and cited in the report should be listed; web URLs for information resources should also be provided.
- **Appendices** to the report should contain, at minimum the SOW for the analysis, biographical sketches of analysis team members, a list of persons contacted and their institutional affiliation, and other background or supporting material as needed.

Further notes, clarifications or requests for additional available information to be included in analysis report may be added as desired by the Mission during the review process.

### Deliverables:

The Contractor's primary deliverable under this contract is the Sri Lanka Tropical Forest and Biodiversity Analysis delineated above that examines the biodiversity, natural resource management, tropical forest and other related environmental issues and identifies contributions and/or potential contributions to meeting identified conservation needs by the USAID/Sri Lanka's new three-year strategy. The Contractor shall submit a draft Sri Lanka Tropical Forest and Biodiversity Analysis to the Mission Environment Officer for Mission review and comments. Upon receipt of Mission inputs, the Contractor shall finalize the report and submit it to the Mission Environment Officer for Mission final review and acceptance.

### Scheduling and Logistics:

The Contractor will coordinate the timing of activities and logistical arrangements with the USAID/Sri Lanka Mission Environment Officer and with the USAID/Washington International Expert upon his/her arrival, who will jointly be responsible to guide the Contractor's efforts and provide input for the Contractor's final work product. The Mission may assist the Contractor by providing available key references and contacts as well as available logistical support when deemed needed and necessary. USAID/Sri Lanka's Environment Officer and the Program Office will also help facilitate meetings with the Mission Director, Mission Office Directors or their staff to fully brief the Contractor on USAID's program and future vision for their strategy.

# Appendix B 1

**List of Participants for the Briefing Meeting on Preparation of the Report on Sri Lanka Tropical Forest and Biodiversity Analysis**
**IUCN SRILANKA COUNTRY OFFICE**
**30TH June 2011**

| No | Name | Organization |
|---|---|---|
| 1. | Ariyadasa K. P/Mr | Conservator of Forests (Operations), Forest Department |
| 2. | Sathurusinghe Anura/Mr | Conservator of Forests (Research & Education), Forest Department |
| 3. | Gunasekara Samantha/Mr | Sri Lanka Customs |
| 4. | Gunathilaka W M P/Ms | Deputy Director, Central Environment Authority |
| 5. | Ruwanpathirana Nimal/Dr | D.G.M-(Research , Development & Training), State Timber Corporation |
| 6. | Ratnayake R S S/Mr | Ministry of Environment |
| 7. | Tennakoon Ajith/Mr | Regional Field Director (S&W), Sewalanka Foundation |
| 8. | Munasinghe Nalin/Mr | FAO, Sri Lanka |
| 9. | Pilapitiya Sumith/Dr | Senior Environment & Infrastructure Engineer, World Bank, Sri Lanka |
| 10. | Volk Richard/Mr | Natural Resource management, USID , International Consultant |
| 11. | Dissanayake Priyanka/Ms | Project Management Specialist, USAID |
| 12. | Bandaratillake Herath/Mr | Consultant |
| 13. | Shamen Vidanage/Mr | Acting Country Representative, IUCN , Sri Lanka |
| 14. | Sampath de A Goonatilake/Mr | Programme Officer, IUCN , Sri Lanka |

# Appendix B2

**List of Participants for the Workshop on**
**Sri Lanka Tropical Forest and Biodiversity Analysis**
**Held at Waters Edge, Capital City, Battaramulla**
**21st July 2011**

| No | Name | Organization |
|---|---|---|
| 1. | Amarasinghe Anusha/Ms | Head, International Liaison Division, National Science Foundation (NSF) |
| 2. | Ariyadasa K P/Mr | Conservator of Forests (Operations), Forest Department |
| 3. | Sathurusinghe Anura/Mr | Conservator of Forests (Research & Education), Forest Department |
| 4. | Daraniyagala Ravi/Mr | President, Wildlife and Nature Protection Society of Sri Lanka |
| 5. | De Silva Darshani/Ms | World Bank |
| 6. | Gunasekara Samantha/Mr | Sri Lanka Customs |
| 7. | Jayasinghe Gamini/Mr | Acting DDG(EMA), Deputy Director, Central Environment Authority |
| 8. | Ruwanpathirana Nimal/Dr | D.G.M-(Research , Development & Training), State Timber Corporation |
| 9. | Gamage, Gamini/ Mr | Director, Biodiversity Secretariat, Ministry of Environment |
| 10. | Hettiarachchi Shiranthi/Ms | Ministry of Fisheries and Aquatic Resources |
| 11. | Ratnayake R S S/Mr | Ministry of Environment |
| 12. | Tennakoon Ajith/Mr | Regional Field Director (S&W), Sewalanka Foundation |
| 13. | Munasinghe Nalin/Mr | FAO, Sri Lanka |
| 14. | Perera Susantha/Mr | Ministry of Finance and Planning (MF&P) |
| 15. | Pradeep Gayan/Mr | Green Movement of Sri Lanka (GMSL) |
| 16. | Premathilake B H J/Mr | Project Manager/GEF-IFAD Project, Coast Conservation Department |
| 17. | Samarasekera Hector/Mr | Individual Expert |
| 18. | Dissanayake Priyanka/Ms | Project Management Specialist, USAID |
| 19. | Bandaratillake Herath/Mr | IUCN, Consultant |
| 20. | Shamen Vidanage/Mr | Acting Country Representative, IUCN , Sri Lanka |
| 21. | Ms Candice Perera | IUCN |
| 22. | Mr Deepal Perera | IUCN |

