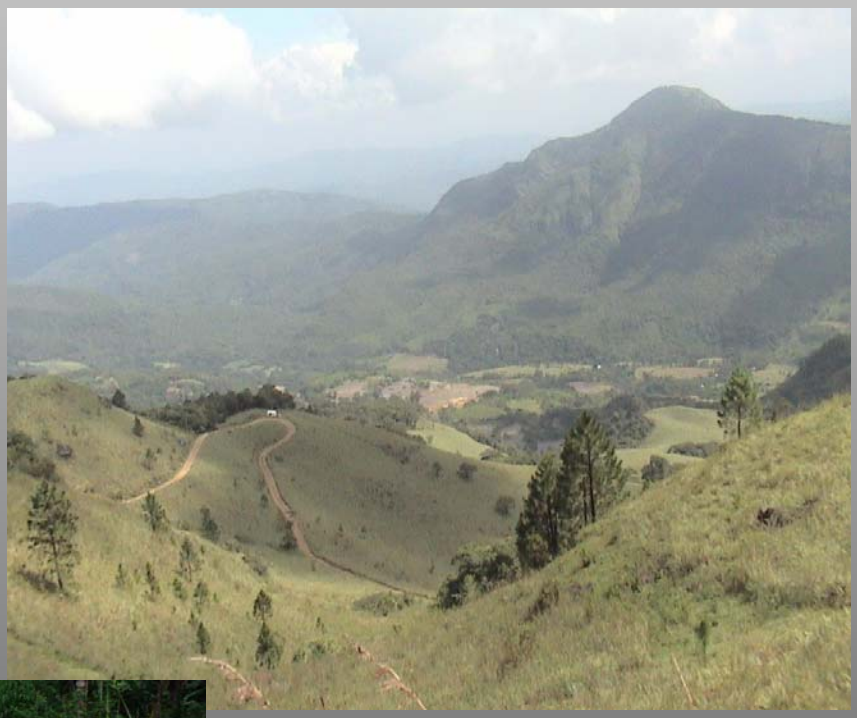
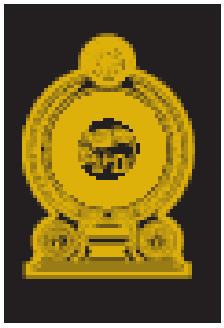
Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity



Jinie D S Dela
National Consultant

For preparation of the
Fourth National Report to the Convention on Biological Diversity



Fourth Country Report from Sri Lanka to the United Nations Convention on Biological Diversity

Jinie D S Dela
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for preparation of the Fourth National Report to the Convention on Biological Diversity

March 2009

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- Grasslands and forest at Illukkumbura, Knuckles Conservation Forest: © Jinie D S Dela.

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“As we march into the 21st century; picture a glorious cloud decked morn, the sun splashing the sky with rainbow hues, and the mountains in their blazing rapture, crying out, the dawn is here, the dawn is here! But a man may say that all his thoughts are centred on that dreadful dawn when man may cry – 'O scorching sun, O cloudless sky, my mountains are but barren rocks!”

W. R. H. Perera, 1996

(Source: Sri Lanka a Personal Odyssey by Nihal Fernando, 1997, Studio Times. 1997)

Photo of Horton Plains National Park © Christopher Silva/ Studio Times Limited

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Executive Summary

Sri Lanka is a sovereign island nation in the Indian Ocean, located at the tip of the southern point of the Indian sub-continent. Despite its small size of 6,570,134 ha, the island exhibits a wide array of ecosystems with a remarkable diversity of species: considered to be the richest per unit area in the Asian region. Sri Lanka has several distinct climatic zones, each with their characteristic forests. They include rainforests, montane cloud forests, Dry Zone monsoon forests and arid thorn scrub forests. Sri Lanka's wetlands are also diverse, comprising 103 major rivers with their associated marshes and about 12,000 irrigations tanks that harbour wetland species. Being an island, the country has a rich marine and coastal biodiversity along its 1620 km coastline including coral reefs, mangroves, sea grass beds, salt marsh vegetation, sand dunes and beaches. The high biodiversity of Sri Lanka has been influenced by a complex geological history, altitudinal variation, climate determined mainly by the distribution of rainfall both spatially and temporally, and the island's placement in the Indian Ocean. Isolation for over 20 million years has also resulted in an exceptional degree of endemism among Sri Lanka's wild flora and fauna, including a large number of geographic relicts and many point endemics that are restricted to extremely small areas within a single forest. Due to a unique hydraulic civilization that flourished in the country for many centuries, Sri Lanka also has a rich agro-biodiversity due to selection by farmers and adaptation to varied ecological conditions.

Throughout the centuries of self rule in Sri Lanka, the island's natural resources were recognised, carefully nurtured and used, without destroying the resource base. Underlying these practices were ethics that are remarkably similar to the modern concepts of conservation and sustainable use promulgated by the Convention on Biological Diversity (CBD). These ethics were ingrained in the very fabric of ancient Sri Lankan society, supported by state policy and traditional knowledge, both greatly influenced by the teachings of the Buddha. It is not surprising, therefore, that Sri Lanka was one of the first countries in the world to establish sanctuaries for wildlife and to instigate measures for conservation of plants and animas. The trend for a disregard of environmental considerations in the face of monetary gain began with colonial rule and continued thereafter resulting in large extents of land being cleared for monoculture plantations, and later for irrigated agriculture, settlements and other development activities deemed necessary to accommodate the needs of a rapidly growing human population.

Presently, Sri Lanka has 677 extant species of indigenous vertebrate (excluding marine forms), and a further 262 species of migrant birds. Endemism among vertebrates is about 43%, with highest endemism among amphibians, freshwater fishes and reptiles. Similarly the island is home to over 3000 angiosperms, of which a quarter comprises endemic species. Most invertebrate taxa in the island have been incompletely surveyed, but a rich diversity is apparent. Species diversity is also high in coastal and marine systems that sustain the food and ornamental fishery.

The threats to Sri Lanka's biodiversity have been identified, chief among which are habitat loss and fragmentation, habitat degradation, over exploitation of biological resources, loss of traditional crop and livestock varieties and breeds, pollution, human - wildlife conflicts, a burgeoning spread of alien invasive species and increasing human population density.

Although forest loss has occurred in all climatic regions, clearing of Wet Zone forests for plantation agriculture has had the most serious consequences. These forests that are the main repositories of the country's rich biodiversity, and much of the endemics, have continued to recede perceptibly due to the demand for land in the densely populated Wet Zone. They exist today as a series of small and fragmented forests located precariously in a sea of human settlements and monoculture holdings of tea and rubber. The valuable Wet Zone forests were also selectively logged in the 1970s. Although now afforded protection, there is concern that most of these forests may now be too small and fragmented to maintain functional ecosystems and viable populations of fauna and flora in the long term. As a result, many of Sri Lanka's endemics are threatened with extinction in the foreseeable future. Formerly these forests were surrounded by home gardens with good canopy cover, but these systems too are now increasingly fragmented with a loss of tree cover, further isolating the forest patches. Slash and burn agriculture in the Dry Zone and encroachment for cash crops in the Wet Zone have also caused forest loss and degradation. Like wise a*d hoc* reclamation of wetlands; indiscriminate use of coastal lands for constructions and unplanned establishment of aquaculture farms in coastal areas in the past; and landfills in wetland habitats--particularly in urban areas--have also resulted in habitat loss for wetland and coastal species.

Over exploitation of biological resources at levels exceeding the recuperative capacities of ecosystems and species; and the haphazard disposal of wastes and pollutants, loss of genetic diversity by the replacement of traditional varieties of livestock and crops with new high yielding varieties that show low resistant to pests and disease, threats to native species and ecosystems from alien invasive species, and increasing human-wildlife conflict that has already reached alarming proportions in the Dry Zone due to 'large scale human colonization of elephant habitats are other major threats to Sri Lanka's biodiversity. These threats are compounded by poverty in the country--despite many poverty alleviation programmes, high adult literacy levels that reach 90 per cent of the population, relatively good health care islandwide--and a high population density, despite a successful population control programme and a lowering of the country's population growth rate. Unplanned development in the past, including unregulated tourism and rapid expansion of vehicular traffic sans the necessary infrastructure, has added to the environmental burden. Sri Lanka, as a relatively small island in the southern hemisphere is also particularly vulnerable to the impacts of global climate change and sea level rise that may occur in the future with repercussions on both wild and agro-biodiversity. The impacts of climate change on agro-biodiversity is being addressed, but understanding of possible impacts of climate change on wild biodiversity is poor as yet.

The socio-economic and ecological implications of biodiversity loss for a developing country such as Sri Lanka can be considerable and wide ranging, due to changes in forests and related ecosystems, inland wetlands, coastal and marine systems and impacts of such change on development activities, including tourism and trade.

Recognizing the threat to the island's valuable biodiversity, Sri Lanka ratified the CBD in 1994. Following this, Sri Lanka prepared and published a comprehensive Biodiversity Conservation Action Plan (BCAP) in 1999 through a widely participatory process, thus fulfilling country obligations under Article 6a. This was updated with the publication of an Addendum to the BCAP in 2007 to reflect several issues that had a major bearing on biodiversity conservation in Sri Lanka since publication of the BCAP. During 2005 and 2006, Sri Lanka also carried out extensive stakeholder consultations through the National Capacity Needs Self Assessment (NCSA) Project to identify national capacity needs to implement the Convention on Biological Diversity. Among the main capacity building requirements identified were for cross-sectoral integration of biodiversity considerations, application of the ecosystem approach for establishing new protected areas covering biodiversity in forests, inland wetlands, coastal and marine systems and agricultural systems, and establishing an ABS regime.

An emerging national awareness since the 1990s about the need for environmental management to secure socio-economic development has created a conducive climate for biodiversity conservation in the country. The importance of biological resources from forests, wetlands, and coastal and marine systems and agricultural produce for export earnings and consumptive use are recognized. State commitment for better environmental management during the past two decades has lead to several important policy and environment management measures that are critically important for biodiversity conservation. Chief among these are the preparation of the National Conservation Strategy in 1988, enactment of the National Environmental Act (NEA) No. 47 of 1980 and its comprehensive revision in 1988 for better control of environmental pollution and development activities; introduction of Environmental Impact Assessments to all development projects; preparation of the National Environmental Action Plan in 1991 and its systematic revision; the periodic revision of the Coastal Zone Management Plan (CZMP) and the adoption of the national Biodiversity Conservation Action Plan (BCAP) in 1999 as a framework for biodiversity conservation in the country. A direct intervention through the BCAP was the setting up of a biodiversity unit in the Ministry dealing with the subject of environment. This was later expanded to form the biodiversity secretariat which has now been elevated to a separate division in the Ministry of Environment and Natural Resources (MoENR).

Policies, plans and programmes in the environmental sector agencies reflect a commitment for biodiversity conservation with adequate integration of the CBD objective into policies, plans and programmes of the forestry and wildlife sub-sectors, the wetland sector and the institutions concerned with conserving the coastal and marine environments. Major steps have also been taken in the coastal and marine, and the forestry and wildlife sectors, to better manage natural resources. Among these are the Forestry Sector Master Plan of 1995, which devotes a chapter to biodiversity conservation; a comprehensive assessment of biodiversity in the natural forests of the country through the National Conservation Review (NCR) completed in 1996, the National Forest Policy of 1995 and the National Wildlife Policy of 2000 that address biodiversity conservation and promote a major shift in the protection oriented forest and wildlife management policy towards a more participatory approach by all stakeholders. Public concern regarding the logging of Wet Zone forests that led to an Accelerated Conservation Review (ACR) of Wet Zone forests in the 1990s by the Forest Department, culminated in the landmark moratorium on state mediated logging in all natural forests of Sri Lanka since 1990, and later identification of 33 Wet Zone forests for strict conservation. A positive outcome of this is that most of the logged Wet Zone forests are now regenerating well. Illegal timber felling has also been reduced, particularly in Wet Zone forests, with the introduction of a permit system for transportation of most species of timber value. The ACR, NCR, and the recent

Baseline Biodiversity Survey (BBS) of seven Protected Areas under the Department of Wildlife Conservation, have shown a rich biota in the remaining contiguous blocks of rainforests, although further forest loss may well lead to species extinctions on a massive scale. The Forest and Wildlife Departments that are the custodians of forest biodiversity have also invested heavily on institutional capacity building for better management and conservation of forests under their purview. This augers well for conservation of forest biodiversity.

Systematic coastal resource management in Sri Lanka commenced in the early 1980s with the setting up of the Coast Conservation Department (CCD) and the enactment of the Coast Conservation Act of 1981. This has led to the periodic preparation of Coastal Zone Management Plans (CZMP) and the formulation and implementation of Special Area Management (SAM) Plans that promote a participatory approach to the management of coastal resources. The current CZMP has incorporated all relevant recommendations from the BCAP. The National Wetlands Policy of 2006 and the establishment of a unit to oversee wetland conservation are positive measures for biodiversity conservation. The latter came about as a recommendation during preparation of the Addendum to the BCAP. However, threats to coastal and marine and wetland biodiversity have not been addressed effectively.

There is cross-sectoral integration of biodiversity concerns into the laws, policies and plans of the agricultural and fisheries sectors. There are also close links between the Biodiversity Secretariat and the agricultural sector with regard to conservation of ago-biodiversity and preventive measures for entry and establishment of Invasive Alien Species (IAS). Likewise, the institutions concerned with *ex-situ* conservation also participate in implementing Article 9 of the CBD, and have incorporated activities that promote biodiversity conservation into their programmes. Similar integration is lacking with the development sector--such as the mining, tourism, and industrial sectors—and the urban and road development agencies, due to insufficient understanding of biodiversity considerations.

While considerable measures that benefits biodiversity conservation have been initiated in Sri Lanka, much more remains to be done. One constraint is that the national BCAP (and Addendum) have not been implemented in a holistic manner. The special mechanisms required have been identified, but are in abeyance due to the need for funds and other support to be made operational. The coordination required for implementing the BCAP is also made difficult due to the complexity of the vast number of institutions and laws that govern and have an impact on biodiversity. Even so, the wide stakeholder processes for preparation of the BCAP and Addendum, the NCSA Action Plan, and the National GEF Strategy, as well as other fora to prepare biodiversity related policies, plans and projects, have provided opportunities for inter-institutional interaction among sectoral agencies and some of the cross-sectoral agencies that are mandated to manage bio-resources. Further, despite the lack of a coordinated mechanism to implement the BCAP, much of its recommendations with regard to *in-situ* and *ex-situ* conservation, as well as some cross-cutting areas, have been implemented by the institutions with a mandate to conserve wild and agro-biodiversity.

Overall, a review carried out of 87 recommendations in the BCAP pertaining to *in-situ* conservation (in forests, wetlands, coastal and marine systems and agricultural systems) and *ex-situ* conservation during preparation of the Addendum showed that implementation of 26 recommendations were critically hampered due to inadequate institutional capacity or mandate for the required actions, and nine had not commenced at all for the same reason. The balance 52 reconditions (60%) were being implemented at the time of review to some degree.

While the preparation of the BCAP and establishment of the Biodiversity Division in the MoENR have definitely helped to promote biodiversity conservation and to highlight the CBD goals and objectives, the need for systematically implementing the BCAP is required to and bring about better cross-sectoral involvement in biodiversity conservation. In this regard, there is also a clear need for assistance from the CBD for biodiversity focal points for capacity building in Communication, Education and Public Awareness (CEPA) to promote sectoral and cross-sectoral integration of biodiversity concerns.

Funding for biodiversity conservation has been largely for *in-situ* or *ex-situ* conservation rather than the other aspects of the CBD, such as Article 15. Funds from domestic sources have been sufficient to maintain the protective and management related functions of the Forest Department (FD), Department of Wildlife Conservation (DWLC), the Coast Conservation Department (CCD), and the Central Environmental Authority (CEA), but funds for the CBD focal point has not been sufficient to deal with BCAP implementation or to promote an ABS regime. Funding patterns for Sri Lanka have also changed with most funds being accessed from multi-lateral sources rather than from bilateral sources as seen in the mid 1990s.

With regard to action planning for biodiversity,

- the BCAP and Addendum recommends a course of action to "ensure that the biological diversity within the country is conserved and used sustainably, and that development programmes pursued by the different

sectors do not cause serious or irreversible damage to the indigenous biodiversity." This meets with the objectives of the CBD.

- The four systems prioritised by the BCAP as forest, wetland, coastal and marine and agricultural systems closely parallel the thematic work programmes identified under the CBD in ecosystems that are of relevance for Sri Lanka.
- Under each system, Articles 7 (a-c), and 8 (a, b, c, d, e, f, i, k, l, 10 b, d, e) and 11 are addressed in the BCAP and the Addendum.
- Under the following cross-cutting areas of the BCAP and Addendum, several sub-articles and articles of the CBD are addressed at the national level. These are *ex-situ* conservation (Article 9); biodiversity information (Article 7d and 17); biodiversity related legal measures (Articles 8 g, j, k; 12; 15, 16). Research (Article 12), education and awareness (Article 13); institutional support for biodiversity conservation and valuation of biodiversity, Access and benefit sharing (Article 15) and preservation and use of traditional knowledge (Article 8 j and 16).
- Capacity for CEPA is generally inadequate, with greater emphasis on education and training.

With regard to meeting the objectives of the 2010 targets,

- Goal 1 and 2 to promote the conservation of the biological diversity of ecosystems, habitats and biomes and to promote the conservation of species diversity have been well addressed. Although threats remain, considerable work has been done to identify and mitigate these threats;
- Goal 3 to promote the conservation of genetic diversity has been mainly met with regard to agricultural biodiversity;
- Goal 4 to promote sustainable use and consumption has been facilitated by participatory forest management done on a pilot scale in various locations with very positive results; Some work has been initiated in the coastal areas, and the agriculture and fishery sectors, but this needs to be more widely practiced;
- Much has been done to achieve Goal 5: pressures from habitat loss, land use changes and degradation, and unsustainable water [in terms of wetland and watershed use]. However, while threats have been addressed to a fair degree in forest areas due to law enforcement, participatory approaches, and boundary marking of PAs, they continue and are still of major concern in wetland and coastal and marine systems.
- Measures are taken to meet Goal 6: control threats from invasive alien species, by seeking to enhance capacity for prevention of entry and establishment of IAS. Control measures have also been taken in PAs severely affected by IAS by the DWLC as relevant for habitat enrichment and by the agricultural sector.
- Pollution abatement has been given considerable focus by the MoENR which had a Division to address this threat. However, due to the complex nature of the problem, Goal 7: to Address challenges to biodiversity from climate change and pollution, has still to be accomplished. The impact of climate change on wild biodiversity and ecosystems has not been adequately addressed in the BCAP or Addendum.
- Efforts are being taken to meet Goal 8: Maintain capacity of ecosystems to deliver goods and services and support livelihoods. However this has not been completely achieved and efforts are ad hoc.
- Goal 9 to maintain socio-cultural diversity of indigenous and local communities is met with as all cultures and religions are given recognition in the country as a constitutional requirement. Protection of traditional knowledge, innovations and practices is however at an early stage, although the required policy has been formulated. Documenting traditional knowledge holders is taking place.
- Goal 10 to ensure fair and equitable sharing of benefits arising out of the use of genetic resources (in terms of legal aspects only) has not been met with adequately, but the background work to establish an ABS regime has been done through the NCSA project. The existing legal framework is sufficient to permit an ABS regime in Sri Lanka, but funds are lacking to establish such a regime, and to carry out the staff training and institutional strengthening to make the regime operational. Further, clarification if required from the CBD COP on several aspects important to implement an ABS regime. Even so access occurs even now through MTAs in the agricultural sector.
- Goal 11: Parities have improved human, scientific, technical and technological capacity to implement the Convention is partly true for Sri Lanka. The country has had access to funds for major projects that have benefited biodiversity. However, this has not bee available for crucial work such as a mechanism to coordinate and track BCAP implementation and setting up an ABS regime. Absence of a holistic implementation of the BCAP has resulted in many biodiversity related activities taking place in isolation or being duplicated by different agencies due to poor coordination. Further capacity building to access funds

through skills building for reporting, project proposal writing and project/programme evaluation and monitoring are required for focal points to meet Goal 11.

With regard to the Global Strategy for Plant Conservation limited work has been carried out as preliminary measures. However, Sri Lanka has made good progress with the Work Programme on Protected Areas. There is also good agreement between the global targets and national targets in the BCAP and Addendum and in the NCSA Action Plan.

Key recommendations for capacity building among Parties:

- A major multi-institutional capacity building initiative for establishing an ABS regime in source country Parties through GEF funding.
- Parities should be assisted to implement the NCSA recommendations and to establish mechanisms for implementing the national BAPs holistically with adequate emphasis on coordination, monitoring and implementation of a CEPA strategy (for which capacity building is required).
- Parties should be helped to widely popularise and practice the ecosystem approach to biodiversity conservation.

Structure of this report:

- Chapter 1 provides a general overview of Sri Lanka's rich biological diversity, its status, trends and threats; and is meant as a general overview of biodiversity in the island to inform decision-makers and other stakeholders rather than as an exhaustive documentation of the country's biodiversity.
- Chapter 2 provides an overview of the status of implementation of the BCAP, the process for updating this document with an Addendum, the efforts to mainstream biodiversity in different sectors, the obstacles and challenges for implementation of the BCAP, and funding to implement the CBD in Sri Lanka.
- Chapter 3 deals with the status of sectoral and cross-sectoral integration of biodiversity concerns in Sri Lanka to promote conservation and sustainable use of biodiversity
- Chapter 4 provides a summary of progress made towards achieving the 2010 target in Sri Lanka, and an assessment of the extent to which actions taken to implement the BCAP and related sectoral and cross-sectoral plans have contributed to progress towards these goals and objectives, progress towards the Goals of the Strategic Plan and the major obstacles encountered in meeting them, and a brief summary of progress relating to the Cartagena Protocol on Biosafety.

Appendix 1 - provides information concerning the reporting Party and mode of preparation of the national report.
Appendix II provides further sources of information, including references for this report
Appendix III gives progress towards targets of the Global Strategy for Plant Conservation and the Programme of Work on Protected Areas

Chapter 1

1.1 Introduction

This chapter provides a general overview of Sri Lanka's rich biological diversity, its status, trends and threats, to inform decision-makers and other stakeholders rather than to provide an exhaustive documentation of the country's biological wealth. The chapter is structured as follows to concur with the approach adopted by the Biodiversity Conservation Action Plan which deals with forest, inland wetland, coastal and marine and agricultural biodiversity. This is consonant with the thematic areas adopted by the Convention on Biological Diversity. Accordingly:

- **Section 1.1** provides a brief introduction to this chapter.
- **Section 1.2** gives a overall snapshot of biodiversity status and trends in Sri Lanka and introduces general threats to biodiversity in the country.
- **Section 1.3** deals with species biodiversity in terrestrial, inland wetland and coastal systems: status and trends and general threats.
- **Section 1.4** deals with biodiversity in forests, status and trends and specific threats.
- **Section 1.5** deals with biodiversity in inland freshwater wetlands, both natural and manmade, status and trends and specific threats.
- **Section 1.6** deals with biodiversity coastal and marine ecosystems, status and trends and specific threats.
- **Section 1.7** deals with biodiversity in agricultural ecosystems, status and trends and specific threats.
- **Section 1.8** deals with the implications of biodiversity loss from an economic perspective and impact on human well being.

Sri Lanka published a comprehensive Biodiversity Conservation Action Plan (BCAP) in 1999 through a widely participatory process to fulfil obligations under Article 6 of the CBD. This was updated recently with the publication of an Addendum to the BCAP in 2007, to reflect several issues that had a major bearing on biodiversity conservation in Sri Lanka since publication of the BCAP. During 2005 and 2006, Sri Lanka also carried out extensive stakeholder consultations to identify national capacity needs to implement the Convention on Biological Diversity. Eleven prioritised areas were scrutinised at several workshops. Among those prioritised were: cross-sectoral integration of biodiversity considerations and application of the ecosystem approach for biodiversity conservation in forests, inland wetlands, coastal and marine systems and agricultural systems. There were also wide stakeholder consultations for preparing of Sri Lanka's present Coastal Zone Management Plan (2004) as well as the National Environmental Action Plan: Caring for the Environment (2003) and preparation of a National GEF Strategy (2006). The outcomes of these wide stakeholder consultations and discussions are reflected in this document. Furthermore, Sri Lanka has carried out comprehensive surveys of forest biodiversity at the national level since the mid 1990s, and has embarked on continual species assessments since 1989 for identification of threats to indigenous fauna and flora, all of which have contributed to the preparation of this chapter.

1.2 An overview of Sri Lanka's biodiversity

1.2.1 Factors influencing Sri Lanka's unique biodiversity

Sri Lanka is an island nation off the southern point of the Indian sub-continent between 5^{o} 54' and 9^{o} 52' North Latitude and 79^{o} 39' and 81^{o} 53' East Longitude (MOFE, 1999). Despite its small size of 6,570,134 ha, 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 mega diversity countries in this regard such as Malaysia, Indonesia and India (NARESA 1991). The concentration of avian species per unit area in Sri Lanka is also second only to Malaysia in Asia (NARESA 1991). Sri Lanka has a rich marine and coastal biodiversity due to a 1620 km coastline (CCD, 2004) surrounded by the Territorial Sea and Exclusive Economic Zone comprising 21,500 sq km and 517,000 sq km respectively (ibid).

Geo-evolutionary history

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 (MoENR, 2008). Sri Lanka has a richer biodiversity than most small island nations (Cruz, 1984; Erdelen, 1989). The diversity of species in the island reflects that it was once part of Gondwanaland during the Tertiary (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, before rafting northwards to join up with Lauracea in the Tertiary (Ashton and Gunatilleke, 1987). The result are species with a distinct Gondwanic and Lauracean ancestry (MoENR, 2008). While Sri Lanka falls within the Indo-Malayan Realm (Ashton and Gunatilleke, 1987), lateral movements and linkages during its geo-evolutionary history have resulted in species showing affinities to those of the Palearctic, the Australian and the Ethiopian (now Afro-tropical, Udvardy, 1975) Regions. Examples are seen among the bees and the Colubrid genus *Boiga,* and the shrimp genus *Lancaris*—now limited entirely to the highlands of Sri Lanka (MoENR, 2008).

While most of Sri Lanka's faunal and floral species show a close affinity to those of Peninsular India (MoENR, 2008), Sri Lanka's biodiversity is unique, due to the separation from India in the Miocene about 20 million years ago (Deraniyagala, 1992). Despite intermittent land connections with biotic exchange up to about the Holocene (ibid), the island become a remarkable centre of endemism (Bossuyt *et al*., 2004, cited in Batuwita and Bahir, 2005). Overall, 43% of the island's indigenous vertebrate fauna are endemic (IUCN and MoENR, 2007) as are over 24% of the island's flowering plants (Seneratne, 2001). Research at the molecular level has revealed a "unique endemic insular radiation" among Sri Lanka's tree frogs, agamid lizards and skinks (IUCN and MoENR, 2007). Among these endemics are many geographical relicts that were isolated in the island (Cruz, 1984, MoENR, 2008), exemplified clearly by as much as 11 geographically relict endemic reptile genera in the island (de Silva, 2006).

Topography and climate

The rich biota of Sri Lanka has been influenced by numerous "geological upheavals and geographic movements" (Tan, 2005), resulting in the south-central mountains rising to 2500 m from the surrounding broad lowland plains occurring at 0 - 75 m above sea level (Wijeisnghe, *et a*l., 1993). The mountainous regions **(Figure 1.1)**, covering about 3% of the island, comprise three distinct mountain ranges that have been isolated from each other for many thousands of years, and hence habour faunal and floral elements that are unique to each, (MoENR, 2008). The general topography of the island displays a "staircase pattern" of about 11 planation surfaces (Wickramagamage, 1998 cited in MoENR, 2008). Sri Lanka's climate is tropical and varies with the seasonality of rainfall, influenced by two distinct monsoons and convectional and cyclonic effects. The rainshadow effect caused by the central mountains has given rise to two pronounced wet and Dry Zones (**Figure 1.2**) separated by the 2000 m isoheyt. The Wet Zone with its perhumid, ever-wet climate, has a rainfall of 2500 -5000 mm, and is stratified into low, mid and montane regions that rise to 2500 m above msl. Due to this altitudinal variation, the mean temperature of the Wet Zone drops progressively from 27^0C in the lowlands to around 13^0C - 16^0C in the montane areas (Wijeisnghe, *et al*., 1993). The Dry Zone, with a mean daily temperature of 30^0C, is spread over much of the lowlands plains. Despite a rainfall of 1250 mm - 1900mm per year this region has a long drought period of about 5 months (ibid). A narrow Intermediate Zone with a mean annual rainfall between 1900 and 2500 mm lies between the Wet and Dry Zones, and there are two extra dry coastal strips with prolonged drought periods in the north-west and south-east coastal regions forming the Arid Zone with a mean annual rainfall less that 1250 mm (Wijesinghe, *et al*., 1993).

Agriculture

Apart from the natural features, agriculture and soils have played a central role in the development of a rich agro-biodiversity in the island. Agriculture has shaped the county's culture since the unique hydraulic civilisation of Sri Lanka that reached a peak during the 10^{th} and 11^{th} Centuries (Fernando, *et al*., 2008). Twenty four agro-ecological regions are currently recognised, based on variations in altitude and rainfall, and the rich diversity of soils in the island that amount to fourteen of the Great Soil Groups (Panabokke, 1996).

Cultural features

Cultural features too have served to fashion and maintain the island's unique biodiversity. The conservation of forests, watersheds and fauna were deeply ingrained in the culture of ancient Sri Lanka, fostered by Buddhism, which promotes respect for all forms of life (MoFE, 1999; MoENR, 2006). Not surprisingly, wildlife `sanctuaries' for the protection of fauna and flora existed in Sri Lanka as far back as the third century BC, while stone edicts of the twelfth century AD show that ancient rulers had promoted concepts akin to `urban nature reserves' (ibid).

1.2.2 Overall ecosystem diversity

Influenced by both natural and anthropogenic features, Sri Lanka has a fascinating multitude of terrestrial, coastal and marine, inland wetland and agricultural ecosystems **(Table 1.1**). The forests that contain much of the biodiversity of

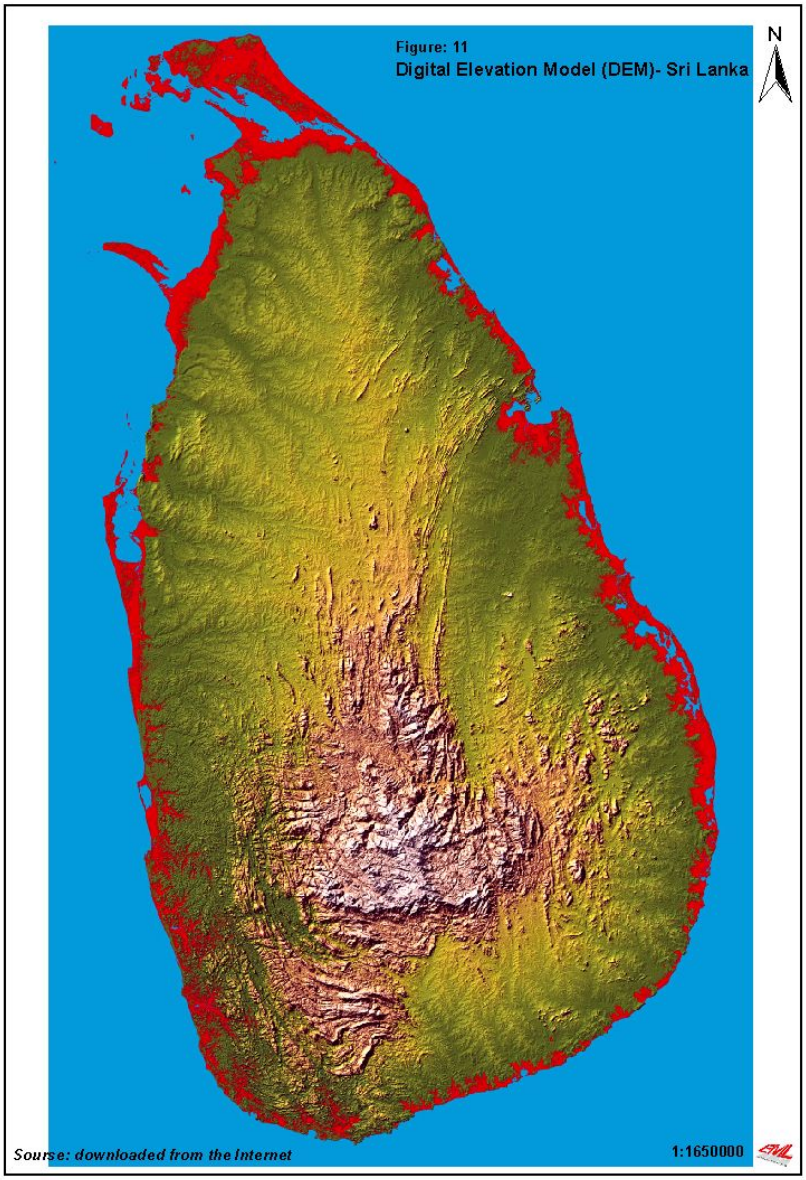


Figure 1.1 Map of Sri Lanka

Sri Lanka 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 **(Figure 1.3).** A total of 15 distinct floristic regions **(Figure 1.4)** have been recognised in the island by Ashton and Gunatilleke (1987). The island also contains several types of grasslands in the wet and dry areas, at low to high elevations. There are ample wetlands associated with over a hundred major rivers that originate from the central mountains (**Figure 1.5**), and although there are no inland lakes, several thousand irrigation tanks and reservoirs dot the island **(Figure 1.6)** Together they provide habitats for a unique freshwater wetland fauna and flora,

TABLE 1.1: **Ecosystem Diversity of Sri Lanka**

Ecosystems	Provisional extent (ha)
Forest and related ecosystems	
• tropical wet lowland evergreen forest (lowland rain forest)[+]	141,506
• tropical moist evergreen forest[+]	243,886
• tropical dry mixed evergreen (monsoon) forest[+]	1,090,981
• tropical thorn forest (Arid Zone)	na
• riverine forest[+]	22,435
• tropical sub montane forest[+]	68,616
• tropical montane forest[+]	3,108
• grasslands (wet *pathana*, dry pathana, savannah)	na
Inland wetland ecosystems	
• flood plains	na
• swamps	na
• streams and rivers	5,913,800
• reservoirs and ponds	179,790
• wet villu grasslands	na
• wet montane grasslands wet patanas	na
Coastal and marine ecosystems	
• mangroves[**]	6,080
• salt marshes[+]	23,819
• sand dunes and beaches[+]	19,394
• mud flats	9.754
• seagrass beds	na
• lagoons and basin estuaries	158,017
• coral reefs	na
• coastal seas	na
Agricultural ecosystems	
• paddy lands[x]	525,000
• fruit cultivations[+]	97,000
• small crop holdings or other field crops (pulses, sesame etc)	128,000
• vegetables (including, root and tuber crops)[++]	110,000
• crop plantations	772,000
• home gardens (cultivated)[+]	367,800
• chena lands (slash and burn cultivation)	na

Source: Statistical Compendium on Natural Resource Management for Sustainable Development (2001) except for data from MOFE (1999) denoted by [+]; data from MoENR, 2002 denoted by [++]; data from CRMP Coastal Survey *denoted by ** and data from CB, 2008 denoted by [x]*

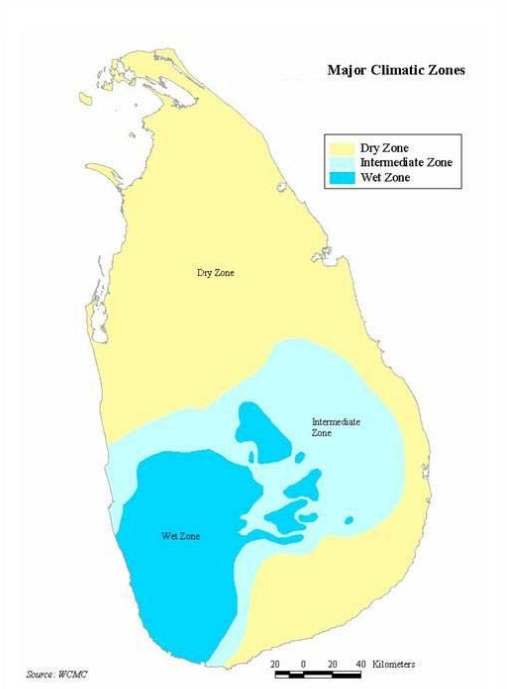


Figure 1.2: Major climatic zones based on rainfall

Sourse: Gap Analysis Report, MoENR, 2006

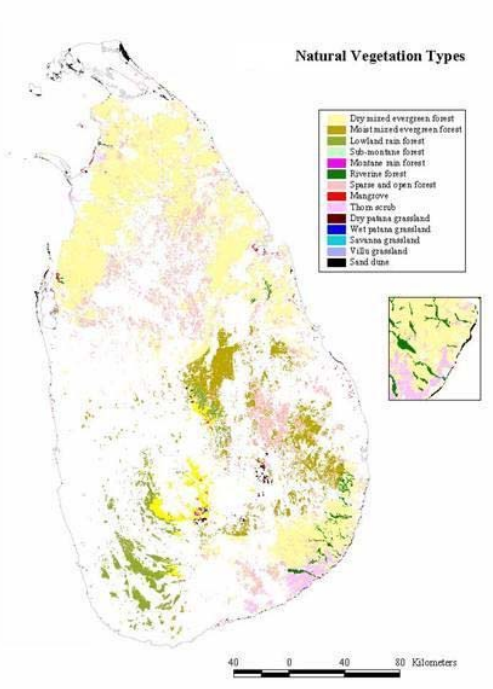


Figure 1.3: Major climatic zones based on rainfall

Sourse: Gap Analysis Report, MoENR, 2006

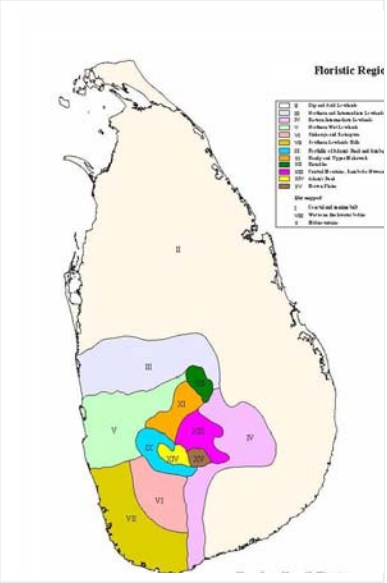


Figure 1.4: Floristic regions

Sourse: Gap Analysis Report, MoENR, 2006

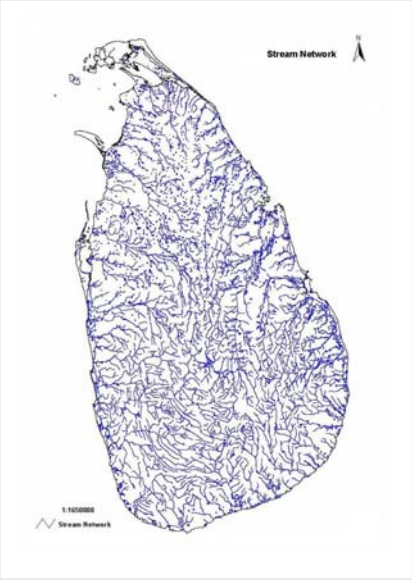


Figure 1.5: Sri Lanka's stream network

Sourse: Gap Analysis Report, MoENR, 2006

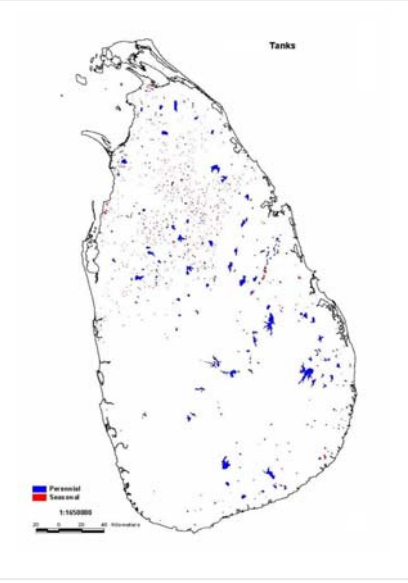


Figure 1.6: Sri Lanka's irrigation tanks *Sourse: Gap Analysis Report, MoENR, 2006*

with a large complement of endemics. Being an island, Sri Lanka has a multitude of marine and coastal ecosystems, featuring several types of reefs, picturesque bays and lagoons, wide sandy beaches, mangrove habitats and coastal marshes (CCD, 2006). Considerable biodiversity exists in human modified habitats such as village home gardens, agricultural lands, plantations, and even in built-up areas such as roadsides and urban environments. **Table 1.2** provides the distribution of land among different land uses in the country.

TABLE 1.2: **Land Balance Sheet for Sri Lanka**

Type of land	Hectares (ha)
Reserved land (reservoirs, streams, roads etc.)	585,300
Forests and catchment areas	2,000,000
Steep lands	380,000
Lands above 5000 ft. Contour	76,400
Barren lands	77,000
Marshes and mangroves	70,000
Presently used land	2,635,000
Sparsely used land (chena, patana, etc..)	728,800
Total land area	**6,552,500**

Source: adapted from Somasekeran (1996) cited in Madduma Bandara (2000)

1.2.3 Overall species diversity

Sri Lanka's rainforest biome

Sri Lanka's Wet Zone in the southwest of the island, spread over about 15,000 km^2, contains representatives of the world's rainforest biome with a high concentration of endemics. About 90% of the island's endemic flora and fauna are found in this region (MoFE, 1999). Sri Lanka'a rainforests are of two distinct elements: the lowland and mid-country rainforests and the montane and submontane rainforests. The respective complement of fauna and flora as well as the natural forest formations of these two groups show distinct differences (MoENR, 2008). The rainforests of the southern wet lowland hills and plains are believed to be the richest species wise in South Asia (Ashton and Gunatilleke, 1987).

Not surprisingly, the high ecosystem diversity in the island has given rise to a wide range of indigenous species. Among them are many climatic and edaphic variants, particularly among the plants (MoFE, 1999), indicating the existence of a high genetic diversity. Furthermore, the various geo-evolutionary and geological processes in Sri Lanka, coupled with spatial variations in climate and topography, have promoted isolation of species resulting in a large number of geographically relict species not found anywhere else in the world (MoENR, 2008).

1.2.4 Overall genetic diversity

Among agricultural crops, a high genetic diversity has been identified among grains, cereals, vegetables, and root and tuber crops due to farmer selection and adaptation to varied climatic conditions. Likewise there are local varieties of that are resistant to pests and disease. Sri Lanka's forests and other wild habitats also contain many wild relatives of cultivated plants, that form a valuable pool of germplasm for future genetic improvement of crop species.

Genetic diversity among wild species is the least known among the three components of biodiversity in Sri Lanka, indicating much scope for future investigation. However, a substantial genetic diversity is inferred among both wild flora and fauna, and is particularly apparent in terms of morphological features among the mammals.