# Appendix C

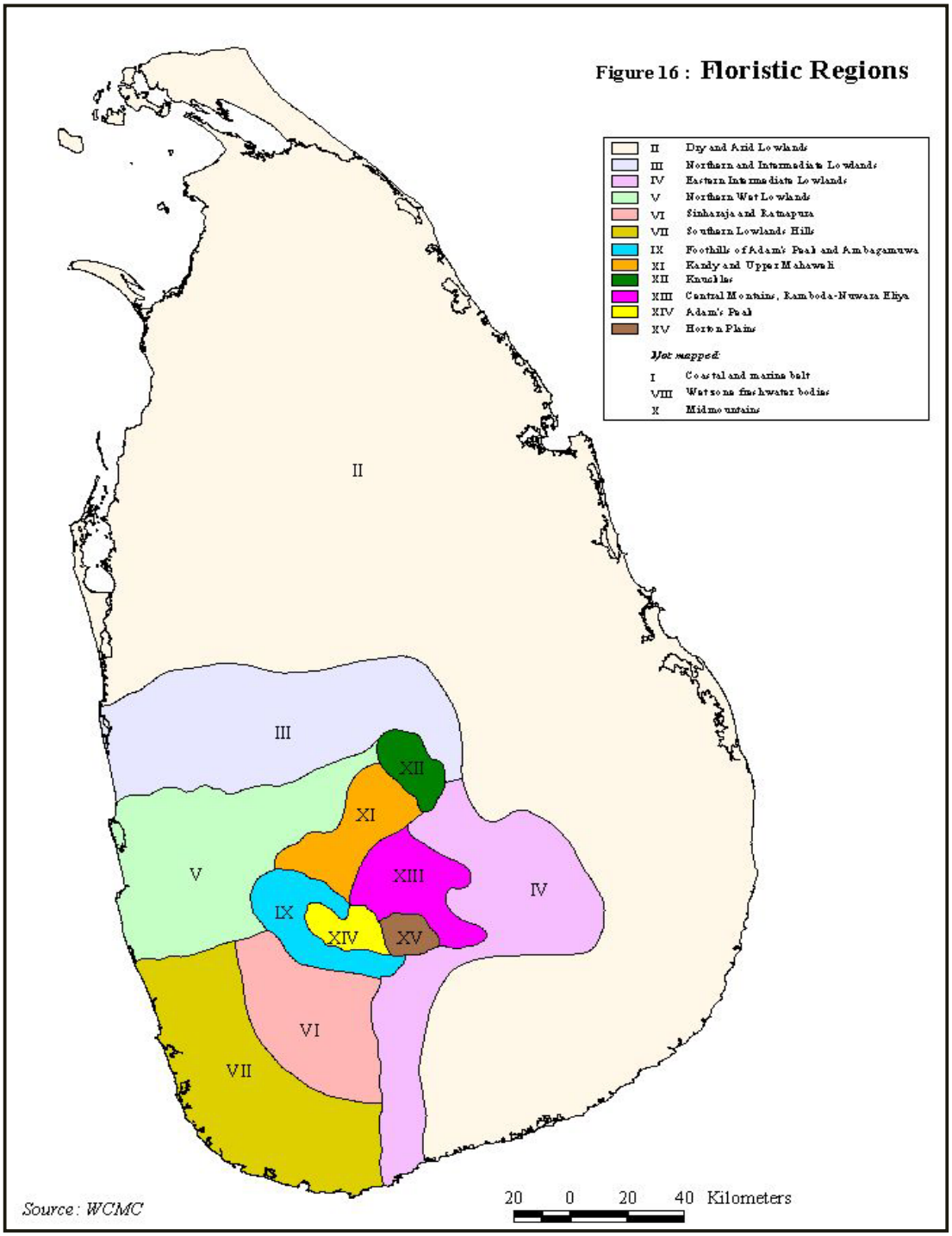
## Participants for the Community Organizations Meeting
## Field Visit to KDN Forest Complex
## 4th July 2011

| No | Name | Organization |
|---|---|---|
| 1. | N.W. Karunaratne | Veda Madura, Thavalama South, Thavalama |
| 2. | N.H.Anusha Thilani | Koralegama, G/Panangala |
| 3. | Lalitha Gamage | Lalitha Gamage |
| 4. | K.A. Dhanavathi | Hiniduma – North |
| 5. | M.A. Maduri | Malgolla, Talangalla |
| 6. | L.L. Malani | Malgalla, Talangalla |
| 7. | Ranjani Apa Seneviratne | Nugagala Road, Hniduma |
| 8. | P.P.Chandrika | “Sachin” Tavalama south, Tavalama |
| 9. | W.K. Rohini | Malgalla, Talangalla |
| 10. | Samanthika Sandamali | ‘Jaya Aruna’ Malgalla, Talangalla |
| 11. | Sunil Ranaveera | BFO, Kanneliya FR, Department of Forest Conservation |
| 12. | K.B. Anura | Forest officer, Kanneliya FR, Department of Forest Conservation |
| 13. | H.I.P.T Dimuthu Kumara | Forest Officer, Tavalama B- Office |
| 14. | Richard Volk | International Consultant, USAID |
| 15. | H. M. Bandarathilake | Consultant, IUCN, Sri Lanka |
| 16. | Sampath de A. Goonatilake | Programme Officer, IUCN, Sri Lanka |