Evolutionary significance of Sri Lanka's fauna

Despite being part of the Indian subcontinent for much of Sri Lanka's geological history, there is ample evidence to show evolutionary processed have caused species to diverge since the island severed links with peninsular India in the Miocene. For example, Sri Lanka's *Semnopithecus vetulus*, *Macaca sinica* and *Paradoxurus zeylonensis* have evolved into distinct species that are endemic to the island, although they show close similarities with the Indian *S. johnii*, *M. radiata*, and *P. jerdoni* respectively. Likewise, molecular genetic analysis has shown that the Sri Lankan leopard, the only representative in the island of the genus *Panthera*, is a unique sub species (*Panthera pardus kotiya*), which diverged from other felids about 1.8 million years ago and is quite distinct among the 10 subspecies of leopard in the world (Miththapala, 2006). Among the primates, the endemic monkeys *Macaca sinica* and *Semnopithecus vetulus,* and the slender loris (*Loris lydekkerianus*) show morphologically distinct sub-specific variation, indicative of high intra-specific genetic variability (Groves, 2005).

However, the trend for loss of populations of species due to habitat loss, degradation and fragmentation, can be expected to have adverse effects in the long-term on the genetic diversity of species -–among both the fauna and flora.

1.2.5 Overview of threats to Sri Lanka's biodiversity

Sri Lanka's unique biodiversity with a high percentage of endemics is now threatened, mostly as a result of past depletion of forest cover, a high and yet increasing population density, and habitat degradation and unplanned development activities (MoENR, 1999, 2006, 2007). Consequently, Sri Lanka together with the Western Ghats of India is ranked among the world's 34 biodiversity hotspots (Mittermier, *et al*., 2005).

The main threats to biodiversity are highlighted below. The subsequent sections on forests, freshwater wetlands, coastal and marine systems and agricultural habitats provide greater detail on the more specific pressures relevant to each of these areas.

The main threats to Sri Lanka's rich biodiversity

- **Habitat loss and fragmentation**

This constitutes the most serious threat to terrestrial wild biodiversity in Sri Lanka. Some of the most acute problems have been loss of forests through clearing for development or conversion to monoculture plantations in the past, illegal slash and burn cultivation in the Dry Zone and encroachment for cultivation of cash crops in the Wet Zone; *ad hoc* reclamation of wetlands; indiscriminate allocation of coastal land for construction of tourist hotels and unplanned establishment of aquaculture farms in coastal areas in the past; and continuing landfills in wetland habitats--particularly in urban areas--for housing and commercial and industrial development (MoFE, 1999). Forest fragmentation to establish plantation agriculture and human settlements over several hundred years in the biologically rich 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.

- **Habitat degradation**

The degradation of freshwater wetlands has been severe, due to pollution and siltation from unsustainable land use (including deforestation), agricultural runoff, salinity intrusion, over extraction of water for irrigation, and illegal sand mining. The traditional practice of clearing wetland vegetation in forests for "*deniya"* cultivation with paddy or betel has also affected wetlands within Wet Zone rainforests. State logging of Wet Zone forests in the 1970s, caused a severe threat to many of the already fragmented Wet Zone forests, although a high biodiversity has survived and the forests have regenerated well. Considerable habitat degradation has also been particularly acute in coastal ecosystems such as mangroves, lagoons and estuaries. The causes are unsustainable fishing practices, over-exploitation of resources, pollution, unauthorized encroachment, and land reclamation to convert coastal ecosystems to other uses. Many near-shore coastal reefs, especially in the southern region, are now severely degraded due to coral mining for production of lime and natural El Nino effects (CCD, 2004).

- **Over exploitation of biological resources**

Over collection of bio-resources and destructive harvesting practices have resulted in reduction or loss of populations among many plant and animal species, leading them to the verge of extinction. Particularly affected by unsustainable collection are coastal food fish and lobsters, marine and freshwater ornamental fish, medicinal plants, and species that provide raw materials for cottage industries (such as rattan) or have subsistence value as food items or wood (posts and poles) and fuelwood.

- **Loss of traditional crop and livestock varieties and breeds**

Indigenous breeds of livestock and traditional varieties of rice and other food crops that show resistance to pests, biotic and abiotic stresses under varied agro-ecological conditions have been largely replaced in farming systems by new high yielding varieties that are heavily dependant on fertiliser and pesticides (MoENR, 2002). This change has also brought about the loss of associated traditional knowledge developed over thousands of years. Furthermore, the spread of monocultures around 500 years ago during colonial rule, has been a prime factor for forest loss in the country and for large scale soil erosion (MoFE, 1999).

- **Pollution**

Pollution in inland freshwater and coastal wetlands (i.e. lagoons, estuaries) and associated marshes has been severe due to contamination with fertilizers, pesticides, weedicides, sewage, chemical compounds from shrimp farms in coastal areas, and dumping of solid untreated industrial wastes. Some beach ecosystems have also been degraded by dumping solid waste due to the paucity of land for safe disposal. Pollution has made many aquatic habitats unusable to freshwater species, including several endemics that need clean clear water. Pollution of lagoons and estuaries has also severely affected the fishery industry in several lagoons, while the release of ballast water and waste oil and tar from ships add to coastal pollution.

- **Human - wildlife conflicts**

The disruption of continuous stretches of forest, particularly in the Dry Zone, has continued over the past century for establishment of human settlements, irrigated agriculture and chena cultivation, affecting the travel patterns of wildlife, particularly elephants, leading to human-wildlife conflicts. The human–elephant conflict has now become acute, with continual damage to crops and habitations, injury to elephants, and frequent deaths of both humans and elephants. The proximity of human habitations and hotels to forest areas has increased garbage and crop raiding and harassment of tourists and householders by the endemic toque macaque. Likewise, the severe fragmentation of Wet Zone forests due to plantation agriculture in the past has affected primate dispersal, leading to the present co-occurrence of monkeys in home gardens and crop plantations. In some areas crop raiding and roof damage by primates is severe, giving rise to considerable conflict with humans, and even local extinctions due to anthropogenic factors.

- **Spread of invasive alien species (IAS)**

Sri Lanka's freshwater biodiversity is threatened due to both accidental and intentional introduction of alien invasive plants and animals. Exotic waterweeds such as salvinia and water hyacinth introduced accidentally have caused serious environmental and economic problems by reducing functional area of wetlands, problems in irrigation tanks, and loss of native species. Similarly invasive exotic fish and larvae introduced to aquaculture ponds are believed to have ousted indigenous species in natural water bodies and irrigation tanks. Several national parks also have major problems due to the spread of alien invasive species as have agricultural systems. Remedial measures involve a high cost and effort for their removal and continued maintenance of these ecosystems.

The Sinharaja Biosphere Reserve and World Heritage Site is located in the densely populated Wet Zone. An estimate of population size around the reserve based on village level administrative reports show the presence of about 26,000 persons in 6,500 families living in about 40 villages (compared with 5,457 persons in 1980), with about 42-429 households in a single village (Wijesuriya *et al*, 2003).
Source: Dela, 2003

- **Increasing human population density**

Sri Lanka has a total human population of over 20 million, as opposed to 7.2 million when the country gained independence in 1948 (MoENR, 2002). This high population density has increased the pressure on natural ecosystems and species, especially on the species rich Wet Zone forests that are surrounded by human settlements with increased risk of forest encroachment and poaching. The escalating demand for land has also resulted in the fragmentation of home gardens that are important repositories of horticultural biodiversity, and are important habitats for birds, butterflies, small mammals and the Critically Endangered and endemic western purple-faced langur. Home gardens in villages and semi-urban areas of the Wet Zone, where the human population density is more than 500 persons per sq km, are particularly affected with rapid fragmentation and loss of canopy cover.

1.3 Species diversity

1.3.1 Status

Sri Lanka's wild fauna and flora are relatively well researched though considerable work remains to be carried out. Important in this regard are the National Conservation Review (NCR), carried out by the Forest Department in the 1990s with the assistance of the World Conservation Monitoring Centre and IUCN-The World Conservation Union; the recent biodiversity assessments in seven important Protected Areas by the Department of Wildlife Conservation; surveys carried out in association with the National Species Red Listing Exercise culminating in the 2007 national Red List; a coastal survey by the ADB sponsored CRMP project in 2002, and continual coastal and marine research by the National Aquatic Research and Development Agency (NARA). In addition, Important research initiatives by individuals, universities and Environmental NGOs have added to the knowledge base on Sri Lanka's biodiversity.

1.1 Terrestrial and freshwater wetlands

• Fauna

Overall Sri Lanka has 677 indigenous vertebrate species (excluding marine forms), of which 43% are endemic, and a further 262 species of migrant birds (**Table 1.3**). Endemism among vertebrates is highest among amphibians (85%), freshwater fishes (54%) and reptiles (50%). Sri Lanka is notably one of the richest countries for amphibian diversity with 3.9 species per 1000 sq km (Goonewardena, *et al*, 2006), compared to which Costa Rica is a fairly distant second (Manamendra-Arachchi and Pethiyagoda, 2005). Valid amphibian species may also increase further to 140 with the description of several newly discovered species (ibid).

Most invertebrate taxa in the island have been incompletely surveyed, but a rich diversity is apparent (**Table 1.3**) among butterflies, dragonflies, bees, carabid beetles and spiders, and particularly land snails (Ranawana, 2006). The isolation of Sri Lanka in the Miocene has resulted in a molluscan fauna that is the most distinctive in the South Asian Region, with exceptional endemism among the land snails (Naggs and Raheem *et al*., 2000) that represent 60 genera and 26 families (Ranawana, 2006). Sri Lanka's land snails also have more Gondwana relict taxa compared with India (Naggs and Raheem, 2000, cited in Naggs, *et al.*, 2005); a total of 14 species from five endemic genera (i.e. *Ravana*, *Ratnadvipia*, *Acavus*, *Oligopsira* and *Aulopoma*) are considered geographical relicts. Among the other faunal groups that have been studied to some extent, endemism is notable among freshwater crabs (100%), dragonflies (46%), and carabid beetles (24%) that are from ten endemic genera (MOFE 1999). Many endemic species are point endemics restricted to extremely small areas within a single forest (MoENR, 2008).

• Flora

Sri Lanka has over 3771 angiosperms (**Table 1.3**) from 214 families and 1522 genera, of which about a quarter are endemic (Seneratne, 2001). The fact that this extraordinary endemicity occurs mainly at specific and intraspecific level salso makes the Sri Lankan flora of outstanding interest (Ashton & Gunatilleke, 1987). Remarkably all 58 species of Dipterocarps in Sri Lanka, which form the dominant structural and floristic component in Wet Zone rainforests, are endemic; with 26 species of *Stemonoporus* occurring throughout the full elevation range of the Wet Zone (MoENR, 2008). Interestingly, these Dipterocarps also share a common Gondwanic ancestry with Sarcolaenaceae which is now endemic to Madagascar (*Ducousso et al. 2004 cited in MoENR, 2008*).

Increased research on biodiversity (Article 12)
With grater awareness about the importance of the island's biodiversity has come a perceptible increase in taxonomic research on the faunal groups during the past decade, which has lead to the discovery and scientific description of many new species of invertebrate and vertebrate fauna, with amphibian species increasing from 34 (Kirtisinghe, 1957) to 106 (Dutta and Manamendra-Arachchi, 1996; Manamendra-Arachchi and Pethiyagoda,1998; Manamendra-Arachchi and Pethiyagoda, 2005; Meegaskumbura and Manamendra-Arachchi, 2005). During the past decade more than 20 species of new reptiles (Pethiyagoda & K. Manamendra-Arachchi, 1998; Batuwita, & Bahir, 2005; Samarawickrama, et al, 2006; Wickramasinghe, 2006; Wickramasinghe & Munindradasa, 2007; Batuwita & Pethiyagoda, 2008; Manamendra-Aarachchi & Pethiyagoda, 2007); birds (Warakagoda and Rasmussen, 2004), mammals (Groves and Meijaard, 2005; Nekaris and Jayawardena, 2004; Meegaskumubura et al., 2007); and more than 40 new species of freshwater crabs (Ng, 1994, 1995a, b; Bahir, 1998, 1999; Ng and Tay, 2001; Bahir and Ng, 2005; Bahir and Yeo, 2005) have been discovered. Several lesser-known invertebrates such as insects, spiders and land snails (Karunaratne, 2004; Wijesinghe, 1991a, 1991b; Benjamin, 2000; Benjamin and Jocqué, 2000; Benjamin, 2001; Naggs *et al*., 2005) have also been discovered. well. Molecular investigations have confirmed an even higher degree of endemism than previously estimated among faunal groups in the island. Despite repeated land connections with India during the Pleistocene period, the island has high endemism among the less mobile faunal groups such as tree-frogs (Meegaskumbura *et al*., 2002), agamid lizards (Macey, *et al*., 2000; Schulte *et al.,* 2002) and skinks (Austin, *et al*., 2004).

TABLE 1.3: **Species diversity among selected groups of Sri Lanka's fauna and flora in terrestrial and freshwater wetlands**

Taxonomic group	Number of species	Number of endemic species and % endemism	Reference
Land snails	246	204 (83%)	Ranawana, 2006
Dragonflies	120	57 (47.5 %)	Bedjanic, 2006 and MoENR, 2007)
Bees	148	21 (14%)	Karunaratne and Edirisinghe, 2006
Carabid beetles	525	127 (24%)	MOFE, 1990
Butterflies	243	20 (8.2%)	Perera and Bambaradeniya, 2006
Spiders	501	NA	MoENR, 2007
Freshwater crabs	51	51 (100%)	MoENR, 2007
Freshwater fish	82 [1]	44 (54%)	Pethiyagoda, 2006
Amphibians	106 +	90+ (85%)	Pethiyagoda, *et al*, 2006
Reptiles (terrestrial)	183	92 (50%)	Ranawana, 2006
Birds (including migrants)	482 (220 residents)	25 definitive* and 8 proposed (*5% of all species and 11% of residents)	Kotagama, *et al*, 2006;
Mammals	91	16 (18%)	Weerakoon, *et al*, 2006
Angiosperms	3,771	926 (24.55%)	Dassanayake and Fosberg (1980-2004) cited in IUCN and MoENR, 2007
Pteridophytes (Ferns only)	348	48+	IUCN and MoENR, 2007
Mosses	560	63+	IUCN and MoENR, 2007
Liverworts	303	NA	MoENR. 2006
Lichens	661	NA	MoENR. 2006

NA= data not available

Most lower plant groups are as yet insufficiently identified, but research during the past three decades indicate 560 species of mosses, 303 species of liverworts (S. Wijesundra pers.com, this report), 896 species of algae and about 1,920 species of fungi in the island (MOFE, 1994). A considerable diversity among ferns and fern allies is also suspected (ibid).

1.1 Coastal and marine ecosystems

TABLE 1.4 **Species diversity among selected faunal groups in coastal and marine ecosystems**

Taxonomic group	Number of species
Hard coral species	183*
Echinoderms	213+
Marine molluscs	228+
Sharks	61+
Rays	31+
Marine reptiles	18+
Marine mammals	38+
Pelargic fishes	1800+ **

Sources: *Rajasuriya *et al.*, 2000, + IUCN and MoENR, 2007; ** CCD, 2004

Among the species identified in marine and coastal waters **(Table 1.4)** are a wide diversity of pelagic fishes of which 146 are bony fishes important in the commercial food fishery (MoFE, 2000), five species of turtles that nest on the beaches, and 37 species of cetaceans and the dugong (MoENR, 2002). Several species of sea snakes and a diverse array of coral and reef associated organisms, including 72 species of common reef fishes are associated with coral reefs. Genetic diversity within coastal habitats is believed to be high, and of possible economic value, but this aspect has not been investigated adequately as yet (CCD, 2004).

1.1 *Ex-situ* collections

Sri Lanka has several institutions that engage in captive breeding or propagation that aids *ex-situ* conservation of terrestrial and freshwater biodiversity. Among them are the National Botanic Gardens (NBG), The National Zoological gardens (NZG) at Dehiwala, and the National Aquatic Resources Research and Development Authority (NARA).

Initiatives for ex-situ conservation

Under the National Botanic Gardens (NBG) are the Royal Botanic Gardens (RBG) at Peradeniya, Hakgala, Gampaha (Henerathgoda), Sitawake (Awissawella) and Mirijjawila (Hambantota District) providing a coverage of all major climatic zones. The medicinal plant gardens at Ganewatte (on 23 ha) in the North Western Province, and a Biodiversity Complex at Gampola, also function under the NBG. The RBG at Peradeniya, located on 59 ha has over 4000 species under cultivation. It is mandated for *ex-situ* conservation; and has pioneered floriculture in Sri Lanka. However, only a fraction of the species in the Botanic gardens at present are endemic to Sri Lanka, and the role of this institutions as reservoirs of indigenous biodiversity is not well established due to historical reasons. This trend has been reversed somewhat in recent times and the RBG now has 1471 specimens from local species, while the more recently developed herbarium at the Hakgala Botanic Gardens has about 2000 specimens from local species. One of the main objectives of the NBG now is for development of technologies related to exploitation of lesser known and under-utilised plants and development of ornamental and amenity horticulture.

There are several Medicinal Plant Gardens located in the Wet Zone of Sri Lanka (i.e. in Navinna and Meegoda). The Ayurvedic garden in Navinna harbours around 200 species of medicinal plants, with more than 1500 individual plants (MoENR, 2009).

The National Zoological gardens (NZG) at Dehiwala houses about 3500 animals from 350 species of mammals, birds, reptiles, fish, amphibians, butterflies and marine invertebrates in a space of about 10 ha. While most of the animals are non-indigenous, the zoo has initiated support for biodiversity conservation by breeding some rare and endangered species, with special emphasis on endemic ornamental fish. The NZG also promotes *ex-situ* conservation of indigenous species in the walk-in aviary for birds, the small cats zone and the butterfly garden. The role of the National Zoological Gardens for *ex- situ* conservation is limited as yet, due to few scientifically managed captive breeding programmes for threatened fauna, though captive breeding has been successful with species like the leopard and elephant. These issues will be rectified with the setting up of the Sri Lankan section of the new zoological gardens at Pinnawela.

Though captive breeding has been carried out for elephants at the Pinnawela Elephant Orphanage, the animals are not reared for re-introduction to the wild. In contrast, re-introduction is the goal at the Orphan Elephant Transit Home at Uda Walawe, but such initiatives need to be carefully managed with the required technical expertise and stringent monitoring to ensure their long-term success.

Sri Lanka has several bio-repositories that are valuable to facilitate research. A collection of all the documented angiosperm flora in Sri Lanka are held at the National Herbarium at Peradeniya. The biorepository at the National Museum in Colombo has a good collection of vertebrates (I.e. 2885 mammals; 3243, birds; 7128 reptiles: 1059 amphibians: 15064 fish) and invertebrates (4671 molluscs: 2001polychaetes and > 100,000 arthropods).
Source: MoENR, 2009

1.3.2 Issues and threats

Species loss

Sri Lanka has been engaged in the preparation of nationally threatened species lists since 1989 (Wijesinghe *et al. 1989;* 1993; Gunatilleke and Gunatilleke, 1991; IUCN, 2000 and 2007). They have influenced policy for conservation of biodiversity in the country. This is in accord with the Convention on Biological Diversity, ratified by Sri Lanka in 1994, which requires Contracting Parties to identify important components of biological diversity for conservation and sustainable use (*Article 7 of the CBD*).

The 2008 IUCN global list of threatened species contains 534 species found within Sri Lanka, of which 119 are invertebrates, and 280 are plants. During the latest National Red List assessment of 2007 (**Table 1. 5**) 223 species of vertebrates (amounting to 33% of all vertebrate species in the island), of which 62% were endemics were found to be threatened; among them about 57 species of inland vertebrates assessed were Critically Endangered.

TABLE 1.5: **A Summary of Some Threatened Fauna and flora of Sri Lanka from Selected Taxonomic Groups**

Group	Species in the 2007 Red List of Threatened fauna and flora of Sri Lanka		Species in the 1999 List of Threatened Fauna and Flora of Sri Lanka	
	Number Assessed *(no. of endemics in parenthesis)*	Number threatened *(no. of endemics in parenthesis)*	Number Assessed *(no. of endemics in parenthesis)*	Number threatened *(no. of endemics in parenthesis)*
Land snails	246 (204)	33 (32)	235 (198)	117 (103)
Freshwater shrimps	-		23 (7)	18 (7)
Freshwater crabs	51 (51)	37 (37)	25 (25)	25 (25)
Dragonflies	120 (57)	20 (20)	116 (49)	70 (49)
Butterflies	243 (20)	60 (13)	243 (20)	76 (13)
Therapsid spiders	7(5)	1 (1)	--	--
Evaluated invertebrates				
Freshwater fishes	82 (44)	28 (20) [34%]	78 (32)	39 (32) [50%]
Amphibians	106 (90)	52 (51) [49%]	54 (35)	33 (31) [61%]
Reptiles	171 (101)	56 (37) [33%]	155 (81)	87 (67) [[56%]
Birds (residents only)	227 (33)	46 (16) [20%]	226 (23)	61 (22) [27%]
Mammals	91(16)	41(14) [45%]	90 (14)	34 (13) [38%]
Evaluated vertebrates	677 (284)	223 (138)		
Evaluated Flowering plants	1099 (553)	675 (412)		

Sources: IUCN and MoENR (2007) and IUCN Sri Lanka (2000)

(*note:* The above two lists have been prepared using different criteria. The 2007 list used the IUCN Red Listing Criteria while the 1999 list used objective, but specially designed national criteria that reflect risk of extinction).

The percentage of threatened species among species assessed was highest among amphibians, followed closely by mammals. Despite a amazing extant amphibian diversity in the island, 21 species of amphibians have become extinct during the past 100 years (IUCN and MoENR, 2007). They include species of evolutionary importance such as *Nannophrys guentheri* (Guenther's rock frog)--one of three relict frog species from an endemic genus. Significant local extinctions have also occurred among several mammal and bird species in the Wet Zone. The Comb Duck (*Sarkidiornis melanotus*) is among the species to have disappeared from Sri Lanka in recent years. The underlying reasons are mainly loss or disturbance of tree cover in natural as well as terrestrial modified areas, and the loss and degradation of

wetland habitats (MALF, 1995; IUCN and MoENR, 2007). Significantly, most of the threatened terrestrial vertebrates and fishes are distributed within the Wet Zone with a high human population density **(**IUCN and MoENR, 2007).

Among the invertebrate fauna that were evaluated, the highest number of threatened species were among the butterflies—amounting to 25% of butterfly species assessed. About 72.5% of all freshwater crab species recorded to date are also threatened, and notably, most of the threatened species among the freshwater crabs, land snails, dragonflies are endemic species.

One of Sri Lanka's flagship species – the elephant – has been affected by a populations decline in both Dry and Wet Zones. At the turn of the century they numbered around 10,000, but have now dwindled to a mere 3,000 and are almost restricted to the Dry Zone. Large scale hunting for trophies and ivory, along with clearing of wet montane forests for plantation agriculture were the reasons for a drastic decline in the elephant population during colonial rule. Consequently, with the exception of a very small herd of about 20 animals (DWC, 2008 personal communication), the elephant has become locally extinct in the Wet Zone of Sri Lanka where they were once prolific. In more recent years, deforestation in the Dry Zone with habitat loss for elephants and expansion of human settlements has led to an escalation of the human-elephant conflict, with the killing of elephants to defend crops, habitations and self defence. According to recent estimates, an elephant death is reported every two days, mainly due to gun shot injuries (IUCN and MoENR, 2007).

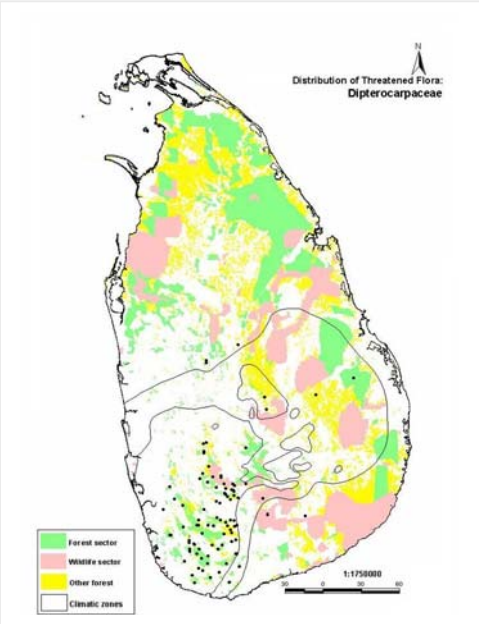


Figure 1.7: Distribution of Dipterocarpaceae in Sri Lanka
Sourse: Gap Analysis Report, MoENR, 2006

Hunting and poaching has also aggravated the threat status of many other vertebrate species, such as the leopard, which is shot and speared for skins and are also prone to be killed by snares set for other species such as wild boar and deer hunted for meat (Jayawardene, 2002 and Kittle and Watson, 2002 cited in IUCN and MoENR, 2007).
With regard to the indigenous angiosperm species assessed through the recent National Red Listing exercise (IUCN and MoENR, 2007), 675 species were found to be threatened, of which 412 (61%) were endemics, and 37% were Critically Endangered. Significantly, a further 72 species (6.5%) out of the total number assessed had already become extinct (ibid). The dipterocarps with a remarkable endemicity of 100% comprised 6.5% of the threatened plants in the list, with 42 species threatened out of 58 assessed, and one extinct species. Most of the threatened dipterocarps are also confined to the Wet Zone **(Figure 1.7)**.

Loss, fragmentation, modification and degradation of natural habitats is the prime cause for many of Sri Lanka's terrestrial and freshwater species being pushed towards the brink of extinction (MoENR, 2002; IUCN and MoENR, 2007). The recent red listing exercise shows that much of the threatened species are within the populous districts of the lowland Wet Zone and the central highlands, where there is a high population density, unplanned land use causing loss, modification and degradation of habitats; over-exploitation of species with resource value; spread of alien invasive species, and pollution (IUCN and MoENR, 2007). These threats are also akin to drivers of biodiversity loss identified in the Millenium Biodiversity Assessment of 2005. Pollution and siltation caused by improper land use has adversely affected aquatic fauna and flora and some of the lower plants, such as several mosses and liverworts and the fern *Schizaea digitata* that have disappeared from around the city of Colombo most probably due to pollution (MoENR, 2002). Similarly, there is growing evidence that forest dieback in the montane rainforest of Horton Plains National Park may be due to air pollution and acid rain in urban areas (MoENR, 2008).

Over exploitation has been a major determinant of species loss in of Sri Lanka. For example, all ten species of rattans in Sri Lanka have been over-collected and are now threatened. Likewise, many species of medicinal or commercial value, such as *ekaweriya* (*Rauwolfia serpentina*), *asoka* (*Saraca asoca*), *rodanti* (*Capparis moonii*), *amukkara* (*Withania somnifera*) and *bim kohomba* (*Munronia pumila*) have become rare in the wild due to heavy collection (MoFE,1994; MALF,1995). The largest number of threatened plant species (122), amounting to 18% of all threatened plant species, are from the family Orchidaceae that yields many ornamental and epiphytic species; notably, four species of orchids have already become extinct. Most threatened endemic epiphytic orchids depend on the conservation of the Wet Zone forests for their survival (MoENR, 2008). Similarly, a large number of freshwater and reef fishes have become threatened with over-collection from the wild in the ornamental fishery (IUCN and MoENR, 2007). Several valuable timber species such as satinwood (*Chloroxylon swietenia*), ebony (*Diospyros ebenum*), calamander (*Diospyros quaesita*) are also now listed as threatened due to selective removal of mature trees; similarly, the Madara tree (*Cleistanthus collinus*) has been so heavily exploited that it is suspected to have become extinct during the latter half of the past century (MALF, 1995).

A minimum of 38 species of fauna and 20 species of flora (some of which are now domesticated) have already reached, or have high probability of reaching, invasive proportions in the country (MoFE, 2000). As these species can pose severe threats to national biodiversity, effective control measures to prevent their entry and establishment are considered an urgent need.

Sri Lanka has suffered major environmental and economic problems from previous invasions such as the 'water hyacinth' (*Eichhornia crassipes*) which commenced with one plant brought in 1904 from Hong Kong for ornamental purposes. The agricultural sector has already had several problems due to the introduction of alien invasive species that have reached pest proportions in Sri Lanka, such as the coconut pest *Promecotheca cumingii*. Other major problems were felt from non-intentional introduction of Salvinia (*Salvinia molesta*) in the 1940s. Although both were subjected successfully to biological control measures, the financial loss by for control measures and loss of productivity was considerable. The Parthenium weed (*Parthenium hysterphorus*) was observed for the first time in Sri Lanka in 1999, introduced as contaminants in imported condiments and food stuff. Although it posed a threat to biodiversity, it too was controlled with timely and effective action by the Department of Agriculture using the control agent *Zygogramma bicolorata*. The latest threat to agriculture is the papaya mealy bug *Paracoccus marginatus* that is also spreading to other horticultural crops and even native flora. This is proposed to be controlled with a biological control agent from Puerto Rico.

The alien invasive Clown Knife Fish (*Chitala ornatus*) was introduced to Sri Lanka as an ornamental aquarium fish, with breeding populations in streams and reservoirs in the Wet Zone that harbour most of the threatened endemic freshwater fish. The population reductions of many species of endemic fish have are suspected subsequent to the introduction and spread of *C. ornatus* (Gunawardane, 2002). There are several other species of alien invasives, such as the plants *Annona glabra, Dillenia suffruticosa* and *Eichhornia crassipes* that have resulted in degradation of the remaining marshy habitats of the threatened blind eels (*Monopterus* spp.) in the western region of Sri Lanka. Liekwise, Wijesinghe (2001) had recorded negative abundance relationships between endemic (ie., *Srilankamys ohiensis*) and non-endemic (ie., *Rattus rattus*) rat species in study sites within Sinharaja rainforest suggesting that these species are competing. Large herds of feral domestic buffalo (*Bubalus bubalis*) occur in many protected areas in Sri Lanka (Bambaradeniya, 2002), where it has hybridized with the threatened wild water buffalo (*Bubalus arnee*) resulting in the local extinction of genetically pure populations of the latter species in locations such as the Wilpattu National Park (Deraniyagala, 1964).

1.4 Forests and grasslands

1.4.1 Status

Forests

Diversity of forests in Sri Lanka

For a relatively small country, Sri Lanka shows a marked diversity of forest types as a result of the differences in spatial distribution of rainfall, altitude and soil. The canopy height of Wet Zone forests show a progressive decline, with wet lowland forests occurring at 0-1000 m transforming into sub-montane forests around 1000 - 1500 m, and again into montane forests at elevations of above 1500 m. Patches of unique pygmy forests occur in some areas above 2000 m. The lowland Intermediate Zone contains yet another distinct group of vegetation termed the tropical moist evergreen forests. The Dry Zone has the characteristic tropical dry mixed evergreen forests, with an overall canopy height of less than 20 m that is also more open compared with the Wet Zone rainforests. Due to historical factors, the Dry Zone forests are secondary and seral, although climax vegetation can be found in isolated hills such as Ritigala. These forests change into the characteristic thorny scrub of the Arid Zones in the northwestern and southeastern coastal areas.

Sri Lanka falls within the Biogeographical Provinces termed the Ceylonese Rainforest and Ceylonese Monsoon forest (IUCN 1987). At the beginning of the last century Sri Lanka had about 70% of land area under natural forest (Wijesinghe, *et al*., 1993). This was reduced to 23.88 % of the total land area by 1992. More recent Forest Department data for 1999 and 2007 reveal that closed canopy natural forests had dropped further between this period from 22.55% to 22.22%, though all forests including "sparse forests" (mainly scrub), brings the total forest cover in the country to 31% of the land area (Dela, 2003; CB, 2007). Forest plantations, maintained by the Forest Department, added around 135,623 ha to the vegetation cover in 1999 (Central Bank, 2001; Bandaratilleke, 2000), and about 72,350 ha of viable forest plantations had been established by 2000 (Central Bank, 2001). Since the 1990s, several important initiatives have been carried out in Sri Lanka to assess the extent and status of the country's forestry resource. **Figure 1.8** shows the percent composition of Sri Lanka's main natural forest categories in 1999.

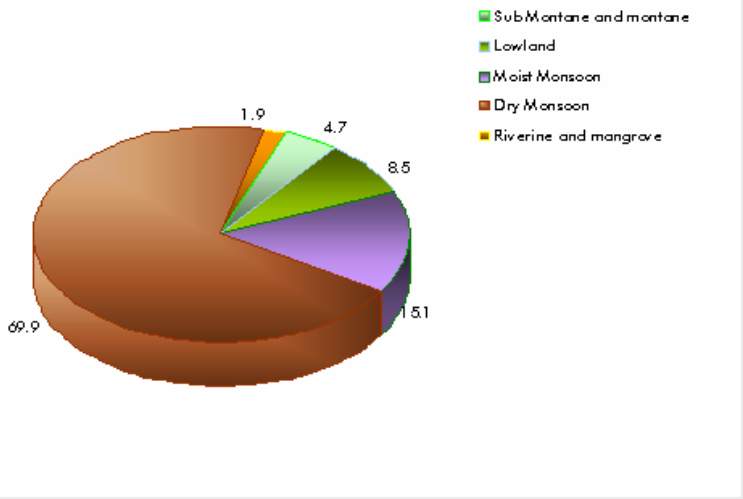


Figure 1.9: The percent composition of Sri Lanka's main natural forest categories in 1999.
Sourse: Forest Department data, 1999

Dry monsoon forests **(Figure 1.3)** located mainly in the northern and eastern regions of the island are the most widespread and cover an area of about 10,27,544 ha **(Table 1.6**). In contrast, the biologically valuable wet lowland forests cover only around 1,24,340.8 ha, while sub-montane and montane forests are even more scarce. The mangrove swamps in Sri Lanka are also naturally fragmented and occur in a narrow inter-tidal belt that extends less than 1 km landward from the mean low water tidal level (MoFE, 2000).

TABLE 1.6: **Change in Natural Forest Remaining in 1992 and 1999, by Forest Type**

Forest type	Total forest area (ha) 1992*	Total forest area (ha) 1999*
Montane forest	3,108.0	3,099.5
Sub-montane forest	68,838.0	65,792.3
Lowland wet evergreen forest	1,41,549.0	1,24,340.8
Moist evergreen forest	2,43,877.0	2,21,977.0
Dry mixed evergreen forest	10,94,287.0	10,27,544.1
Riverine forest	22,411.0	18,352.1
Mangroves	8,687.0	9,530.5
Total extent of "closed canopy" forest	15,82,757.0	14,70,636.2
Open Canopy Sparse Forest	4,63,842.0	4,71,583.2
Total forest cover in the country	**20,46,599.0**	**1942219.5**

Source: Legg and Jewell (1995) and Forest Department (1998)*

The National Conservation Review (NCR) carried out by the Forest Department in the mid 1990s, comprised a major biodiversity assessment of the islands natural forests over 200 ha. This survey identified the wet lowland rainforests as the richest among Sri Lanka's forests in terms of biodiversity and endemism, as well as being of prime importance for soil and water conservation (IUCN/FAO/1997). These extremely fragmented wet lowland forests are also the last remnants of the once widespread mid-Miocene tropical rain forests of Sri Lanka. In terms of evolutionary importance among endemic species, the forests of the Montane Zone are the main habitats for the most conservative faunal elements in the island, due to mountain top isolation and least disturbance by biotic invasions from south India (MoENR, 2008)

The Wet Zone rainforests harbour nearly all the country's woody endemic flora, about 75 per cent of the endemic fauna, and all the endemic genera (MOFE, 1999). They also provide refuge for the relict Gondwana-Deccan biota (Ashton and Gunatilleke, 1987). The level of endemism in Wet Zone forests ranges from 37 - 64 % for woody plants and 14 - 52 % for animals, compared with 10-16% for species in the Dry Zone forests (MOFE, 1999).

The NCR also 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 Wet Zone, while the Intermediate and Dry Zones contain one complex each (MoFE, 1999). The fact that the biologically diverse lowland rain forests amount to less than 2% of the island's total land area, with wet sub-montane and montane forests adding only a further 1.01 % and 0.05% respectively (Forest Department data for 1999). This issue is compounded by the fact that although 9,462 sq km of natural forest and scrubland, amounting to about 14% of the island are declared as Protected Areas (National Environmental Outlook, 2006), and only about 18% of this system falls within the Wet Zone (MoENR, 2002).

As a result of considerable anthropogenic factors, of which the main cause is deforestation on a massive scale for establishment of plantation agriculture under colonial rule, Sri Lanka's rainforest biome is 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 (IUCN/WCMC/FAO 1997), and many are suspected to be too small to sustain functional ecosystems in the long-term, or provide viable habitats for the mammalian macro-fauna of the Wet Zone. Consequently, forests that continue to harbour most of the endemic species are severely fragmented forest patches that are surrounded by a high human population density.

Sri Lanka's dipterocarp-dominated lowland forests are characterised by a dense canopy of trees reaching 30-40 m in height, with emergents rising through the canopy to about 45 m. Due to the height of the canopy trees and the straightness of their boles, these forests were considered to be a viable source of timber around the 1940s, and this trend continued until 1989, resulting in their selective logging.
Source: MoFE, 1999

Due to intense public concern with regard to the logging of the Sinharaja Forest Reserve, an Accelerated Conservation Review (ACR) of 31 Wet Zone forests was carried out in the 1990s by the Forest Department. The findings of this survey resulted in a moratorium on logging in all natural forests of Sri Lanka from 1990. Illegal timber felling has also been reduced, particularly in Wet Zone forests, as permits are now required for transportation of most species of timber value. However, illegal timber felling in forests is still a problem in some forests of the Dry Zone, and more marginally in the Wet Zone forests. The latter is mainly for personal use for housing construction. Surveys such as the ACR, the NCR, and the recent Baseline Biodiversity Surveys in seven Protected Areas under the Department of Wildlife Conservation, have shown that the remaining rainforests have a rich biota, although further forest loss may well lead to species extinctions on a massive scale. Already 33 Wet Zone forests have been identified for strict conservation.

During the period 1956-1983, nearly 12 percent of the Sinharaja was deforested almost entirely on the periphery, so that only 66 percent of the World Heritage site remains as primary forest (Barnyard and Fernando, 1988).

Despite these valuable conservation initiatives, assessment of the viability of natural vegetation in Sri Lanka through the recently concluded 'GAP analysis' of the existing Protected Area system using GIS technology (**Figure 1.9**) showed that a considerable percentage of forests in the island are of the condition categories of 'moderate' or 'poor' (Gap Analysis final report, 2006).

Despite a slow regeneration of logged forests, as demonstrated by poor representation of endemic woody species in selectively logged areas in the Sinharaja eight years after logging was halted (de Zoysa *et. al*., 1990), a remarkable improvement in ecosystem quality and forest regeneration is now apparent in some of the larger Wet Zone forests that were selectively logged in the 1970s (IUCN, 1993; Dela, 2003). This has been attributed to the ban on official logging of natural forests in the country, and the veering away of the Forest Department's focus from production to forest conservation. The conservation value of Wet Zone forests as the only refuge of some of the rarest faunal and floral species in the world is also now recognised, and there is a positive move by many Protected Area managers to engage local communities in forest conservation to preclude anthropogenic disturbances to forest ecosystems in all climatic zones.

Much of the remaining large tracts of forests in the country **(Figure 1.3)** as well as the larger Protected Areas **(Figure 10 a & b)** consist of Dry Zone forests. These forests, though less diverse than Wet Zone forests, are nonetheless the main habitats for large mammals including the elephant; and carnivores, ungulates and primates show their highest species diversity in the Dry Zone (MoFE, 1999). The Ruhuna National Park in the Dry Zone is exceptional in terms of

woody species and faunal diversity with regard to large herbivores and carnivores and the floodplains of the Mahaweli river in the Dry Zone are the most important habitats in the country with regard to wildlife biomass (ibid).

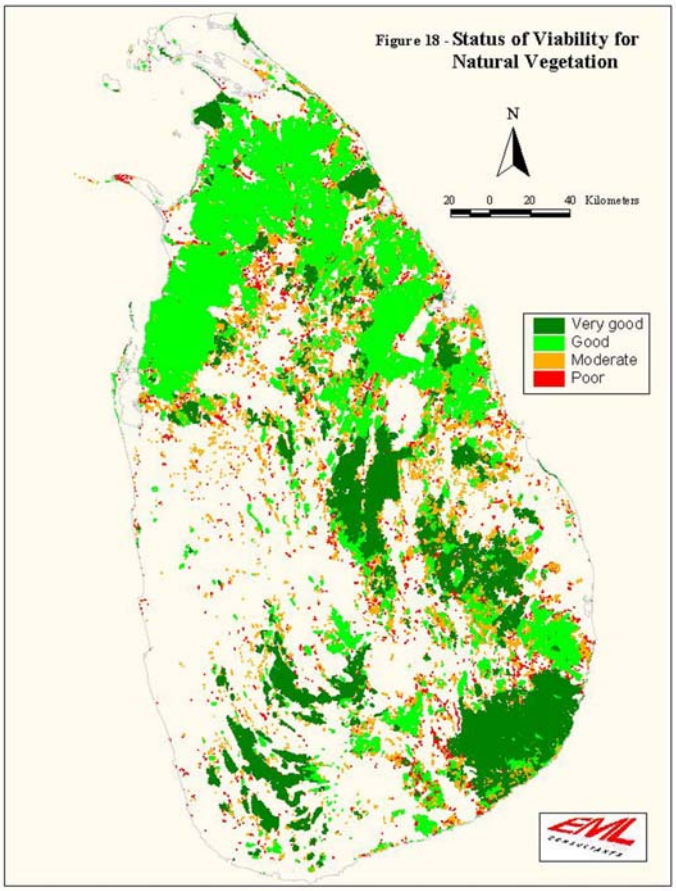
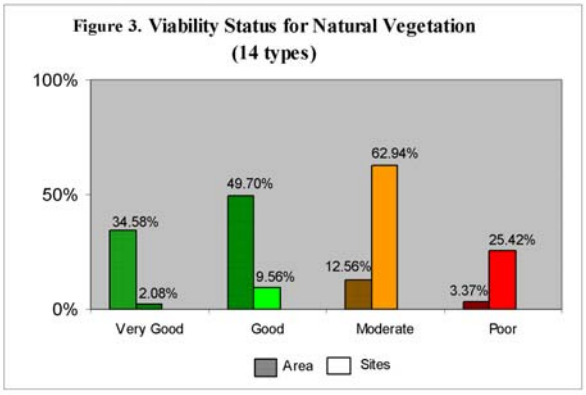


Figure 1.8 Status of viability for natural vegetation

Sourse: Gap Analysis Report, MoENR, 2006



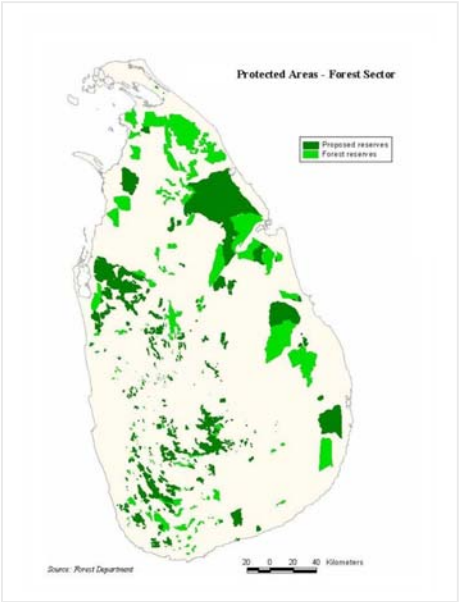


Figure 1.10a: Protected Areas under the Forest Department

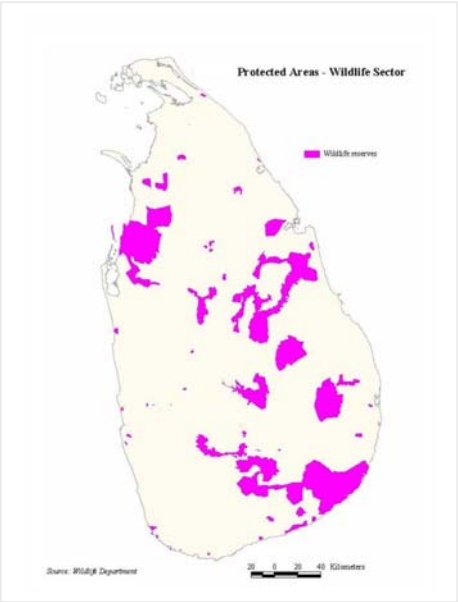


Figure 1.10b: Protected Areas under the Department of Wildlife Conservation

Sourse: Gap Analysis Report, MoENR, 2006

Grasslands

Sri Lanka's forests are associated with several different types of grasslands. These include: the savannas that occur as a distinct community around Bibile, the extensive dry *patanas* that are generally devoid of tree flora (except in the valley bottoms) are found in the Uva basin, and the wet *pathana* grasslands *that* occur at very high elevations around 2000 m in association with upper montane forests. The *damana* grasslands of the Dry Zone found mainly in the Eastern Province and the *talawa* grasslands of the lowland Wet Zone are believed to be the result of forest clearing and repeated firing. The wet *villu* grasslands in the flood plains of rivers flowing through the Dry Zone are particularly rich in biodiversity among the large grazing and browsing herbivores such as deer and elephant.