# Appendix D

## Map of Fifteen (15) Floristic Regions in Sri Lanka

Source: Gap Analysis Report



# Appendix E

## List of Protected Areas widely used for nature tourism in Sri Lanka

| No | Name of the Site | Category/Legal Status | Main Ecosystem | Extent ($km^2$) | Management |
|---|---|---|---|---|---|
| 1 | Yala | NP | Forest | 978.8 | DWC |
| 2 | Udawalawa | NP | Forest | 308.2 | DWC |
| 3 | Bundala | BR/NP | Wetland/Forest | 62.2 | DWC |
| 4 | Wasgamuwa | NP | Forest | 370.6 | DWC |
| 5 | Wilpattu | NP | Forest | 1,316.7 | DWC |
| 6 | Kumana | NP | Wetland/Forest | 181.5 | DWC |
| 7 | Lahugala Kitulana | NP | Forest | 15.5 | DWC |
| 8 | Gal-Oya | NP | Forest | 259.0 | DWC |
| 9 | Maduru-Oya | NP | Forest | 588.5 | DWC |
| 10 | Somawathiya | NP | Forest | 396.5 | DWC |
| 11 | Flood Plains | NP | Forest/Wetland | 173.5 | DWC |
| 12 | Lunugamvehera | NP | Forest | 235.0 | DWC |
| 13 | Minneriya | NP | Forest | 88.9 | DWC |
| 14 | Kaudulla | NP | Forest | 69.0 | DWC |
| 15 | Hikkaduwa | NP | Marine | 1.0 | DWC |
| 16 | Pigeon Island | NP | Forest/Marine | 4.7 | DWC |
| 17 | Horagolla | NP | Forest | 0.1 | DWC |
| 18 | Galway's Land | NP | Forest | 0.3 | DWC |
| 19 | Angammedilla | NP | Forest | 75.3 | DWC |
| 20 | Ussangoda | NP | Forest | 3.5 | DWC |
| 21 | Mullaitivu | NP | Forest | NA | DWC |
| 22 | Horton Plains | NP | Forest/Grassland | 31.6 | DWC |
| 23 | Sinharaja | WHS/BR/NHWA | Forest | 88.6 | FD |
| 24 | Knuckles | CF | Forest | 170.0 | FD |
| 25 | Kanneliya | BR/FR | Forest | 80.3 | FD |
| 26 | Hurulu | BR/FR | Forest | 25.5 | FD |
| 27 | Udawattakele | S/FR | Forest | 1.9 | FD |
| 28 | Namaluyana | CF | Forest | NA | FD |

# Appendix F

## Key Institutions for Conservation of Biodiversity and Forest Resources

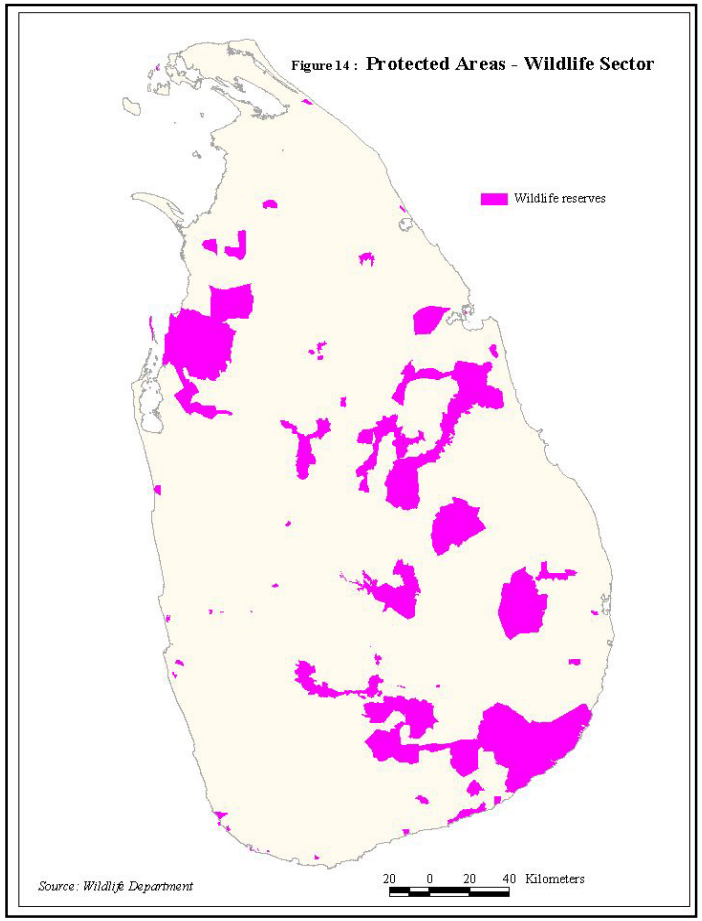
| No | Institution | Role / Responsibility |
|---|---|---|
| | **State Organizations/Ministries** | |
| 1. | Ministry of Environment | Management of the environment and natural resources of Sri Lanka. Conservation of biodiversity is the main responsibility of the Biodiversity Secretariat of ME. |
| 2. | Ministry of Agrarian Services and Wildlife Conservation | Administration of the Agrarian Services Act. and Paddy Land Tenure, Preparation of policies for the Wildlife sector of Sri Lanka. |
| 3. | Ministry of Finance and Planning | Design and execute economic and fiscal policies of the Sri Lanka |
| 4. | Ministry of Agriculture | Efficient and effective performance of the food, spices and allied crop in the country |
| 5. | Ministry of Lands and Land Development | Ensure the ownership to land through the management and development of land resources |
| 6. | Ministry of Fisheries and Aquatic Resources Development | Directing the utilization of fisheries and aquatic resources on sustainable basis |
| 7. | Ministry of Indigenous Medicine | Optimum use of the nationally available medical practice and resources for a healthy nation |
| 8. | Ministry of Livestock and Rural Community Development | Ensure sustainable development among rural community and in the livestock sector |
| 9. | Ministry of Economic Development | Regional and rural development, poverty alleviation, promoting investments to the country including tourism development |
| | **State Organizations/Departments** | |
| 1. | Forest Department (FD) | Conservation and Development of Forest Resources in Sri Lanka. In-situ conservation of forest resources |
| 2. | Department of Wildlife Conservation (DWC) | Protection and Management of wildlife resources of Sri Lanka. In-situ conservation of genetic resources |
| 3. | Department of National Zoological Gardens (DNZG) | Ex-situ conservation of native and exotic animals |
| 4. | Department of National Botanic Gardens (DNBG), | Provide opportunities for the public to study, sustainably conserve, and admire plant resources |
| 5. | Central Environmental Authority (CEA) | Protecting & managing the quality of the environment |
| 6. | Marine Environmental Protection Authority (MEPA) | Preventing marine pollution by using legislative authority |
| 7. | Department of Agriculture (DOA) | Maintaining and increasing productivity and production of the food crop sector in the country |
| 8. | Coast Conservation Department (CCD) | Sustainable management of coastal resources in the country |
| 9. | Department of Fisheries & Aquatic Resources (DFAR) | Management of Fisheries & Aquatic Resources for the sustainable development of the fishing industry |
| 10. | National Aquaculture Development Authority (NAQDA) | Development of coastal and brackish water aquaculture, fresh water aquaculture and inland fisheries |
| 11. | Department of Export Agriculture (DEA) | Enhancement of quality and quantity of Export Agricultural Production |