1.4.2 Issues and threats for forests and grasslands

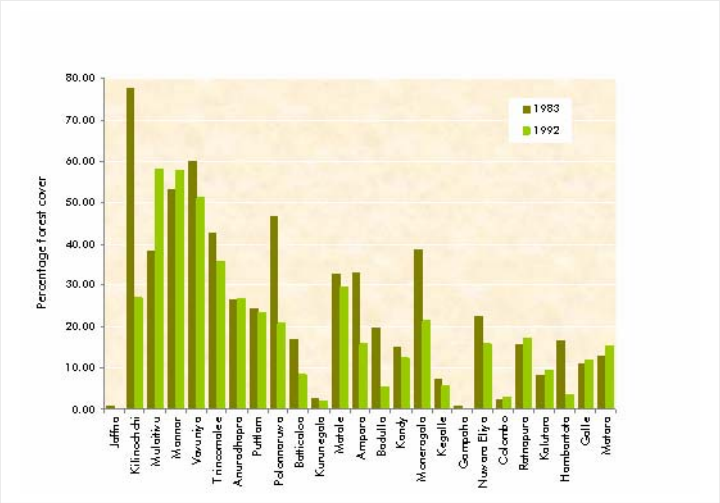


Figure 1.11a: Sri Lanka's forest cover by district in 1983 and 1992
Source: Legg and Jewel, 1995

Deforestation has been the most serious threat to terrestrial biodiversity in Sri Lanka with the island loosing approximately 50% of its forest cover within about 50 years. The area under closed-canopy dense natural forests shows a marked decline from 44% (2.9 million ha), to 26.6% (1.76 million ha) and 23.88.2% (1.33 million ha) of the land area respectively in 1956, 1983 and 1992 (Legg and Jewel, 1995; FD, 1999) and to 22.5 in 1999 (Forest Department data. 1999). The rate of deforestation also increased from 42,000 ha between 1956 and 1983 to 54,000 ha between 1983 and 1992, Consequently the per capita figure of 0.12 ha of forests in 1983 dropped to 0.09 ha by 1993 (Bandaratillke, 2000). **Table 1.6** shows that all categories of closed canopy natural forest in the island had decreased between 1992 and 1999. **Figure 1.11 a & b** compares Sri Lanka's forest cover by district in 1983 and 1992 (Legg and Jewel, 1995) and 1999 (Forest Department data, 1999). Although a drop to 17 % by 2020 was predicted if no preventive action is taken MALF, 1995), various conservation measures have been adopted to reduce deforestation. The rate of deforestation had dropped to 20,000 ha per year between 1994-1999 (National Biodiversity Outlook, 2006), showing that the trend for forest loss has now considerably slowed down, though continuing. While some of the forest loss (per district) is attributed to redefining of district boundaries,[2] the acceleration of deforestation from 1983 to 1992 was partly due to extensive land clearing in the Dry Zone for irrigation schemes established through the Mahaweli Development Project. Much of the post colonial forest loss has been directly as a result of expansion of irrigation, human settlements, agricultural development, and other non-forest development activities such as hydro electric generation (Bogahawatte, N.D).

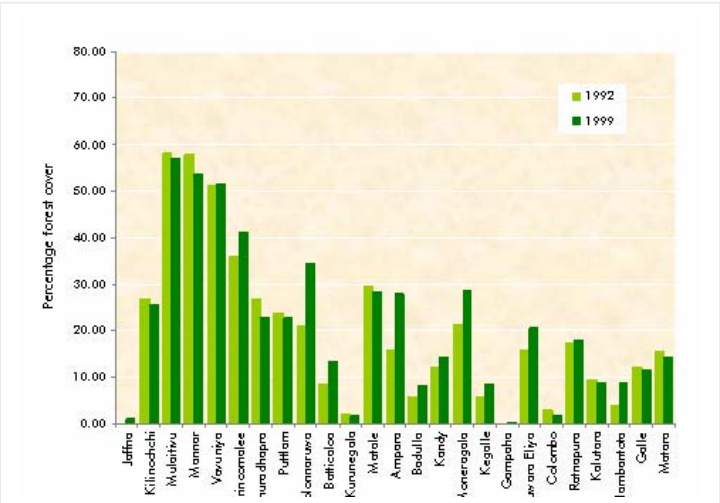


Figure 1.11b: Sri Lanka's forest cover by district in 1992 and 1999
Source: Forest Department, 1999

[2] A decrease in land area within the district results in a reduced forest cover for the district.

TABLE 1.7: **Trends in detection of illicit forest encroachments**
(in areas managed by the Forest Department)

Year	Area encroached (ha)	Detections
2002	517.56	1218
2003	950.42	960
2004	567.09	805
2005	359.17	697

Source: National Environmental Outlook (2006)

Between 2002 and 2005, only about 2394.24 ha of forest encroachments on forest reserves were recorded despite 3680 detections of illicit clearing (**Table 1.7**). Past deforestation and continuing illegal timber felling has already reduced the biodiversity of Dry Zone forests, so that mature individuals of valuable timber species have become exceedingly rare. Many of these species were listed as threatened during successive threat listing process (IUCN, 2000; IUCN and MoENR, 2007). While relatively large forests tracts do still remain in the Dry Zone, clearing to establish reservoirs for hydropower generation, human settlements and agriculture has considerably depleted the forest cover in this region during the last century. This has in turn increased the threat status of the large and charismatic mammalian fauna, particularly the elephant, by reducing their preferred habitats, increasing vulnerability to poaching and disrupting wildlife migration routes with a consequent increase in human-wildlife conflicts. Forest loss due to *chena* or slash and burn cultivation is still a major threat to Dry Zone forests, while cattle grazing degrades Dry Zone forests and results in loss of fodder for wildlife such as elephants and other large herbivores.

Birds such as the orange-billed Babbler (*Turdoides rufescens*) are suspected to have become locally extinct from some degraded and fragmented forest patches, and the endemic Whistling Thrush (*Myophonus blighi*) is affected by the extensive clearance and degradation of montane forests for conversion to timber plantations and agriculture. The adverse impacts of forest loss and forest fragmentation have also had its toll on the unique and threatened shrub frogs of the genus *Philautus* that are restricted to the Wet Zone. Several of these species are now extinct.
Source: IUCN and MoENR, 2008

The loss of natural habitats has caused several species to undergo local extinctions in the Western Province of Sri Lanka during the last three decades. The national Red List of 2007 states that amongst those most affected have been several arboreal endemic mammals: the purple-faced leaf monkey (*Semnopithecus vetulus*), the golden palm civet (*Paradoxurus zeylonensis*) and the red slender loris (*Loris tardigradus*).

Due to selective removal, mature trees of several valuable timber species such as satin wood and ebony are now very rare, despite adequate natural regeneration. The nature and extent of forest resource use varies according to location and socio-economic level of the local communities. However, depletion of non-timber forest resources occurred in all climatic zones due to over exploitation of species of commercial or subsistence value. This demand for forest products such as wood for poles and posts, food items, resins, rattan and bamboo, biomass for fuelwood and medicinal plants was a major cause of forest degradation through to the 1990s. As a result, all ten species of rattans in the country, and several bamboo and medicinal plants of commercial value, are now nationally threatened (MALF, 1995; IUCN and MoENR, 2007). Fuelwood collection has been particularly damaging to forests *IUCN, 1994), due to debarking of trees to increase dead wood for collection, and this is continuing in some regions even now.

Alien invasive species have been identified to reach threat proportions in several natural forests, such as *Lantana* sp. at Uda Walawe National Park; *Ulex europeus* at Horton Plains National Park and *Prosopis julifolra* at the Bundala National Park.

1.5 Freshwater wetlands

1.5.1 Status

"Wetlands, both natural and man-made, were the centres of Sri Lanka's ancient hydraulic civilization that thrived for over a thousand years and formed the hub of its [Sri :anka's]cultural, economic and social evolution. Due to the system of land use adopted in ancient times, catchment areas and other important wetlands in the uplands were preserved under forest cover, while the Dry Zone lowlands were irrigated using water from thousands of rainfed tanks dotted throughout this region. This system of land use served to conserve the biodiversity of natural wetlands. There is also evidence that the conservation of biodiversity in man-made tanks was given consideration in Royal Decrees as early as the twelfth century A.D.. "
Source: MOFE, 1999.

Wetlands, both natural and man-made, currently make up about 15% of the land area of Sri Lanka. Among the former category are rivers and streams, riverine floodplains, small isolated freshwater bodies, freshwater springs, seasonal ponds and freshwater marshes. The most important wetalands are associated with Sri Lanka's network of 103 major rivers that commence in the highlands and radiate across the lowland plains into the sea **(Figure 1.6**).Forming a total collective length of about 4,560 km (MoFE, 1999), they cover cover an area of about 59,245 sq km with their river basins (Manchanayake and Madduma Bandara, 1999),which amounts to about 90 per cent of the island's total land area (MEPA, 1991). Sri Lanka's freshwater availability is considerably influenced by climate, and its location in respect of the equator and the landmass of the Indian sub-continent.

The floodplains associated with freshwater aquatic systems are among Sri Lanka's most valuable habitats for large mammals such as deer, buffalo and elephant. Wetlands are also home to many species of freshwater algae, diatoms and other phytoplankton; floating plants; rooted aquatics; grasses, sedges, reed bamboo and ferns. These ecosystems also contain wild varieties of crop species such as wild rice. (*MoFE, 1999).*

Most rivers have extensive freshwater marshes and swamps associated with them, and the marshes associated with the *Mahaweli Ganga* and its tributaries cover about 10,000 ha (MoFE, 1999). The network of saucer-like depressions called *villus* in the riverine floodplains of the Dry Zone become inundated with the overflow from rivers during the rainy seasons and contract during drought months, resulting in a cyclic variation of salinity and water depth that determine their high productivity (MoFE, 1999).

The freshwater invertebrate fauna include a rich variety of crustaceans: notably 68 species of cladocerans, 27 species of copepods (of which none are endemic), 31 species of ostracods among 19 genera (with 11 endemics) and over 60 species of decapods including prawns and crabs (MoFE, 1999). Sri Lanka's inland waters and associated wetlands also contain about 140 species of rotiferans, over 31 species of freshwater molluscs (with 12 endemics), 18 species of endemic mayflies (MoFE, 1999) and over 23 species of freshwater shrimps, with 18 endemics (IUCN, 2000). There are also about 51 species of endemic freshwater crabs, of which all are endemic to the island *(Bahir and NG, 2005).* Among the vertebrates, there are about 82 species of freshwater fishes indigenous to Sri Lanka, of which 44 are endemics (IUCN and MoENR, 2007). These species are generally riverine or marsh dwelling, and their main habitats are the Wet Zone streams. Wetlands also contain numerous species of reptiles, including two species of crocodiles, hard and soft shelled terrapins, the water monitor and water snakes, and provide habitats for a multitude of water birds.

Overall, about two-thirds of the total area of all wetlands in the islands are man-made, and consist of rice paddies, irrigation tanks, large reservoirs, canals, and aquaculture ponds (MoFE, 1999). Though lacking large natural lakes, Sri Lanka has about 12.000 irrigation tanks (C M Madduma Bandara pers. com. 2001) that vary in size from 1 to 6,500 ha. and less than 100 exceed 300 ha in size (MoFE, 1999). While most irrigation tanks were originally constructed several centuries ago, they have been restored for present use. Most tanks are located mainly in the Dry Zone (**Figure 1.6**), and together they irrigate over 500,000 ha of agricultural land., the larger irrigation reservoirs exceeding 200 ha each cover an area of 7820 ha. At present the irrigation reservoirs and their associated canal network add up to about 2,400 sq km. (MoFE, 1999). Rice paddies, an important component of the wetland scene consist of about 525**,**000 ha (Central

* More recently, Pethiyagoda has recorded 104 specie of indigenous fish (belonging to 36 families) in inland aquatic systems, including brackish water species.

Bank, 2008), and are distributed throughout the country. Almost all wetlands (other than rice paddies) are under state ownership, while some are wholly or partly under private ownership (MoFE, 1999).

Many wetland sites in Sri Lanka are now recognized as important internationally; and three (Bundala National Park, Anaiwilundawa and Madu Ganga) 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 (NEO, 2006)

1.5.2 Issues and threats

Most aquatic ecosystems in Sri Lanka have deteriorated over the last three decades, as a result of reclamation, clearing, deforestation, hydrological alterations, over extraction of fresh water for irrigation, improper land use practices that result in siltation, sand and gem mining, and pollution from agro-chemical run-off, sewage and industrial effluents. Reclamation of wetlands in urban areas due to landfills for housing and commercial and industrial development has been prolific, especially in the Western Province (MoFE, 1999), leading to local extinction and drastic reduction of species associated with these ecosystems (IUCN and MoENR, 2007). Local extinction is shown for the already threatened fishing cat (*Prionailurus viverrinus*) and the otter (*Lutra lutra*) due to vast scale conversion of lowland marshes to other uses (ibid). Wetland *deniya* cultivation with paddy or betel, after clearing the wetland vegetation in forests is a traditional activity, which in the past led to loss of natural wetland habitats (IUCN 1995). However, no new *deniya* permits are now awarded for new *deniya* cultivations.

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 (MoENR, 2002). Likewise polluted waters will further imperil already threatened endemics such as *Puntius nigrofasciatus, Danio pathirana*, *Malpulutta kretseri* and *Rasbora vateriflori* that need clean clear water. Hydrological alterations and over use of irrigation water are also now burgeoning problems in wetlands.

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. The populations of native food fishes such as the Lesser Spiny Eel (*Macrognathus ara*), Green Labeo (*Labeo fisheri*) and the Orange Fin Labeo (*Labeo lankae*), which were once considered to be common and widely distributed (Fernando, 1980), had declined drastically within a decade, and virtually disappeared from many of their original localities (Pethiyagoda, 1994). Some water plants such as *Cryptocoryne* sp. are collected in bulk for the aquarium trade (MoENR, 2002), resulting in six endemic aroids of the genus *Cryptocoryne* being listed as Critically Threatened (IUCN and MoENR, 2007). Most of these species have also now disappeared from several localities where they used to be common (IUCN and MOENR, 2007). Populations of colourful varieties of threatened endemic fish species that are exported, such as *Rasbora vaterifloris*, *Puntius titteya*, *Puntius nigrofasciatus*, *P. cumingii*, *Acanthocobitis uropthalmus*, *Aplocheilus werneri* and *Schismatogobius deraniyagali,* have been subjected to drastic declines due to over-exploitation for the ornamental fish trade (Gunasekara, 1996).

Sri Lanka's freshwater biodiversity is also threatened due to accidental or purposeful introduction of alien invasive species of plants and animals.

Eutrophication due to run-off of excessive agro-chemical application in agricultural holdings has also resulted in the proliferation of water hyacinth and other invasive aquatic weeds, eroding the species diversity of wetlands further (MoFE, 1999). It is believed that there are currently about 22 species of introduced food fish in the inland freshwaters. The exotic food fish Tilapia (*Oreochromis mossambicus* and *O. niloticus*) that were deliberately introduced to tanks and ponds to promote inland fishery, have increased considerably, and the latter species have expanded their spread into brackish water habitats as well (Bambaradeniya, 2002). There is a suggestion that *Tilapia* is the direct cause of population decline among indigenous aquatic fauna (Pethiyagoda, 1999). Others, such as the trout, common carp and rohu, are also now spawning in the wild. Some brackish water indigenous species introduced to freshwaters could also become invasive in the future posing a threat to the indigenous freshwater species.

1.6 Coastal and marine systems

1.6.1 Status and trends

Sri Lanka has a variety of coastal habitats that include estuaries and lagoons, mangroves, sea grass beds, salt marshes, reefs and large extents of beaches including barrier beaches, spits and dunes. All marine and coastal biodiversity are threatened by contamination of these habitats with oil and tar released from boats and ships, and ballast water that may contain alien invasive species.

Reefs

About 183 hard coral species (divided among 68 genera) occur in the coral reefs, and about six species of spiny lobsters and many other invertebrates, sea turtles and dolphins (Rajasuriya *et al.*, 2000), and as much as 900-1000 species of coral reef fishes may be associated with these coral reefs.
(CCD, 2004).

Famed for their spectacular beauty, coral reefs are among Sri Lanka's most valuable shallow water marine ecosystems. Three types of distinctly different reefs comprising coral, sandstone, and rocky reefs have been identified around the island, occurring separately or mixed together (CCD, 2004). Fringing coral reefs are found along 2% of the coastline (ibid). 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 (Rajasuriya and Premaratne, 2000; Anon, 1999). Together these reefs support around 72 reef fishes (Anderson, 1996), some of which are important in the ornamental as well as the food fishery.

Seagrass beds

Sri Lanka's coastal waters have extensive sea grass beds that often occur in association with coral reef ecosystems or within estuaries and lagoons (CCD, 2004). Around 12 species of seagrasses have been recorded in Sri Lankan waters (Abeywickrema, 1986; Samarakoon and Pinto, 1988). Sea grasses are mainly found in the basin estuaries and lagoons of Puttalam, Negombo, Mawella, Koggala, Kokilai, Jaffna and Batticaloa. These ecosystems are of particular interest as they are believed to be the main habitat of the endangered dugong (*Dugong dugong*) and are valuable habitats for the globally threatened sea turtles.

Estuaries and lagoons, mangroves and salt marshes

Sri Lanka's lagoons are defined in the Coastal Zone Management Plan of 2006 as coastal bodies of water that may be brackish, fresh or hypersaline, and are separated from the sea over a very long period of time by any of several type of barriers that restrict water circulation.
Source: CCD, 2004

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. Overall, there are 45 estuaries, of which 28 are of the riverine type that discharge directly to the sea, and 17 are of the basin type. The Coastal Habitat Survey of 2002 carried out by the Coastal Resources Management Project (CRMP) in 2002 revealed a total area of 88,850ha for basin estuaries, and about 2,113 ha for riverine estuaries. There are about 89 lagoons, ranging in size from 3 ha - 7,589 ha in extent, with only eight exceeding 1,000 ha individually. These extremely productive ecosystems contain at least 112 edible species of fish and economically important invertebrates, including 5 annelids, 28 species of edible molluscs, over 26 species of shrimps, mud crabs and swimming crabs (Pillai, 1965, cited in CCD, 2004; MOFE, 1999).

Sri Lanka's naturally patchy mangrove areas amounting only to 6080 ha were mapped by the CRMP Coastal Habitat Survey of 2002. Due to a low tidal variation hardly exceeding 75 cm, these mangroves occur as a narrow belt that rarely extend beyond 1 km landwards in inter-tidal areas of lagoons, estuaries and associated islands and river mouths where there is low wave action. Even so, the mangal vegetation in Sri Lanka 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 (Amarasinghe, 1996 cited in CCD, 2004; IUCN, 1996).

According to the CRMP Coastal Habitat Survey of 2002, there are around 23,800 ha of salt marshes in the country, found generally close to the landward margin of the inter-tidal zone that has a relatively high soil salinity. Extensive

salt marshes occur along the coast from Mantai to Vankalai, where tidal flats contain about 56 species of marsh vegetation. Patchy salt marshes occur mainly in sedimented lagoon/estuarine areas such as Hambantota, Puttalam, Kalpitiya and Mundel (CCD, 2004). These ecosystems are important habitats for salt marsh vegetation, brine shrimps (such as *Artemia marina),* wading and migratory birds, and milk fish fry (*Chanos chanos*) for which these areas form nursery grounds (ibid).

Barrier beaches, spits and dunes

Sri Lanka's wide and sandy beaches that are famous for their scenic beauty support a distinct littoral fauna and flora. The barrier beaches isolate lagoons and swamps from the sea; spits are most common along the western and eastern coasts of the country in association with estuaries (e.g. Negombo and *Kalu Ganga* estuaries), and 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 (CCD, 2004). The most prominent sand dunes are found along the northeastern, northwestern and southeastern coasts of Sri Lanka (*ibid*). 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 (ibid). 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.

1.6.2 Issues and threats

Once Sri Lanka had many healthy reefs remote from human settlements, such as the Bar Reef. Marine surveys in 1999 and the early 2000s showed, however, that live coral cover in shallow reef habitats of about 3m depth was almost non existent in the Bar Reef Marine Sanctuary; only 7% at Hikkaduwa Marine Sanctuary; and down to 28% at Weligama and 20% at the Rumassala reefs..
Source: CCD, 2004

The CRMP coastal habitat survey of 2002 revealed degradation of that most of Sri Lanka's coastal habitats in varying degrees during the past five decades, resulting in reduction in extent of coral reefs, estuaries and lagoons, mangroves, seagrass beds, salt marshes barrier beaches, spits, and dunes.

Over the years, coral mining for the lime industry has caused extensive damage to coral reefs, and as much as 7660 tons of coral was mined in 1984. Despite a subsequent ban imposed on mining, collecting, transporting and processing of sea coral in 1988, 2200 tons in the coastal area between Ambalangoda and Dickwella were mined in 1998, with 211 persons engaged in mining, collecting and transporting of sea corals (Katupotha and Wickramasinghe, 1999 cited in CCD, 2004). Natural features such as cyclones (in the east coast), the 'El Nino' Southern Oscillation (ENSO) effect in 1998--which led to mass scale coral bleaching and death (Arudpragasm, 2000), and the tsunami of 2004 have all caused damage to coral reefs in Sri Lanka.

Among the other serious threats were, the conversion of coastal habitats to other uses, destructive fishing methods, unregulated fishing effort, pollution from ships, and adverse inland activities that had negative impacts on coastal habitats due to pollution and sedimentation. These impacts have been exacerbated by the increase in human population density in Sri Lanka's Coastal Zone during the past few decades, due to tremendous human-induced disruption of coastal processes, and a corresponding decline of coastal habitats.

Seagrass beds in lagoons and coral reefs have been seriously damaged or degraded due to the use of destructive fishing practices, polychate harvesting, siltation from land-based activities, changes in hydrology due to release of irrigation waters, and sandbar formation either through natural or anthropogenic causes (CCD,2004). Large scale commercial trawling, drift netting and beach seining in certain sections of the coastline are also particularly detrimental to seagrass beds (ibid).

The clearing of mangroves for the construction of ponds for shrimp farming has been particularly severe. Out of 750 ha of mangroves lost in the Puttalam area between 1981 and 1992, around 160 ha (21%) were lost due to shrimp farming. It is now accepted that mangrove habitats are unsuitable for intensive aquaculture, and mixed mangrove – aquaculture systems are being used to restore previously degraded mangrove areas.
CCD, 2004

Coastal waters are polluted by the release of domestic wastewater, sewage, untreated or partially treated wastewater and toxic substances from industries, tourist resorts and shrimp farms; dumping of solid waste in coastal areas; and pollutants conveyed from rivers, estuaries and lagoons. Coastal waters also receive waste oil and tar from fishing boats, ships, coastal service stations and oil spills. Lagoons and estuaries are particularly affected by fresh water flows from inland irrigation schemes; and sediment from soil disturbance by inland agriculture, deforestation, mining and construction. The loss of functional

area due to unauthorised encroachment and reclamation of lagoons has also been seen, particularly so in the Bolgoda and Negombo estuaries and the Mawella and Lunawa lagoons (CCD, 2004).

The naturally fragmented mangrove swamps of the island have further shrunk or disappeared entirely due to establishment of shrimp farms, lowland agriculture and housing. Such encroachments are largely responsible for a reduction of about 50% of mangrove cover between 1986 and 2002, while water pollution, siltation, and resource exploitation have degraded mangrove ecosystems. The extraction of mangrove poles and fuelwood for domestic use, and twigs for the brushpile fishery, are clearly beyond sustainable levels (MoENR, 2002).

Similarly salt marsh areas have been reduced through reclamation and conversion for salt production and aquaculture, with nearly 2,960 ha being lost between 1986 and 2002 in the Puttalam district. Sand dunes, barrier beaches and spits have been affected by encroachment for construction of dwellings, unplanned growth of tourist hotels, and conversion to agricultural lands. The use of trammel nets, purse seines, explosives (blast fishing), bottom-set nets, and trawlers that use long drift nets, have all served to destroy marine habitats and biodiversity (CCD, 2004). In some areas exotic plant species introduced for dune stabilization, such as *Prosopis juliflora* have become invasive.

With regard to coastal species, the five species of turtles that come ashore for nesting are affected by degradation of these habitats due to indiscriminate allocation of land for construction of hotels and other tourist facilities, proliferation of slums and shanties. Likewise nylon gill nets spell death to turtles and small marine mammals leading to serious problems of bycatch (MoFE, 1999; CCD, 2004). Over-fishing has already led to the exhaustion of the near-shore fish resource, while promotion of the use of large multi-day motorised crafts with insulated fish holds has led to unsustainable fishing effort. Likewise the indiscriminate harvesting of gravid female lobsters, over collection of reef organisms in the food fishery, illegal slaughter of dolphins and the rare dugong for meat, and over collection of rare species of ornamental fish and edible sea cucumbers are examples of unsustainable use of coastal resources (MoFE, 1999).

1.7 Agricultural systems

1.7.1 Status

Farming systems

Sri Lanka's traditional farming systems have developed over hundreds of years, with farmers managing production systems to best suit local conditions (MoFE, 1999). This has given rise to a wide range of crop species and land races that are resistant to diseases and insect pests, and are suited for varied conditions of soil and climate in the island. 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. It is recognized that maintaining this biodiversity in agricultural lands and livestock, especially in traditional farming systems, is essential to increase future national agricultural and livestock productivity, and to meet the challenges posed by climate change, through genetic improvement (MoFE, 1999).

Sri Lanka has many traditional varieties of rice such as *saldiri, heeneti, herathbanda* and *pokkali* that exhibit a wide range of genetic characteristics with potential for varietal improvement. Among these are traditional upland varieties well known for their drought tolerance; varieties grown in the coastal areas and floodplains of rivers that possess tolerance of submergence and flash floods; a few rice varieties cultivated at higher elevations (over 1000 m) that grow at low temperatures; and several varieties that show broad-based resistance to serious pests, high salinity and other adverse soil conditions (MoFE, 1999). Sri Lanka also has several wild rice species that are crucially important for varietal improvement. These include the indegenous Oryza nivara; and the endemic *O. rhyzomatis* and *O. rufipogon* with rhyzomes.

Source: DOA, discussions during preperation of this report and MoFE, 1999).

About 2,037,000 ha are under some form of agriculture in Sri Lanka (MoENR, 2002). The long history of paady cultivation spaning over two thousand years, and the climatic variations under which it is grown, has porvided Sri Lanka with a high varietal diversity of *Oryza sativa*. Among these are several indigenous rice varieties that can tolerate adverse climatic and soil conditions, and are highly resistant to pests and disease (MoFE, 1999). Sri Lanka also five species of wild rice, two of which have rhyzomes and are importnat for use in crop mporvement, expecially in the face of climate change that may well lead to very different rainfall regimes in the country.

Sri Lanka also has a range of cereals such as millet, sorghum and maize, and a large number of vegetables, including both temperate and tropical species that are cultivated throughout the country. Among them, cucurbits, tomato and eggplant exhibit perceptibly high genetic diversity (ibid). Chena or slash and burn cultivation though environmentally destructive, has also resulted in a high diversity of cereals that have been subject to selection by farmers for centuries. Chena lands left to fallow, also have been found to provide abundant food plants for invertebrates such as butterflies, and large mammals such as elephants and deer. Recent studies have clearly highlighted that chena lands located around protected areas contribute to sustain wild animals such as birds and mammals, by functioning as ecotones that offer a wide variety of food resources. (MoENR, 2009).

Chena cultivation (slash and burn), is a traditional shifting cultivation practised in Sri Lanka. Traditional Chena lands are usually dominated by shrubby and herbaceous species growing upto 1.5m, and some scattered trees. Plant biomass of the system is highly variable due to traditional agricultural practices, with abundance of planted vegetation cover in the wet season while the land is left exposed once the harvesting season is over. Due to the reduced fallow period at present compared to what was traditionally practiced in the past, this practice has contributed considerably to soil fertility loss and widespread forest destruction in the Dry Zone.

Source: MoENR, 2002 and 2009.

Sri Lanka's spices have played a significant part in fashioning the country's history. At present there are about eight indigenous species of *Cinnamomum,* of which wild varieties occur in the natural forests of the Wet Zone. The cultivated cinnamon of commercial value is widespread in the southwestern coastal areas. There are about 10 wild races of *Elettaria cardamomum;* about 500 selections and seven wild species of pepper; several indigenous varieties of *Piper betle* (betel leaf); about three species of nutmeg (*Myristica*); two species of chilli (*Capsicum annum* and *C. frutescens*) and one species each of ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*). NARESA, 1991; MoFE, 1999). Local root and tuber crops such as cassava, dioscorea and *innala* also display a rich genetic diversity.

Plantation agriculture plays an important role in Sri Lanka's economy, and research at the respective Tea and Rubber Research Institutions, and selection through the years has resulted in considerable diversification of crops from the originally introduced germplasm of tea and rubber. These research institutes have now produced high-yielding varieties that are resistant to pests and disease; and in the case of rubber, to adverse climatic conditions. With regard to coconut and sugar cane too, a number of new varieties and hybrids have been developed by the Coconut Research Institute (CRI) and the Sugarcane Research Institute (SRI) respectively (MoFE, 1999).

Home gardens

Traditional home gardens contain a rich flora depending on the size of the garden and the region they occur in. Home gardens that are forest analogues have been prominent components of the country's landscape and a chief source of multiple products for rural people (Wickeramasinghe, 1995).

Plants richness in traditional home gardens in central Sri Lanka may reach 640 species, with a species richness of trees shrubs and herbs ranging from 22 – 170 (mean: 53 species) per home garden (Hochegger, 1998). Like wise, studies have revealed that as much as 100 species including coconut, rubber, fruit and timber, comprising over 2500 individuals with a stem density of over 400 trees/ha[3] may occur in a single 7 ha patch of semi-urban home gardens in the western province (Dela, 1998). Jak trees (*Artocarpus heterophyllus)*, providing food and timber to local people, amounted to over 51 trees/ha in the same patch of home gardens (ibid). These home gardens of the western province are also the main refuge of the critically endangered western purple-faced langur, now considered as one of the 25 most endangered primate taxa in the world. However, the same area is now severely degraded due to fragmentation of home gardens for sale of land, housing and felling of timber trees, mainly mature jak trees. Such changes are now increasingly common in other parts of the western province.

Dela, 1998, and in press.

The contribution made by home gardens to agricultural production has been substantial, and it is estimated that there are around 1.33 million home gardens in Sri Lanka, accounting for about 367,800 ha of cultivated land (MoFE, 1999). Home gardens play a key role in maintaining canopy cover in the country, ameliorating the local climate, providing timber and wood products, and preserving crop biodiversity (MaLF, 1995). They are particularly important for maintaining the high species and genetic diversity of fruit and other horticultural crops in the island (MoFE, 1999) and constitute a traditional system of perennial cropping for a wide range of valuable crops. They are also important sites for *in-situ* conservation of germplasm for fruits, such as banana (*Musa* spp), citrus, mango, jak, durian, pomegranate, *rambutan,* guava, avacado, carambola, mangosteen, melon, papaw and passion fruit (MoFE, 1999). Home gardens are also significant repositories of spice crops. *Syzygium aromaticum* (clove) is widely cultivated in the 'Kandyan' home gardens of the Kandy and Matale districts, and *Areca catechu* (arecanut or

[3] i.e. trees over 30 cm girth at breast height

betel nut) is a common home garden species in the Wet Zone. *A. concinna,* a wild relative of arecanut considered endangered in the wild is also found mainly in home gardens (MoFE, 1999).

The timber yield from home gardens is considerable, and at least 70% of the country's wood used for construction and industrial purposes are obtained from home gardens, rubber and coconut plantations, and trees on farm boundaries, roadsides and urban areas (MALF, 1995). Home gardens are important sources of jak (*Artocarpus heterophylus*), an important timber species for housing construction.

Traditional rice (paddy) fields

Sri Lanka's traditional paddy fields are irrigated as well as rainfed. They occur as terraced fields in hilly areas, and as open fields in lowland areas. The structure of the rice paddies consists of small fields surrounded by a network of bunds/levees, streams and/or irrigation canals that run through or besides the fields, sump ponds and islands of trees. These systems form a dynamic and very rapidly changing ecosystem that provides valuable array of animal life, including aquatic and terrestrial forms (Bambaradeniya, 2007).[4]

Traditional varieties of livestock

Indigenous varieties among livestock in Sri Lanka are less diverse than among crops, as historically they were used mainly for draught purposes. While livestock breeding plays a relatively minor role in the current economy, it is an occupation for a considerable population in the rural sub-sector. Among the extant indigenous breeds are a type of locally adapted native cattle *(Bos indicus var ceylonicus) or "Batu Harak" a*nd the white cattle *of Thamankaduwa* that are reared for draught and milk, an indigenous hardy breed of goats, and village chicken with poor egg production but high adaptation to a harsh environment. The locally adapted breeds now show a significant drop in population size due to the move towards high yielding imported breeds and cross-breeding. This can lead to loss of indigenous livestock breeds with traits such as high adaptability to the environment, high resistance to common diseases, high fecundity, early maturity, good mothering ability, longevity and low cost of production that are useful for livestock breeding in the future. Among the factors contributing to this diminishing trend is the lack of proper valuation of local breeds. Among the wild species are several that have potential in the livestock industry, such as wild boar *(Sus oristatus),* wild buffalo, jungle fowl (Gallus lafayetti) and the Sri Lanka Spur fowl *(Galloperdix bicalcarata)*, the common Moorhen *(Gallinula chloropus),* the purple swamp hen *(Porphyrio porphyrio)*; the wild hare *(Lepus nigricollis),* wild ponies *("Delft ponies")* and two types of wild donkeys (Silva, et al, 2005).

Agro-biodiversity *in ex-situ* conservation facilities

All crop research institutes[5] and the Plant Genetic Resource Centre under the Department of Agriculture (DoA), and the research Institutes for plantation crops[6] (i.e. tea, rubber, coconut and sugarcane) all maintain field collections of varieties, cultivars and clones of crops within their purview. The Department of Export Agriculture (DEA) maintains germplasm of coffee, cocoa, cardamom and clove and other export crops. The Botanic Gardens in Hakgala was established in 1861 for the introduction of cinchona to the island while the Botanic Gardens at Gampaha (Henerathgoda) was opened in 1876 for the introduction of rubber. The Department of Animal Production and Health (DAPH), and its research centre--the Veterinary Research Institute (VRI) do not have similar organized programmes for livestock germplasm conservation, although mandated to enhance productivity and use of domesticated animals such as cattle, pigs and poultry.

The 5300 accessions from about 100 crop plant species held by the PGRC in 1999 had expanded to over 11,600 accessions from 130 species by 2003 (MoENR, 2007), and is now over 12000 accessions. This includes 308 species of crop wild relatives, including five species of wild rice: some with very specific decease resistant qualities and resistance to high salinity. In the past, plant characterisation at the PCRC was based on morphological features, but characterisation based on molecular features has now commenced.

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[4] See also under wetlands

[5] They are the Horticultural Crop Research and Development Institute (HORDI), Rice Research and Development Institute (RRDI), Field Crops Research and Development Institute (FCRDI), Grain Legumes and Oil Crop Research and Development Centre (GLORDC), Regional Agricultural Research and Development Centres (RARDC) at Makandura, Bandarawela, Aralaganwila, Bombuwela..

[6] They are the Coconut Research Institute (CRI), Tea Research Institute (TRI), Rubber Research Institute and the Sugarcane Research Institute (SRI).

TABLE 1.8: **Germplasm Collection Status by Crop Group at the PGRC at end of 2008**

Crop Group	Number of accessions at the *(PGRC at end of 2008)*
Rice and related species	4467
Other cereals	1534
Grain legumes	1904
Vegetables (legumes (cucubits, brassics, allium, leafy vegetables, other vegetables)	2488
Solanacious vegetables and condiments	1150
Fruits	163
Root and tubers	150*
Oil seeds	401
Medicinal plants	27
Fibre crops	63
Mustard and related spices	124
Wild relatives of crop species	308

*Stored as tissue cultures
Source: PGRC, personal communication for preparation of this report.

To preserve agricultural biodiversity, it is therefore necessary to conserve the farming systems that produced the original genetic variation and the environment that crops grow, together with the age old knowledge about associated cultivation practices and crop uses that are gradually dying out with the older generation. Overall, narrowing of the national crop and livestock genetic base is bound to reduce options for crop breeding in the future, increase agricultural vulnerability to climate change, pests and, disease, and with time reduce the dietary diversity of rural people.

1.7.2 Issues and threats

Agro and livestock biodiversity in the country are affected with the adoption of high yielding varieties and breeds that are from uniform genetic stock and are relatively vulnerable to pests and disease. They also increase farmers' reliance on agrochemicals to maintain high yields. In the case of rice, there ahs been a perceptible drop in the cultivation of traditional varieties (MoFE,1999), and more than 90 per cent of the paddy lands had switched to New Improved Varieties (NIV) by the 1980s, and the Old Improved Varieties (OIV) and traditional varieties together had declined to less than 10 per cent of the cultivated area by the late 1909s (Central Bank, 1998). With the loss of traditional varieties of crops, there will be inevitable loss of valuable knowledge about their cultivation requirements and associated cultural practices over time.

Insecure land tenure in agricultural holdings, and their small size has resulted in the neglect of soil conservation, and over use of chemical fertilisers and pesticides without recourse to more time consuming environment friendly soil conservation practices. The resultant loss of diversity among soil micro organisms has reduced natural biodiversity associated with farming systems and impoverished agro-biodiversity even further. The pollution of soil and water with agrochemicals also has a deleterious effect on many terrestrial and freshwater indigenous species. Home gardens too in the highly populous Wet Zone have suffered considerable degradation in the past two decades due to urbanisation and fragmentation, with consequent loss of habitat for urban biodiversity.

With regard to livestock, much of the local strains are fast disappearing due to a strong preference for imported germplasm perceived as more productive. They are, however, uniform varieties that are very vulnerable to disease. Efforts by the Department of Animal Production and Health and the Veterinary Research Institute (VRI) to conserve the indigenous animal species of economic value have been constrained by insufficient funds and infrastructure.

1.8 Implications of biodiversity loss

As Sri Lanka progresses into the 21st century, there are unmistakable signs of env
ironmental stress and degradation of the island's biological wealth. The country supports a population of over 20 million, with 22.7% of the population living below the poverty line: (World Bank, Sri Lanka Policy Review, 2002 data). Successive governments have also had to grapple with the problem of balancing economic development and with safeguarding the natural environment, while also having to contend with terrorism.

Sri Lanka has changed from an agricultural to an industrial based economy, and presently follows a liberalised industrial policy. While the latter has focused on development of private sector-led and diverse export-oriented industries in terms of both products and geographical location, insufficient attention has been paid to ensure environmentally sustainable development.

While poverty incidence in urban areas in Sri Lanka have been halved, rural poverty ratios declined by less than 5 percentage points, and poverty in the estate sector actually has increased. Similarly, differences in poverty ratios across provinces have been pronounced: in 2002 the poverty headcount ratio was 11 percent in the Western Province compared to around 35 percent in Sabaragamuwa and Uva provinces.

This has resulted in anthropogenic impacts of over-exploitation of bio-resources, habitat destruction, land degradation, pollution, poor disposal of wastes and rapid expansion of vehicular traffic that depend on fossil fuel combustion. There is also a relatively high level of poverty in the country despite many programmes for poverty alleviation, high adult literacy levels and relatively good health care (MoNER, 2007).

The implications of biodiversity loss for a developing country such as Sri Lanka can be considerable and wide ranging. As less than 20% of the population is as yet urban, a considerable proportion of the population continues to depend in varying degrees on bioresources for their food, income and well being. The island's varied bio-resources are also the basis for a range of economic activities. Foremost among these are agriculture, the marine and brackish water fishery and tourism. Some of the most negative impacts on human well being from adverse changes in biodiversity are presented below as examples from forest, inland wetland, coastal and marine and agricultural systems.

1.8.1 Impact of changes in forests and related ecosystems

Forest dependency as a means of livelihood has dropped perceptibly in villages near Wet Zone forests, due to a shift towards cultivation of cash crops (Bogahawatte, N.D; Dela, 2003; PILF, unpublished). Nevertheless, many villagers continue to obtain firewood, medicinal plants, food items and small wood requirements from adjacent forests (Ibid). Furthermore, many rural villagers near Wet Zone forests depend heavily on freshwater from forests for their daily domestic requirements (PILF, 2005 unpublished; Dela, 2003). Hence loss or degradation of forests resulting in reduced irregular water flows and drying up of natural springs and base flow of streams will affect many communities in the Wet Zone. Traditional activities such as crafts based on rattan and bamboo and products that were once major forest based income sources in the Wet Zone have declined in recent years, due to diminution of the resource within forests.