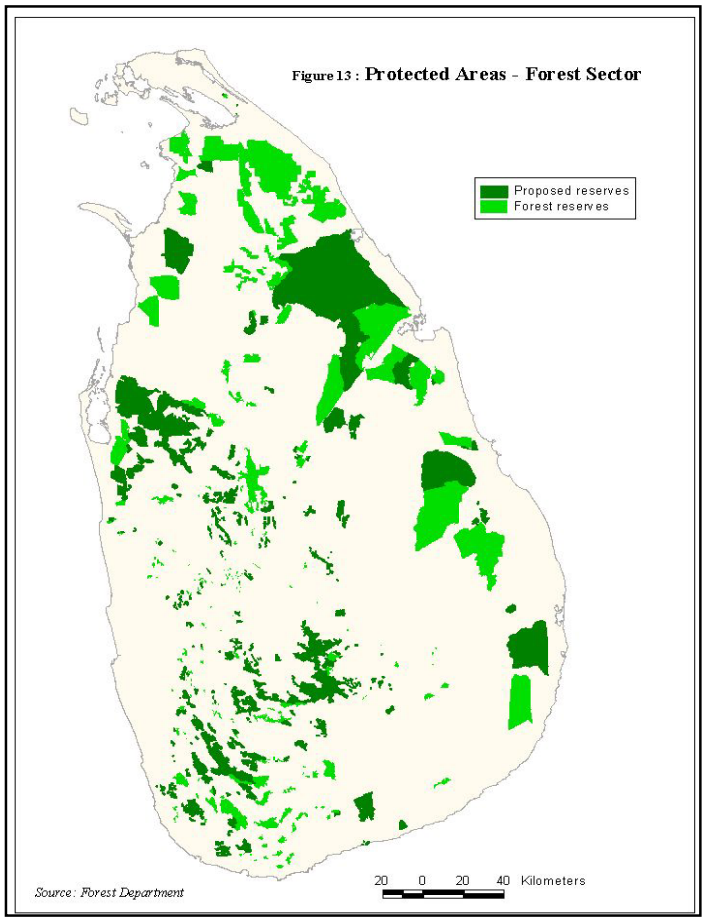
| | | |
|---|---|---|
| 12. | Department of Agrarian Development | Administration of the Agrarian Services Act and Implementation of Farmers' Social Security Benefit Scheme, Farmers' Credit Scheme |
| 13. | Department of Ayurveda | Restoration & development of Indigenous & Ayurvedic methods |
| 14. | Department of Animal Production & Health (DAPH) | Providing technical leadership to the livestock Industry and its stakeholders in the country. |
| 15. | Plant Genetic Resources Centre (PGRC) | Planning, implementing and co-ordination of activities related to conservation of plant genetic resources. |
| 16. | The National Science Foundation (NSF) | To initiate, facilitate and support basic and applied scientific research in the country. |
| 17. | Sri Lanka Customs | Enforce various statutes relating to biodiversity at the point of importation and exportation |
| 17. | Geological Survey and Mines Bureau (GSMB) | Issue Licenses to mine or explore minerals |
| 18. | Ceylon Tourist Board (CTB) | Regulate locations, constructions and operations of tourist activities through CTB guidelines |
| 19. | Urban Development Authority (UDA) | Designates all areas within km of the coastline as "Urban areas" subject to the planning and regulatory requirements of the Act. |
| 20. | Sri Lanka Land Reclamation and Development Corporation (SLRDC) | Reclamation of (low lying) marsh, waste or swamps |
| 21. | Board of Investment (BOI) | Approval and regulation of investments |

# Appendix G

## PAs Managed by the Forest Department and Department of Wildlife Conservation

**(Source:** Portfolio of Strategic Conservation Sites / Protected Area Gap Analysis in Sri Lanka, 2006)



# Appendix H

## List of Environmental Protection Area (EPAs) and Proposed EPAs

| No | Name of the EPA | Location | Gazette No & Date | Land use pattern |
|---|---|---|---|---|
| **Declared EPAs** | | | | |
| 01 | Muthurajawela Environmental Protection Area | Gampaha District | 1466/26-2006.10.13 | Wetland |
| 02 | Thalangama Environmental Protection Area | Colombo District | 1487/10 -2007.03.05 | Water body and paddy fields (Wetland) |
| 03 | Knuckels Environmental Protection Area | Kandy & Matale Districts | 1507/9-2007.07.23 | Forest (lands not under the jurisdiction of Forest Department) |
| 04 | Gregory Lake Environmental Protection Area | N'Eliya District | 1487/10 -2007.03.05 | Water body and the reservation (Wetland) |
| 05 | Maragala Mountain Range Environmental Protection Area | Monaragala District | 1560/26-2008.08.01 | Forest , Water shed , Wetlands |
| 06 | Walauwewatte Waturana Environmental Protection Area | Kaluthara District | 1598/21-2009.04.24 | Swam forest |
| 07 | Hanthana Environmental Protection Area | Kandy District | 1641/28-2010.02.17 | Forest, Watershed, Wetlands |
| **Proposed EPAs** | | | | |
| 01 | Proposed Dadigamuwa kanda Environmental Protection Area | Colombo District | | Mountain with forest and Watershed |
| 02 | Proposed Benthara Ganga Environmental Protection Area | Kaluthra District, Galle District, | | Water body and the reservation (Wetland) |
| 03 | Proposed Koggala lagoon Environmental Protection Area | Galle District | | Water body and the reservation (Wetland) |
| 04 | Proposed Gin Oya Environmental Protection Area | Puttlum District | | Water body and the reservation (Wetland) |

# Appendix I

## The Key Projects and Programmes on Forest and Biodiversity Conservation Implemented during the last 10 years

| No | Project/Funding | Period/ (Implementation Agency) | Objective |
|---|---|---|---|
| 1. | Conservation and Sustainable Use of Medicinal Plant Project (World Bank/GEF) | 1998-2004 DAU/FD/DWC | Conservation and Sustainable Use of Medicinal Plants (In-situ & Ex-situ Conservation) |
| 2. | The National Biosafety Framework Development Project (UNDP/GEF) | 2003-2005 (MoENR) | Risks due to modern biotechnology and its products would be minimized |
| 3. | The Crop Wild Relatives Project (UNEP/GEF) | 2004-2009 (MoA/MoENR) | In-situ conservation of crop wild relatives |
| 4. | Southwest Rainforest Conservation Project (UNEP/GEF) (GEF/UNDP) | 2000-2006 (FD) | Participatory forest conservation |
| 5. | The Forest Resources Management Project (ADB) | 2000-2009 (MoENR) | Conservation of Forest Resources |
| 6. | Sri Lanka Australia Natural Resources Management Project (Aus AID) | 2003-2008 (FD) | Poverty reduction through improved natural resource management |
| 7. | The Protected Area Management and Wildlife Conservation | 2001-2008 (DWC) | Protected Area Management & Wildlife Conservation |
| 8. | The Coastal Resources Management Project (ADB/ Netherlands) | 2000-2006 (CCD) | Coastal resources and habitat conservation |
| 9. | National Capacity Need Self Assessment Project (NCSA) (UNDP/GEF) | 2007-2009 (MoENR) | National Capacity Need Assessment for implementation of Convention on Biological Diversity |
| 10. | Strengthening Capacity for Climate Change Adaptation | 2009-2010 (MoENR) | To assist plan and develop a portfolio of priority and practical projects focused on climate |
| 11. | Mainstreaming agro-biodiversity conservation and use in Sri Lankan agro-ecosystem | 2010-2011 (MoE) | Agro-biodiversity conservation and use in Sri Lankan agro-ecosystem |
| 12. | Strengthening Capacity to Control the Introduction and Spread of Alien Invasive Species | 2008-2009 (MoENR) | Build capacity across sectors to control the introduction and spread of invasive species in Sri Lanka, |
| | **Relevant Institutional Programmes** | | |
| 1. | The National Red listing excercise | 2007 MoENR/IUCN | Preparation of the list of nationally threatened species |
| 2. | Publication of a National Wetlands Directory | 2006 CEA/IWMI/IUCN | Preparation of the list of wetlands in the island |
| 3. | Programme of work to implement the Marine Pollution Prevention Act | MEPA | To prevent Marine Pollution by implementation of Marine Pollution Prevention Act |
| 4. | Setting up Ex-situ conservation facilities | Department of Botanic Gardens | Ex-situ conservation of Genetic Resources |

# Appendix J

## Key projects implemented during the recent past in the sphere of forest and biodiversity conservation

### Forest Resources Management Project (FRMP):

The project was implemented (2000-2009) by the Ministry of Environment and Natural Resources with ADB funding. The main beneficiary from this project was the Forest Department (FD). The main programmes implemented under the project are; Capacity building of the FD by providing training and equipments (computers and equipment for field survey, inventory and communication) , targeted awareness and extension, agro-forestry, rehabilitation of degraded forests, buffer zone development through participatory community programmes, and boundary demarcation of natural forests and forest plantations, . Skills training under the project included technical assistance (TA) provided to the FD staff in related fields and revision of the curricula at the Sri Lanka Forestry Training Institute (SLFTI). In addition Assistance was provided for integrated management planning and biometrics, database development and management (for GIS databases), ecosystem and biodiversity management, improving the Environment Management Information System (EMIS) database established through the NCR. The project also provided assistance to enhance nature based tourism at Sinharaja, Knuckles and Kanneliya forest reserves with the involvement of local people.