Impact of over–collection of rattan on the rural economy and social structure

The rattan and bamboo cottage industry was oiginally a cast based traditional activity in viilages near natural forests, and many Wet Zone villages had at least one family of traditional rattan and *bata* collectors practicing this craft through decent, while some villages were mainly devoted to this industry. The industry depended on three native species of bamboo and 10 indigenous species of rattan in addition to other introduced species (de Zoysa and Vevekanandan, 1991). State support to expand the industry several decades ago encouraged other people to take up this craft island wide. The high market demand resulted in over-collection and exhaustion of raw materials in Wet Zone forests, and endangered all indigenous rattan species. Collection is now controlled with permits, but priority is given to those supplying large commercial scale production centres. The lack of raw material has made it hard for those traditionally involved in this industry to make a living from collection of raw material, and manufacture and sale of rattan and *bata* products, there by making inevitable changes in the life style of these people
Source: *IUCN, 1995*

In the Dry Zone, a considerable rural population near forests yet depend considerably on fuelwood, poles, posts, sticks and climbers, bee honey, food and medicinal plants from adjacent forests for subsistence as well as cash income (IUCN, 1995; socio economic assessment of the PAM&WC project, 2006). A reduction of these resources, without alternate livelihood opportunities will affect the rural economy of these areas.

Soil erosion is extremely high in tea lands established on clear felled lands in the hill country, as shown by an annual soil loss of 0.3 to 0.7 tons per hectare in well-managed lands on slopes less than 20 per cent in the Upper Mahaweli Catchment area since 1980
Source: MoENR, 2002

Other serious consequences of deforestation and forest degradation on human well being are soil erosion, the consequent loss of soil fertility and reduced agricultural productivity. The problem of diminishing agricultural productivity is compounded by the reduction of land available for agricultural expansion. Of the total land area in the country only about 2.9 million hectares were considered arable in 1998, giving a land man ratio of 0.1 ha, which too is decreasing rapidly due to conversion of land to non-agricultural use and soil toxification.[7] Likewise, *chena* or slash and burn cultivation has greatly eroded the Dry Zone lowlands, as chena cycles have become markedly shorter compared with the traditional fallow period of about 10-20 years ago that allowed for soil and forest regeneration through natural succession (NARESA, 1991). A change in reduced agricultural productivity in *chena* plots will impact the supply of a good portion of vegetables in the market to urban areas (ibid).

Rural traditional medicine practitioners near forests still continue to make collections from the wild, but unlike commercial scale collectors, who over extract, their collections are sustainable (Dela, 2003). Despite the popularity of western medication, traditional medication is still quite popular among a large segment of the population as seen by about 47 state hospitals and 300 dispensaries islandwide that offer health care using traditional medicines.

It is estimated that there are 1414 plants used in traditional medicine (Jayaweera, 1981; Mahindapala, 2006), while 30 of the most frequently used 50 medicinal plants in the country are directly harvested from forests (National Environmental Outlook, 2006). Of the total medicinal and aromatic plants in Sri Lanka, about 25% are endemic. The fact that some of these species are becoming rare due to over extraction (IUCN, 1995) will therefore have a negative impact on the health of rural populations.

Similarly, forest clearing in the Dry Zone and disruption of elephant migration routes resulting the severe human–elephant conflict has resulted in at least about 50 human deaths and 150 elephant deaths per year in addition to large scale damage to crops and human habitations (National Environmental Outlook, 2006).

1.8.2 Impact of changes in inland wetlands

Sri Lanka's inland waters are the only source of water for drinking, irrigated agriculture and other domestic requirements for a population of 20 million. In the dry and intermediate zones, the water collected in numerous tanks and reservoirs is vital for paddy cultivation and as a source of water for drinking and bathing. These tanks also account for about 15% of Sri Lanka's total fish production, thereby providing food and income for rural people (MoENr 2002). Pollution of these waters and wells with faecal matter and agrochemicals can also be expected to increase incidence of disease among rural people, due to contact with polluted water and consumption of contaminated fishery products (ibid).

The large reservoirs in the sub-montane Wet Zone are the source for hydro-power that supplies much of the country's electricity requirements as yet. Deforestation, improper cultivation practices in upper catchment areas of drainage basins of rivers, and river sand and gem mining has led to heavy siltation in streams, rivers and irrigation reserviours of this region. Not only does this adversely affect wildlfe in rivers and streams, the regular supply of unsilted water for irrigation and hydropower generation for the nation depends on adequate protection to forests in the catchment areas of streams, irrigation canals and reservoirs. Waste disposal at open dumps in low-lying marshy lands is detrimental to inland wetland biodiversity as well as the health and well being of people living in their vicinity.

In wetlands, freshwater ornamental fish, including endemics, are at risk from over exploitation of wild stock for the export industry. This will be detrimental for the sustainability of the ornamental fish industry which earned export earnings of SLRs 593 million in 2000 (MoENR, 2002).

1.8.3 Impact of changes coastal and marine systems[8]

The fishery sector earns valuable foreign exchange through the export of marine and aquaculture products, and provides direct employment to about 150,000 people, while indirectly sustaining at least a million. However the traditional coastal fishery has been severely affected due to over fishing (CCD, 2006), and the traditional beach seine

[7] DOA/DEA/CARP, Draft Agriculture Research Plan of the Ministry of Agriculture and Lands 2000-2008.
[8] All impacts in this section are from CCD, 2006 except where specifically mentioned.

fishery has been affected by changes in the beach environment due to tourism (i.e. infrastructure and reduced beach access), coast protection structures and coastal erosion (ibid). The revenue from this fishery accounted for over 40% of the total national fish landings until the early 1950s before the advent of motorized fishing crafts, but had dropped to a mere 5% of the total fishery by the late 1980s. The loss of this traditional fishery has had a negative impact on fishers engaged in this occupation and their social systems.

The decline of the traditional shrimp fishery in the Malala lagoon is due to the receipt of excess fresh water from the Lunugamwehera tank. In contrast, adverse impact on the fishery at the Koggala lagoon and lowering of cash income for fishers was due to an increase in the salinity level by the breaching of the sand bar

Source: CCD, 2004

The degradation of estuaries and lagoons, coral reefs, mangroves, seagrass beds and salt marshes that function as vital breeding and/or nursery grounds for numerous species of fish, crustaceans and molluscs, will undoubtedly reduce the commercial value in the inshore and offshore fishery and affect the fisher communities that depend on them for their livelihood. The flow of excess fresh water into estuaries and lagoons from upstream irrigation projects for agricultural expansion (particularly in the southern coast) has already resulted in salinity changes that adversely affect the lagoon fishery and a sharp drop in the income of fishers engaged in this activity.

Sea coral mining that destroys reefs that form natural barriers against wave action is the main reason for severe coastal erosion along the southwest coast of Sri Lanka. This hazard adversely affects coastal communities due to damages to houses and other infrastructure and the retarding of coastal activities such as fishing, tourism and recreation. Furthermore, data for 1998 shows that many of the 250 species of fish and 50 species of invertebrates collected from coral reefs accounted for about 40-50% of US $ 6.6 million received from all ornamental fish exports that year (Rajasuriya *et al*., 2000). Loss of coral reefs will therefore affect this reef fishery as well as the entire marine and coastal food fishery. There are also definite links between increasing levels of pollution and loss of fishery productivity. For example, the estimated annual loss of income from fish sales in the Lunawa lagoon due to pollution was approximately SLRs 1,963 million, and the total annual land value decline in the area was estimated to be SLRs 712 million (CCD, 2006). It is also estimated that the cost to human health from coastal water pollution in the Colombo Metropolitan Area had increased from SLRs. 2 million in 1992, to SLRs.4 million in 1997 and SLRs. 14 million in 2002 respectively (MOFE, 2001).

1.8.4 Impact of changes in agricultural systems

It is estimated that artificial fertilizer use in Sri Lanka has increased from 20,000 t of N, P, K during 1950-51, to 195,000 t in 1974-1975 to 525,651 t in 1995. This trend has continued and use had increased by 9% from 1998 to reach 612,000 t in 1999. It is significant that the annual average level of chemical fertilizer use in Sri Lanka is estimated to be 77 kg/ha, which is two to eight times more than the usage in other Asian countries.
Source: MoENR 2002.

While the importance of the agriculture sector has declined since gaining independence, and now contributes about 18 % of the total GDP (CB, 2007), export agriculture based on the island's bioresources (mainly tea, rubber and several other minor export crops) make a substantial contribution to the economy. Agricultural productivity depends heavily on the availability of fertile soils, arable land and freshwater.

Sri Lanka's inland waters – natural and man made – remain critically important for agriculture - especially as much of the national paddy production is in the Dry Zone where rainfall is limited.

Two important biotic factors that are threatened directly due to over-application of chemical pesticides are Soil Fauna and Pollinators, the proper functioning of which are required to prevent the collapse of agricultural ecosystems. This is quite evident in the Sri Lankan scenario, where the symptoms of soil mismanagement and the obvious destruction to soil fauna is reflected in the "fertilizer crisis" and many farmers who grew traditional crops now complain about yield decreases. Similarly the importance of *Bambaras* or bumble bees for pollination has not been adequately explored in Sri Lanka. *Bambaras* play an important role during the annual migration from cloud forest to costal areas by pollinating native and naturalized exotics species effectively. Traditionally people respected these nests knowing the consequences, but such attitudes and values are changing, with possible negative impacts on pollinator diversity.
Source: R W K Punchihewa, personal communication

The heavy use of chemical pesticides, herbicides and fungicides in agriculture, some of which are persistent, have degraded the soil and polluted ground and surface waters leading to loss of productivity and arable land may will adversely effect human health and agricultural productivity in the long term. The high use of pesticides may also affect beneficial species, and reduce the populations of natural predators of pests as well an insect pollinators.

Similarly, home gardens provide 2,552,400 m^3 of wood products annually (National Environmental Outlook, 2006). The growing trend for the loss of canopy trees and fragmentation of home gardens (MoFE, 1999) will, therefore, reduce the in-country timber availability from non-forest sources even further.

1.8.5 Impact of changes in biodiversity on tourism

Tourism, viewed as the fourth most important foreign exchange earner, is wholly dependant on a clean and healthy environment and high biodiversity. According to estimates, both direst and indirect employment through the tourist industry had reached 37,943 and 53,120 respectively by 2000 (Central Bank, 2001). Many of the initial centres of tourist growth in the country have shown gradual erosion of cultural and traditional values that are important to Sri Lankan society and is self defeating to the long-term growth of tourism and recreational activities in these areas. It is recognised that to reach a target of 2 million tourist arrivals in 2016 and reach the top foreign exchange earner slot in the country with considerable job opportunities for local people, the industry should move away from "only beaches" to maximise potential from the many natural and cultural resources the island has to offer. As this requires unpolluted natural places with high aesthetic value and adequate biodiversity, environmental problems leading to biodiversity erosion will jeopardise the expansion of this industry in the future.

1.8.6 Overall prognosis for the future

On the positive side, the importance of wild bio-resources from forests, wetlands, and coastal and marine systems and arable land for agricultural production are increasingly recognised for economic development and continued well being of the people of Sri Lanka. Despite the many problems that beset the conservation of biodiversity in the island, there is also a growing awareness that economic development and the well being of people are dependant on a healthy environment and abundant bio-resources. This is underscored in the National Environment Action Plan for 2003-2007 termed Caring for the Environment: Path to National Development, The National Biodiversity Conservation Action Plan, the Coastal Zone Management Plan (2004) and the many projects that have been initiated for conservation of biodiversity. Nonetheless, awareness has to move toward concrete action by all segments of society to halt further biodiversity loss and degradation. Adopting Communication, Education and Public Awareness (CEPA) to achieve this objective will, therefore, be of paramount importance. Sri Lanka recognises that conserving the natural environment of this planet and its biodiversity is a shared endeavour that has to transcend national boundaries, and is committed to this end through significant national as well as international commitments such as the Convention of Biological Diversity.

Photo: The endemic Sri Lanka white eye © Samantha Mirandu

1.9 Country profile

Country profile in brief

Population status
Sri Lanka is a multi-ethnic, multi-religious secular state, with a total population of 20 million and a population density of 310 persons per sq.km. The Wet Zone, with a very high biological diversity, and more favourable climate and better socio-economic considerations than the water scarce Dry Zone, contains about two thirds of the country's population despite its coverage of less than a third of the island. The population in Sri Lanka is still predominantly rural and less than 20% of the population live in urban areas. The net enrolment ratio in primary education exceeds 98% and the country has an islandwide network of approximately 10,429 schools which include public, private and religious education centres that provide opportunities for primary and secondary education.

Health care and life expectancy
Sri Lanka has achieved remarkable progress in health and social welfare relative to other low income countries and its neighbouring South Asian counterparts as shown by a Human Development Index (HDI) of 0.743 in 2007. This is due to a large share of public expenditure being redistributed to households perceived to be in need through free education and health services, as well as food subsidies and subsidised credit to improve living standards.

Sri Lanka has relatively high standards of health care, and the national health indicators are comparable with those of developed countries. The Government of Sri Lanka provides free health care services through a network of western and traditional health care institutions including hospitals, dispensaries and health units located in all parts of the country. There is also significant enhancement of health services for women and children through pre- and post-natal care nutritional programmes. Sri Lanka's consistent decline in maternal mortality for over 5 decades is attributed to a wide network of maternal services. which is integrated with childcare. The life expectancy at birth for males and females is respectively 71.7 and 77 years. Infant mortality rates are low at 12 (per 000), while under five mortality at 19 (per 1,000) live births is the lowest for the WHO South East Asian region.

Education
Education was made compulsory for all children between the ages of 5-14 in 1997, and has been free of charge to all students in state schools from the kindergarten to university entrance since 1945. Free educational services include the provision of textbooks and material for school uniforms. As a result, Sri Lanka has a high adult literacy rate of 92.5%. Genderwise the literacy rate is 94.5% for males and 90.6% for females. Sri Lanka has 15 universities (including the Open University), six postgraduate institutions and about seven institutions affiliated to the universities which offer Bachelor's Degree courses in specialised fields. University education is a public sector monopoly, and free of charge, except for the Open University which is open to students of any age and with varying basic educational backgrounds.

Status of women
Men and women are granted equal status and rights under the Constitution of Sri Lanka, and Sri Lankan women - including women in the rural areas - have a comparatively better status than women in many developing countries. Overall there has been a perceptible upward social mobility in the status of women since gaining independence in 1948, mainly due to increased access to free education and economic opportunities for employment in the industrial sector and migrant domestic employment overseas. Sri Lanka's Gender Development Index (GDI) in 2004 was 0.737 but the Gender Empowerment Measure (GEM) was only 0.274. Sri Lanka has almost achieved gender equality in primary and secondary education, especially in the generations that had access to free education.

Housing and lifestyles
Lifestyles are changing in Sri Lanka with increased household income, and household consumption is shifting from food to communication, education, recreation, housing and utilities. The average household size is at present 4.31persons. About 70% of households now own a radio or TV and 30% own a refrigerator. Household access to motorized transport and telephone facilities stand at 22% and 25% of households respectively. The demand for houses and urban infrastructure is increasing, About 75% of the population (outside the north and east where there was civil unreast) live in houses with more than three rooms, and over 72% of houses throughout the island comprise modern building and roofing materials (e.g. bricks and cement for walls and tile or asbestos for roofing); over 77% of households have sanitary and toilet facilities, 80% have electricity and 84.8% of households have access to safe water – although only abut 32% have access to pipe borne water. Consequently much of the rural population still depend mainly on well water, water from forest streams, reservoirs, canals and streams which may be contaminated with faecal matter and other pollutants.

Economic trends and poverty levels
Per capita income in Sri Lanka exceeded US$1000 in 2004, but very high regional disparities remain. Despite the relatively high quality of life, about 5.6% of the population have an income of less than 1 US per day (between 1990-2005), and 775,000 families live below the official poverty line of Rs 1928/- income per month. Overall, incidence of poverty in Sri Lanka has declined since independence, markedly during 1953 to 1985, and more slowly during the early 1990s. The country's macroeconomic policies are pro-growth and pro-poor while continuing to uphold market based economic policies. Overall, the country's monetary and fiscal policies are geared towards improving macroeconomic stability by enhancing development, increasing investment and poverty reduction. The country's economic growth and poverty alleviation programmes focus on regionally balanced growth with rural and small and medium private sector development with the medium-term objective of macroeconomic stability and a regionally balanced economic growth rate of about 6-8 percent**.** Being an open economy, open market operations prevail with considerable individual freedom. This has to some degree had a positive impact on the environment. The economic policies of the country also encourage foreign investments by providing foreign exchange and employment opportunities to catalyse the development process.

Sources: Central Bank,. Annual Reports of 2004 and 2007;. Central Bank of Sri Lanka; Statistical Abstracts - 2005 (Department of Census and Statistics), NCED /UNDP, 2005

Chapter 2

2.1 Introduction

Sri Lanka signed the Convention on Biological Diversity (CBD) on 10th June 1992 and ratified it in March 1994. A strategy for preparation of a National Biodiversity Action Plan (BAP) for Sri Lanka was prepared by IUCN Sri Lanka in1994 for the Ministry of Transport, Environment and Women's Affairs (M/TEWA).This was followed by preparation of a Biodiversity Conservation Action Plan (BCAP) for Sri Lanka under the aegis of M/TEW, with technical collaboration from IUCN Sri anka and the USAID funded Natural Resources Policy Project. To facilitate this process, open-ended biodiversity networks were established by M/TEWA, and focal people were identified in government departments to facilitate implementation of the CBD and preparation of the BCAP. The latter document was developed through a widely participatory process with financial support from the Global Environment Facility (GEF). It received Cabinet approval in 1998 and was published and adopted in 1999. The completion of the BCAP was reported to the CoP of the CBD in 1998 in Sri Lanka's first National Report to COP 1.

This chapter provides an overview of the status of implementation of the BCAP, the process for updating this document with an Addendum, the efforts to mainstream biodiversity in different sectors, the obstacles and challenges for the implementation of the BCAP, and future capacity needs to implement the CBD in Sri Lanka. In this chapter:

- **Section 2.2** deals with achievements and deficiencies with regard to national biodiversity action planning, including an overall snapshot of the BCAP and its Addendum; the approach adopted in the preparation of these documents, achievements, focus, gaps and adequacy of the BCAP for implementing the CBD; arrangements to implement the BCAP and links between the BCAP and the 2010 targets.
- **Section2.3** deals with status of BCAP implementation and problems of implementing it holistically.
- **Section 2.4** deals with in-country capacity for implementing provisions of the CBD and assessment of addressing major threats to biodiversity.
- **Section2.5** provides information on and domestic and international funding for biodiversity conservation in Sri Lanka

2.2 Achievements and deficiencies with regard to national biodiversity action planning

2.2.1 Sri Lanka's BCAP in brief

The BCAP gives a comprehensive overview of the country's species diversity, as well as the biodiversity within the forest, wetland, coastal and marine and agricultural systems; the policies relating to them; and the institutions that have administrative powers over these systems. The document gives conservation objectives and recommended action for these four priority systems as well as several priority cross-cutting and inter-sectoral thematic areas, namely: *ex-situ* conservation; biodiversity information; biodiversity related legal measures, research, education and awareness; institutional support for biodiversity conservation and valuation of biodiversity. Sustainable use, research and awareness creation needs are also identified where specifically applicable under the four priority systems. Policies, Plans and Programmes relating to conservation of biodiversity have been examined under each of the four systems and cross-cutting areas. For each area, the key threats and issues affecting biodiversity conservation as relevant at the time, objectives to be reached, recommended actions, and the main implementing institutions for such action have been identified. The Plan also introduces for the first time 15 terrestrial and coastal bio-regions to address biodiversity conservation issues in the country; eight of these are prioritised for urgent attention.

Approach adopted and achievements

The BCAP has brought within a single framework, a description of the status of national biodiversity, perceived issues and threats, and remedial actions required to conserve biodiversity in the forest, wetland, coastal and marine and agricultural systems and several cross-cutting areas. Important recommended actions from other plans, programmes and policy instruments of the Forest Department (FD), Coast Conservation Department (CCD), Department of Wildlife Conservation (DWLC), Central Environmental Authority (CEA), Department of Agriculture (DOA), the National Botanical

Gardens (NBG), and the National Zoological Gardens (NZG) are included; including those that were already being implemented or were earmarked for action. The mandates and ongoing programme of the many government institutions directly or indirectly responsible for biodiversity conservation were considered. This approach served to link the BCAP with biodiversity concerns addressed by other existing policy documents, plans and programmes in other sectors and to make it possible to track major biodiversity conservation inter-sectorally as well as cross-sectorally.

The 'system' based approach in the BCAP for presenting the status of, and threats to, national biodiversity was adopted after much discussion due to the significant ecological differentiation among these systems as well as the practicality of dividing responsibilities between different organizations that had to implement the recommendations for *in-situ* conservation. These systems correspond to four of the thematic areas later adopted by the CBD.

The BCAP was meant to function both as a policy instrument and a working document to promote and monitor conservation action. To meet these objectives, it was meant to be read and appreciated by a wide audience, including scientists, policy makers, administrators, field staff, interested members of the public and even school children.

Achievements

- The BCAP has brought together specific as well as broad actions required for biodiversity conservation from various state institutions and NGOs, CBOs, the business sector and other social groups into a national 'framework for biodiversity conservation'.

> Identification of priority actions for which operational plans and budgets would be provided were explored during the BCAP preparatory phase, and several prioritised recommendations were developed as proposals with indicative budgets. This was later abandoned as it was felt to be both impractical and counter-productive due to many reasons. For example, many important recommendations could be accommodated under institutional programmes (with existing institutional budgets); so that giving details of resource needs and separate budgets for such activities were not necessary, and could also discourage institutions from accommodating BCAP actions within their existing or future programmes, using available funds.