### Protected Area Management and Wildlife Conservation (PAM&WLC) Project:

The project was implemented (2001-2008) by the Department of Wildlife Conservation (DWC) with funding from ADB/GEF/ Netherlands. The main beneficiary from the project was DWC. The key objectives of the project were: (a) enhancing institutional capacity in the DWC for wildlife management, (b) promoting participatory adaptive management, (c) facilitating collaborative conservation planning, and (d) sustainable financing for community partnership building. Institutional strengthening and human resource development for PA management, building technical and managerial competence in the DWC, habitat enrichment programmes, including management of alien invasive species and pilot research on invasive species eradication, grassland establishment and enhancing water and fodder for animals were conducted under the project. The project facilitated buffer zone community development and enhanced participation of communities in PA management. The project also developed visitor service plans for the pilot PAs, and provided enhanced visitor facilities by establishing visitor centres with interpretive material at several PPAs. The gap analysis carried out under this project also helped to assemble a strategic portfolio of conservation sites for Sri Lanka.

### The Coastal Resources Management Project (CRMP):

The project was implemented (2000-2006) by the Ministry of Fisheries and Ocean Resources with funding from ADB/Netherlands. The main beneficiary from the project was the Cost Conservation Department (CCD). The project activities included, Institutional strengthening of the Coast Conservation Department (CCD) by setting up a GIS unit in the CCD with the required facilities and a database, capacity enhancement for Integrated Special Area Management Planning in the coastal areas, assistance for conservation and mapping of coastal habitats and sites of archaeological, historical and scenic value; assistance for erosion management, controlling coastal water pollution, and identification of coastal land use patterns and sites for future development.

### Southwest Rainforest Conservation Project:

The project was implemented (2000-2006) by the Forest Department with funding from GEF/UNDP. The main beneficiary from the project was the FD. The project pilot tested the development of a viable participatory management model for wet zone forests in Sri Lanka, and was functional in buffer zone villages along the southern perimeter of the Sinharaja Forest Reserve and the perimeter of the

Kanneliya Forest. The project built capacity of the Forest Department for community mobilization and capacities of CBOs for operational affairs. The CBO members were trained in vocational training to develop technical and entrepreneurial skills to become self-reliant in the long-term through establishment of Community Trust Funds (CTFs) for which seed money were initially provided via the FD. The communities had a recognizable role in planning and managing the pilot forest reserves so that they remained committed stakeholders in the process.

As a result of this project, communities have become more aware of the value of the forests due to effective social mobilization, and a dialogue developed between the community and the Forest Department. This has generated greater local commitment towards conservation of the forest resources.

**Sri Lanka Australia Natural Resources Management Project (SLANRMP):**

The project was implemented (2003-2008) by the Forest Department with funding from Aus-AID. The main beneficiary from the project was the FD. The main objective of the project was poverty reduction through improved natural resource management. The project operated in two intermediate zone areas in the Kurunegala and Matale districts. The project intended for institutional capacity enhancement and human resources development in the FD and CBOs. The project expected handing over of the management of degraded forest patches to communities in adjacent villagers who would benefit from enhanced livelihoods due to project activities. This project acted as a pilot project to test an appropriate development processes that the Forest Department could implement through its institutional programmes on a routine basis.

**The National Biosafety Framework Development Project:**

The project was implemented (2003-2005) by the Ministry of Environment and Natural Resources with funding from GEF. Objective of the project was to ensure that the risks due to modern biotechnology and its products would be minimized and biodiversity, human health and environment will be protected; the transboundary movements of GMOs would be regulated through formulation of relevant policies, regulations, technical guidelines and establishment of management bodies and supervisory mechanisms.

# Appendix K

## Objectives of International Conventions regarding Biodiversity Conservation

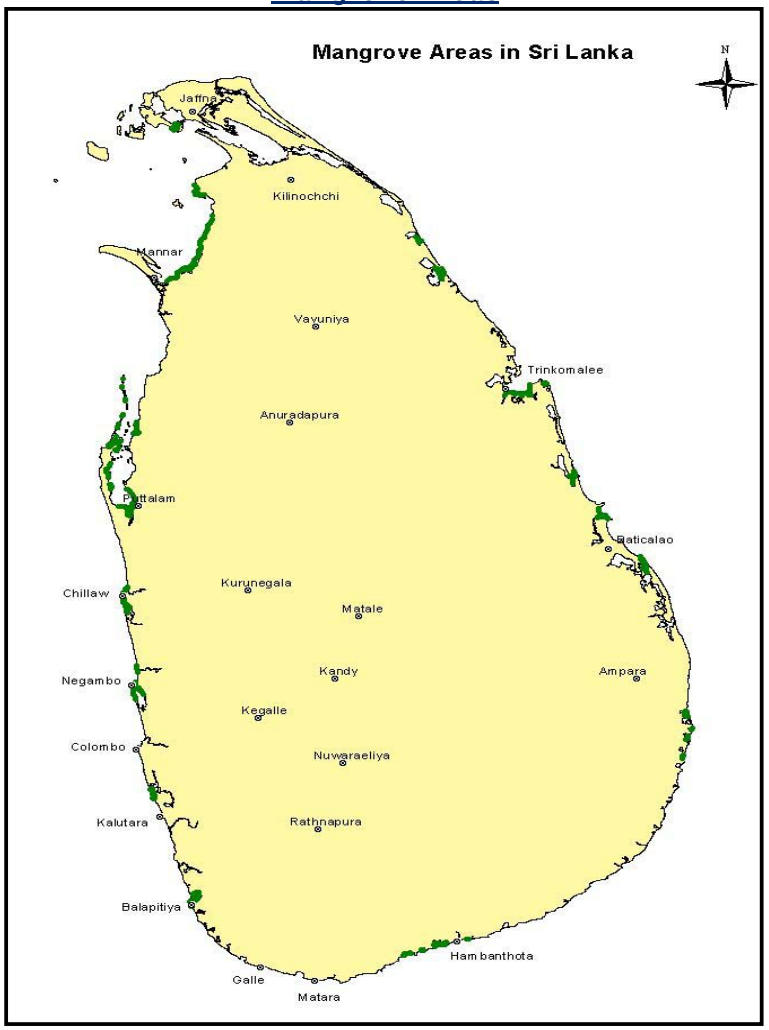
| Entry | International Agreement | Objective |
|---|---|---|
| 1952 | International Plant Protection Convention, 1951 | To maintain and increase international corporation in controlling pests and diseases of plants and plant products, and preventing their introduction and spread across national boundaries. |
| 1970 | UNESCO Man and Biosphere Programme | To establish a global system of Biosphere Reserves representative of natural ecosystems to conserve genetic diversity and promote conservation. |
| 1975 | Convention on International Trade in Endangered Species of Wild Fauna and Flora, (CITES), 1973 | Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival, roughly 5,000 species of animals and 28,000 species of plants are protected by CITES against over exploitation through international trade. |
| 1964 | Convention Concerning the Protection of the World Cultural and Natural Heritage, (World Heritage Convention), 1958 | To establish an effective system of collective protection of the cultural and natural heritage of outstanding universal value organized on a permanent basis and in accordance with modern scientific methods. |
| 1975 | Convention on Wetlands of International Importance especially as Waterfowl Habitat, (Ramsar Wetland Convention), 1971 | The conservation and wise use of all wetlands and their resources through local, regional and national actions and international corporation, as a contribution towards achieving sustainable development throughout the world. |
| 1983 | Convention on Conservation of Migratory species (CMS), 1979 | To protect those species of wild animals which migrate across or outside national boundaries. |
| 1992 | Forest Principles, UNCED 1992. | Non-legally binding authoritative statement of principles for a global consensus on the management, conservation and sustainable development of all types of forests. |
| 1993 | Convention on Biological Diversity, (CBD).1992 | The conservation of biological diversity, sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including appropriate access to genetic resources and by appropriate transfer of relevant technologies and appropriate funding. |
| 1996 | UN Convention to Combat Desertification (UNCCD), 1994 | To combat desertification and to mitigate the effects of drought in countries experiencing serious droughts and/or desertification with the final aim being to prevent land degradation in the hyper arid, arid, and semi arid, dry sub humid areas in the countries that are parties of the convention. |
| 2003 | Cartagena Protocol on Biosafety , 2000 | To contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specially focusing on transboundary movements. |

# Appendix L

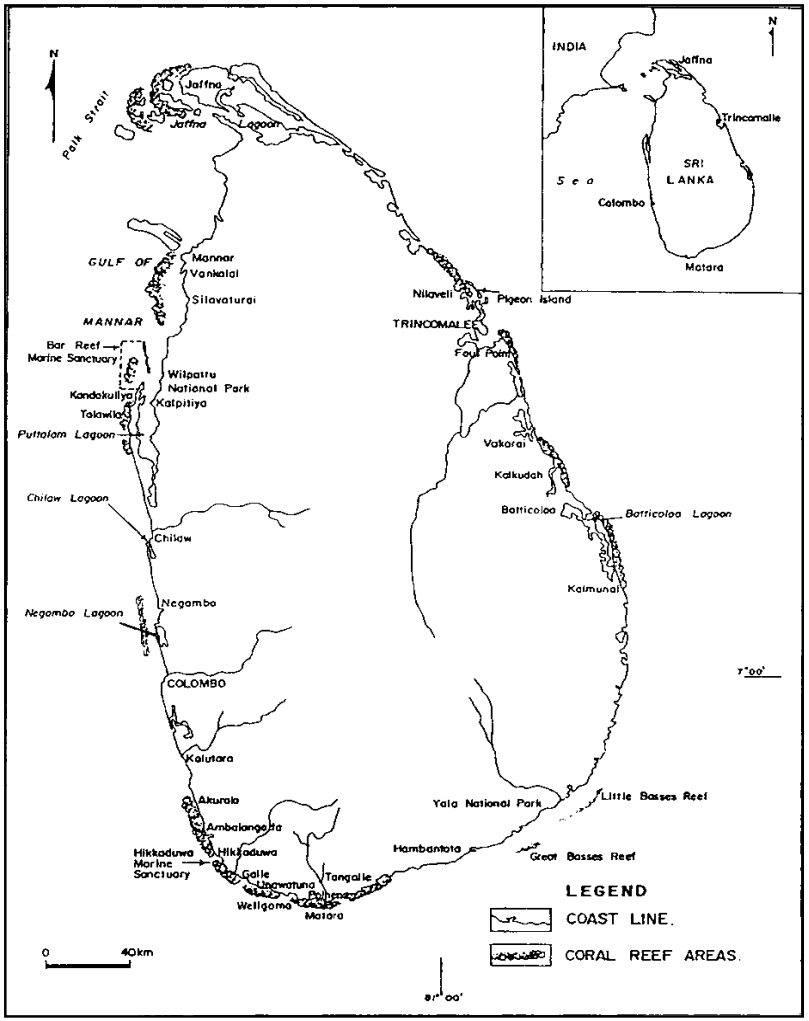
## Important Mangrove Areas and Coral Reefs of Sri Lanka:

*Source: NARA, Rajasooriya and White, 1995*

**Mangrove Areas**




**Coral Ree**



# Appendix M

## Further actions needed for Conservation of Forest Resources and Biodiversity in Sri Lanka

| | *Programme/ Activity* | Short Term | Medium Term | Long Term |
|---|---|---|---|---|
| ***1.*** | ***Strengthen Policy, legal and institutional framework for biodiversity and forest conservation*** | | | |
| *1.1* | Formulate a national policy on biodiversity conservation, including information sharing and networking. | | | |
| *1.2* | Revise National Forest Policy (1995) and National Wildlife Policy (2000) and related legislations (Forest Ordinance (FO), National Heritage and Wilderness Areas Act (NHWAA) and Fauna and Flora Protection Ordinance (FFPO)) in order to include necessary provisions for effective conservation of these resources. | | | |
| *1.3* | Strengthen the enforcement of FO, NHWAA and FFPO by building up the capacities of relevant divisions of FD and DWC. | | | |
| *1.4* | Strengthen the protection of indigenous crop and domesticated animal genetic resources | | | |
| *1.5* | Establish a suitable mechanism to ensure effective co-ordination between FD and DWC in management of PAs and conservation of biodiversity. | | | |
| ***2.*** | ***Establishment of a data base and monitoring of Biodiversity*** | | | |
| *2.1* | Establish and institutionalize biodiversity information management network; Environmental Information Management System (EIMS) in the FD need to be upgraded. | | | |
| *2.2* | Initiate island wide survey of biodiversity in managed landscapes, including home gardens, urban areas and agricultural systems and include the data in the information management network | | | |
| *2.3* | Strengthen the forest inventory and GIS information system in the FD and DWC | | | |
| *2.4* | Carry out studies to decide on sustainable harvesting levels of important NTFPs including medicinal plants and aquatic ornamentals etc, and develop a database. | | | |
| **3.** | ***Establish Optimum Protected Areas (PA) network and ensure recovery of impotent threatened species*** | | | |
| 3.1 | Identify critically important habitats (terrestrial, wetland, coastal & marine) with high biodiversity in the county outside the already declared (gazetted) PA system, demarcate and declare these under relevant legislation. | | | |
| 3.2 | Develop innovative systems for habitat management for critical landscapes with high biodiversity particularly under non state sector ownership. | | | |
| 3.3 | Study the status/trends in wildlife areas; identify the needs for wildlife corridors and linkages as an option for species conservation. | | | |
| 2.4 | Prepare and implement management plans for all PAs including landscapes identified under 3.1 above; ensure that these plans adequately address the conservation and sustainable management, while recognizing the participatory role of communities living in proximity to the area. | | | |
| 3.5 | Prepare and implement recovery plans for threatened species that need special conservation actions. | | | |
| 3.6 | Determine best practices to mitigate animal-human conflicts and implement them (elephant-human, crocodile-human). | | | |
| **4.** | **Strengthen the *Ex-situ Conservation* of threatened species of flora and restoration of ecologically important habitats** | | | |
| 4.1 | Strengthen the ex-situ conservation activities currently available in the country for conservation of flora | | | |
| 4.2 | Expand programmes of aforestation, reforestation and forest rehabilitation paying attention to the use of indigenous tree species as far as possible | | | |
| 4.3 | Expand the homegarden development programme and other social forestry activities to ensure ex-situ | | | |

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| | conservation of indigenous medicinal plants, threatened and endangered species and enrichment of tree cover in the country | | | |
| **5.** | ***Establish biodiversity conservation financing mechanisms and biodiversity valuation system*** | | | |
| 5.1 | Develop appropriate mechanisms for biodiversity valuation in consideration of all the tangible and intangible values (*commodity, amenity, and* moral *values including ecosystem values)* | | | |
| 5.2 | Develop and maintain a database on value of biodiversity, undertake valuation studies and quantify the biodiversity contribution to GDP. | | | |
| 5.3 | Develop innovative financing mechanisms to generate sustainable self financing for biodiversity conservation including management of PAs by relevant agencies. | | | |
| ***6.*** | ***Regulate/Control over exploitation of biological resources*** | | | |
| 6.1 | Prevent over exploitation and regulate harvesting of native freshwater organisms. | | | |
| 6.2 | Prevent over exploitation and regulate harvesting of Non Wood Forest Products (NWFP) including medicinal plants; Promote cultivation of NTFP in home gardens to minimize the threats to biodiversity and forests. | | | |
| 6.3 | Improved resource management of the coastal/marine environment and integrated coastal zone management. | | | |
| ***7.*** | ***Ensure Management and Control of Invasive and Alien species*** | | | |
| 7.1 | Develop a National Strategy/Action Plan and a comprehensive set of clear Guidelines in Prevention of Introduction, Eradication and Mitigation of the impacts of Alien/Invasive Species which have been identified as very important. | | | |
| 7.2 | Establish and maintain a complete national level database on Invasive and Alien species including a proper and well coordinated data sharing mechanism, information on their impacts and management. | | | |
| ***8.*** | ***Enhance the public awareness on the values of biodiversity and forest resources.*** | | | |
| 8.1 | Implement effective awareness programme to enhance the public awareness on the importance of biodiversity | | | |
| 8.2 | Integrate agenda on biodiversity in to curricular of primary, secondary and tertiary education systems as appropriate. | | | |
| ***9.*** | ***Biodiversity Valuation & Mainstreaming Economics of Biodiversity Conservation*** | | | |
| 9.1 | Creation of national awareness on economic valuation of biodiversity | | | |
| 9.2 | Capacity building on Environmental Economics | | | |
| 9.3 | Strengthening Institutions on the application of Environmental Economics in Biodiversity Conservation | | | |
| 9.4 | Implement sector specific training and awareness programmes on biodiversity conservation. | | | |
| 9.5 | Develop and implement biodiversity conservation awareness programmes for decision makers | | | |
| 9.6 | Ensure future investment/economic plans are biodiversity friendly | | | |