- The final chapter in the BCAP on implementation sets out the proposed institutional arrangements for implementing the Plan with time frames for achieving various outputs. A two-year inception phase is proposed, followed by a ten-year implementation phase. The BCAP provides indicators for monitoring the success of meeting the objectives of the CBD through implementation of the BCAP, after five and ten years from the commencement of BCAP implementation.
- An institutional structure has been proposed to implement the BCAP, comprising (a) the Biodiversity Secretariat within the Ministry dealing with Environment to track, coordinate and promote the implementation of all programmes and projects recommended under the BCAP; (b) an apex body in the form of a National Steering Committee on Biodiversity (NSC) for high level coordination and biodiversity policy formulation at the national level; (c) several Task Forces and working groups to provide expert guidance to the Biodiversity Secretariat for translating policy guidelines into viable implementation programmes, and (d) Implementing Agencies to be assigned with the implementation of specific actions, programmes and projects.

Gaps

- The in–country status under the systems based approach and cross-cutting areas were reviewed during the preparation of the BCAP (1996-1999) in line with CBD requirements. However, issues such as in-country capacity to facilitate access to genetic resources while ensuring benefit sharing (*Articles 15 and 19*), facilitating transfer of technology from developed country partners (Article 16), biosafety (*Articles 8g and 19*), use of traditional knowledge for sustainable use of bio-resources (*Articles 8*j, 10*c and 16*), and the problem of invasive alien species (A*rticles 8(h)*) have not been addressed in depth in the BCAP, as at that time (mid 1990s) such issues were at a very incipient stage in the global arena and considerably new at the national level. As such, the recommendations that cover these areas in the BCAP and capacity building needs identified are broad,[9] and are mainly to initiate action in these areas. Even so, many of these recommendations are relevant to date, particularly pertaining to access and benefit sharing.

[9] An exhaustive capacity needs assessment to initiate an ABS regime and to protect and use traditional knowledge was carried out subsequently through the GEF funded National Capacity Needs Self Assessment (NCSA) carried out by the MoENR. Capacity building needs to address IAS is also being identified by this ministry.

- The importance of Communication, Education and Public Awareness (CEPA) as a whole was not addressed during the time of the preparation of the BCAP and is poorly addressed in the Addendum as well.
- The BCAP was not communicated effectively to stakeholders which resulted in poor knowledge about its contents and importance among the policy makers, departments with responsibility to implement the recommendations and other stakeholders.

2.2.2 Addendum to the BCAP

Approach adopted

- As Sri Lanka had produced the BCAP in 1999, an Addendum was felt to be required to update the BCAP to address subsequent developments that emerged from the various COPs and global work programmes and CBD related projects. In 2003, the Ministry of Environment and Natural Resources initiated the preparation of an Addendum to the BCAP, to review recommendations which had been acted upon, and to recognize the recommendations that still had validity, while noting new issues and priorities to be addressed. It was envisaged that this would also help draw up a strategy for a purposeful and holistic implementation of the BCAP.

- Sixteen task forces were appointed for preparation of the Addendum to the BCAP

The Task Forces for preparation of the Addendum, were on *in-situ* Conservation; *Ex-situ* Conservation; Access to Genetic Resources; Traditional Knowledge & Lifestyle; Impacts on Biodiversity; Sustainable Use and Benefit Sharing; Biosafety; Economic Aspects of Biodiversity Valuation and Mainstreaming; Policies, Strategies & Action Planning; Monitoring & Coordination; Institutional Aspects & Capacity Building; Legal & Ethical aspects; Education, Awareness & Training; Research Development and Technology Transfer, and Information Management.

- The TF on Institutional Aspects & Capacity Building used and circulated an assessment tool to all the other Task Forces to address capacity in terms of systemic (policy/legislation), institutional (mandate, funds, etc.), human resource (staffing, skills, etc.) and other concerns which precluded implementation of the BCAP.

Achievements

- The Addendum deals with Access to Genetic Resources (CBD Article 15), Biosafety (CBD Articles 19 (c) and (d)); traditional knowledge (relevant to some aspects of Articles 10(c), 8(j)) that were lacking in the BCAP. The lack of major polices and legal frameworks, and gaps in institutional action have been identified for these areas.
- The Addendum and the reports of eight Task Forces have been published; the publication of a further four Taskforce reports will be completed shortly.
- The TF on Institutional aspects and capacity building reviewed and prioritized key institutional needs for *in – situ* and *ex-situ* conservation and for coordinating the entire process of implementing the BCAP.
- The Task Force on Institutional Aspects and Capacity Building Needs reviewed the present status of BCAP recommendations for *in-situ* and *ex-situ* conservation and proposed institutional mechanisms and capacity building to facilitate the implementation of actions in the BCAP and the new actions recommended through the review.

The following have been suggested as possible themes for the proposed Task Forces *
In-situ* and *ex-situ conservation of biodiversity, **Research and information management** (including meta database development), **Legal issues** pertaining to strengthening sectoral laws, access, biosafety, alien invasive species, biodiversity and trade and foreign policy, **Access and benefit sharing and biotechnology**: to deal with access issues, ethics, bio-technological development and bio- technology transfer (policy and actions of the area); **Communication, Education and Public Awareness** to promote the BCAP and biodiversity conservation among the different segments of Sri Lanka including policy makers, planners, heads of departments etc., and specifically to raise the profile of and funds allocated for biodiversity conservation within government by creating awareness of the BCAP and benefits of biodiversity conservation for national development among policy makers; **Integration and devolution**: Integrating biodiversity concerns into cross-sectoral issues, the private sector, NGO activities and community actions and devolution of biodiversity conservation. (this could be divided into two if desired); **Policy** Task Force to critically examine impacts of all new cross-sectoral laws/policies/trade and access agreements and major development efforts on biodiversity conservation; guide formulation of new policies to address *in situ* conservation outside forests; integrate biodiversity concerns into land policy and wetland policy. (could be combined with the TF on legal issues);**Traditional knowledge** and cultural practices related to biodiversity conservation (should have representation from legal/policy Task Forces).

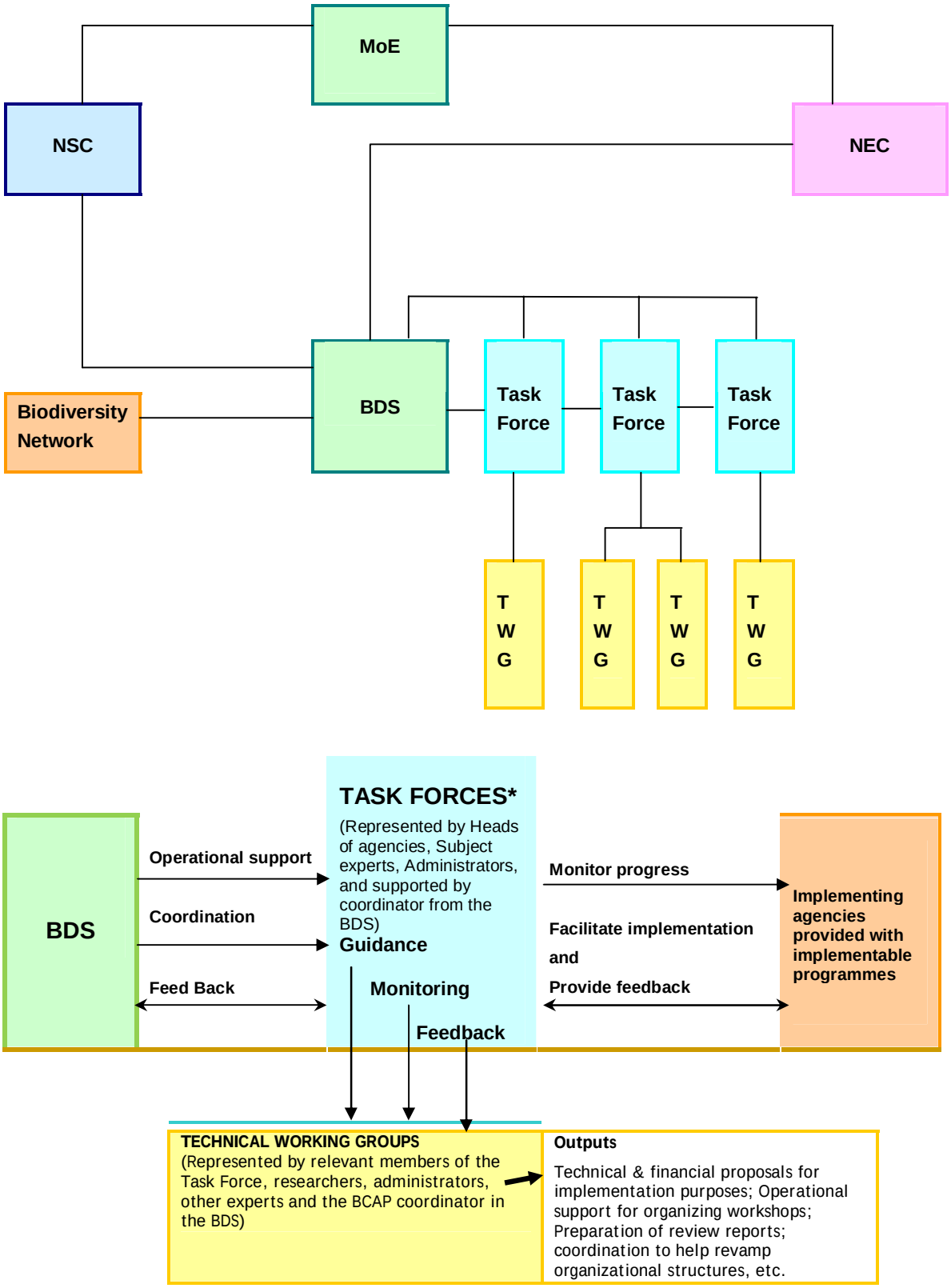


Figure 2.1 Mechanisms proposed for making the BCAP implementation operational
NSC=National Steering Committee, NEC= (National Experts Committee), BDS=Biodiversity Secretariat, TWG=Thematic Working Groups. Biodiversity network of mid professional level staff in BCAP stakeholder institutions.
(Source: Taskforce on Institutional Aspects for preparation of the Addendum).

Deficiencies

- The Addendum addressed some key areas that were deficient in the BCAP. However, the BCAP gap analysis process had many gaps and inaccuracies of its own which reduced its efficacy and even non-adoption by some of the TFs (MoeNR, 2006).
- The Task Forces had not been provided with clear guidance for the BCAP gap analysis, the mode for review of existing recommendations, and tracking of implementation and identification of additional recommendations for inclusion in the Addendum. As such, some TFs had interpreted 'gaps and issues' in the Addendum as issues not addressed in the BCAP, while others had identified areas that had not been implemented. Several issues and recommendations that were in the BCAP had been recorded erroneously as 'gaps' during the BCAP gap analysis.
- The Addendum also did not follow the four systems approach with corresponding cross-sectoral areas that were adopted in the BCAP. This was remedied to some extent by the TF on *in-situ* conservation by addressing each of the four systems separately and some cross-cutting areas are common to both documents. However, implementation of new cross-cutting areas in the Addendum, such as sustainable use (which was addressed under the four systems as specific issues) are difficult to link up with the BCAP recommendations as they were considered under the four systems and address specific issues. As such further effort is required to bring the two documents together.
- The main purpose of an Addendum to the BCAP under the Protected Area Management and Wildlife Conservation (PAM&WC) Project was to promote coordinated future conservation planning and holistic implementation of the BCAP. This has not been achieved. However, the project has strengthened the BDS in terms of staff and much equipment. Despite this, coordinated implementation of the BCAP and Addendum by the Ministry remains in abeyance, mainly due to lack of funds and human resources.
- The priority areas provided in the Addendum do not reflect the priority areas in the BCAP of 1999 that are greatly applicable. As such, a combined list of priority areas should be prepared.
- The review of the BCAP during the Addendum preparation has not used the time bound indicators that are provided in the BCAP of 1999 for monitoring implementation.

This need for capacity strengthening in respect of conceptualising and review during biodiversity planning emerged during the National Capacity Self-needs Assessment (Dela, 2007).

- The National Capacity Needs Self Assessment project of the MoENR addressed capacity needs for implementing the CBD in Sri Lanka through a parallel exercise. However, the findings of this assessment, that has a considerable bearing on BCAP implementation, have not been taken into consideration when preparing the Addendum.
- While the TF on Institutional Aspects and Capacity Building is published separately (MoENR, 2006), the implementation mechanisms it recommends as crucially important to implement the BCAP holistically are not included in the Addendum. These institutional arrangements were, however, reviewed and addressed through the Biodiversity Thematic Assessment of the National Capacity Needs Self Assessment (NCSA) carried out by the MoENR in 2005-2006 (Dela, 2007).
- The addendum lacks an implementation Plan for the BCAP (following the guidelines given in the BCAP) and a mechanism for continual updating of the BCAP without resource to major reviews (e.g. a continual process that is capable of addressing new issues that emerge from the COPs).

2.2.3 Links to 2010 targets

- The BCAP and Addendum, recommend action to "ensure that the biological diversity within the country is conserved and used sustainably, and that development programmes pursued by the different sectors do not cause serious or irreversible damage to the indigenous biodiversity." This meets with the objectives of the CBD.
- The four systems prioritised by the BCAP as forest, wetland, coastal and marine and agricultural systems closely parallel the thematic work programmes identified under the CBD in ecosystems that are of relevance for Sri Lanka.
- Under each of these four systems Articles 7 (a-c), and 8 (a, b, c, d, e, f, i, k, l, 10 b, d, e) and 11 are addressed in the BCAP and the Addendum.
- Under the following cross-cutting areas of the BCAP and Addendum, several sub-articles and articles of the CBD are addressed at the national level. These are *ex-situ* conservation (Article 9); biodiversity information (Article 7d and 17); biodiversity related legal measures (Articles 8 g, j, k; 12; 15, 16). Research (Article 12), education and awareness (Article 13); institutional support for biodiversity conservation and valuation of biodiversity, Access and benefit sharing (Article 15) and preservation and use of traditional knowledge (Article 8 j and 16).

The following goals of the 2010 targets have been addressed in the country:

- Goal 1 and 2 to promote the conservation of the biological diversity of ecosystems, habitats and biomes and to promote the conservation of species diversity have been well addressed. Although threats remain, considerable work has been done to identify and mitiagate these threats;
- Goal 3 to promote the conservation of genetic diversity has been mainly met with regard to agricultural biodiversity;
- Goal 4 to promote sustainable use and consumption has been facilitated by participatory forest management done on a pilot scale in various locations with very positive results; Some work has been initiated in the coastal areas, and the agriculture and fishery sectors, but this needs to be more widely practiced;
- Much has been done to achieve Goal 5: pressures from habitat loss, land use changes and degradation, and unsustainable water [in terms of wetland and watershed use]. However, while threats have been addressed to a fair degree in forest areas due to law enforcement, participatory approaches, and boundary marking of PAs, they continue and are still serious in wetland and coastal and marine systems.
- Measures are taken to meet Goal 6: control threats from invasive alien species, by seeking to enhance capacity for prevention of entry and establishment of IAS. Control measures have also been taken in PAs severely affected by IAS by the DWLC as relevant for habitat enrichment and by the agricultural sector.
- Pollution abatement has been given considerable focus by the MoENR which had a Division to address this threat. However, due to the complex nature of the problem Goal 7: Address challenges to biodiversity from climate change and pollution, this target has still to be accomplished. The impact of climate change on wild biodiversity and ecosystems has not been adequately addressed in the BCAP or Addendum.
- Efforts are being taken to meet Goal 8: Maintain capacity of ecosystems to deliver goods and services and support livelihoods. However this has not been completely achieved and efforts are ad hoc.
- Goal 9 to maintain socio-cultural diversity of indigenous and local communities is met with as all cultures and religions are given recognition in the country as a constitutional requirement. Protection of traditional knowledge, innovations and practices is however at an early stage, although the required policy has been formulated. Documenting traditional knowledge holders is taking place.
- Goal 10 to ensure fair and equitable sharing of benefits arising out of the use of genetic resources (in terms of legal aspects only) has not been met with adequately, but the background work to establish an ABS regime has been done through the NCSA project. The existing legal framework is sufficient to permit an ABS regime in Sri Lanka. However, funds are lacking to establish such a regime, and to carry out the staff training to make the regime operational. Further, assistance is required from the CBD COP for clarifications on several aspects to implement an ABS regime. Even so access occurs even now through MTA in the agricultural sector.
- Goal 11: Parities have improved human, scientific, technical and technological capacity to implement the Convention is partly true for Sri Lanka. The country has had access to funds for major projects that have benefited biodiversity. However, this has not bee available for crucial work such as a mechanism to coordinate and track BCAP implementation and setting up an ABS regime. Absence of a holistic implementation of the BCAP has resulted in many biodiversity related activities taking place in isolation or being duplicated by different agencies. Further capacity building to access funds through skills building for reporting, project proposal writing and project/programme evaluation and monitoring are required for focal points to meet Goal 11.

2.2.4 Preparation of Provincial Biodiversity Plans

Achievements

- Seven Provincial Biodiversity Conservation Profiles with Action Plans have been prepared. These will be implemented through the planning divisions of the Provincial Councils with their own budgets.

Gaps in provincial level planning

- The focus of the provincial plans are to address the regional application of recommendations in the Addendum, which leaves out the main system based recommendations in the BCAP that are of crucial importance at both regional and local levels. This has been correctly expanded to cover all BCAP and Addendum recommendations only in some provincial plans, while the others are deficient in this regard.
- The provincial planning has not taken into account the concept of bioregions in the BCAP, of considerable importance for implementing the BCAP at provincial level.
- Although Provincial biodiversity plans has been prepared, capacity is low at the regional/local levels to contribute meaningfully to such an exercise.

2.2.5 Institutional arrangements for implementing the BCAP

Achievements

The Biodiversity Secretariat (BDS) is specifically responsible for facilitating and formulating policies and plans for national biodiversity conservation, implementing the BCAP and Addendum, carrying out specific responsibilities assigned to it, ensuring that national obligations under the Convention on Biological Diversity and the Cartagena Protocol are met with, and to promote training, and access to funding for COP determined activities. The National Experts' Committee on Biodiversity (NEC) supports and guides the activities of the BDS..

The ministry dealing with environment established a Biodiversity Unit in 1995 to facilitate the BCAP preparation process and to manage the government's biodiversity conservation initiatives. This was expanded to form the Biodiversity Secretariat within the Ministry's Environmental Division under the Director, Natural Resources. This has now been further expanded to form the Biodiversity Division of the ministry, under the Director, Biodiversity. Overseeing the implementation of the BCAP and Addendum is the responsibility of the Biodiversity Secretariat (BDS), as the Ministry dealing with the subject of Environment is also the national focal point for the CBD.

Deficiencies

While come capacity was built in the BDS under the Protected Area Management and Wildlife Conservation Project, the necessary level of capacity for sectoral and cross-sectoral coordination to implement the BCAP and Addendum and for coordinated conservation planning has not been addressed.

2.3 Status of BCAP Implementation

2.3.1 Review of the BCAP

The BCAP recommends that a review of plan implementation be undertaken three years after the commencement of the first stage of the BCAP implementation phase. The National Environmental Action Plan (Caring for the Environment 2003-2007) also recommends an independent review of the actions so far implemented in accordance with the BCAP to assess and evaluate progress, identify the problems and bottlenecks and take corrective action. This is especially relevant because the country experienced varied changes in the economic and political front during the post BCAP preparation period, and many new plans and programmes commenced in the country with the new priorities that emerged.

While the status of BCAP recommendations for *in-situ* and *ex-situ* conservation were reviewed during preparation of the Addendum, this was not done for the cross-cutting areas. The review has also not used the time bound indicators provided in the BCAP of 1999 for monitoring its implementation.

Although the BCAP was approved by the Cabinet in 1998 and published in 1999, with mechanisms and mandates to oversee the implementation of the BCAP being approved by the Cabinet in 1998, the Plan has not been implemented in a holistic manner due to various constraints (see below), and no formal mechanism was established for monitoring to track progress of the BCAP recommendations.[10]

[10] This was done to review progress with in-situ and ex-situ conservation through the Task Forces on In-situ Conservation and Institutional Aspects, this was not a formal review linked to tracking the BCAP recommendations. Some gaps identified by these TFs were however addressed, such as setting up a special unit to address wetland biodiversity.

Status of BCAP implementation

Despite the lack of a coordinated holistic mechanism to implement the BCAP, much of its recommendations with regard to *in-situ* and *ex-situ* conservation as well as some cross-cutting areas have been implemented by the institutions with a mandate to conserve wild and agro-biodiversity. This has occurred in various ways. In some instances, those involved with BCAP preparation have included the relevant recommendations in subsequent plans and programmes they were involved with, examples being the Coastal Zone Management Plan 0f 2004 and the Agriculture Research Plan prepared in 2000- 2008. Further, the Biodiversity Secretariat, the forest and wildlife departments and conservation NGOs are represented in most fora that deal with habitat or species conservation, so that it has been possible to include *in-situ* and *ex-situ* biodiversity conservation considerations into the plans, programmes and projects of the forestry, wildlife, wetland, coast conservation and fisheries and agricultural sectors. Furthermore, there is awareness about the need for biodiversity conservation among sectoral institutions and the conservation community.

Overall, a review carried out of 87 recommendations in the BCAP pertaining to *in-situ* conservation (in forests, wetlands, coastal and marine systems and agricultural systems) and *ex-situ* conservation during the preparation of the Addendum to the BCAP showed that implementation of 26 recommendations were critically hampered due to inadequate institutional capacity or mandate for the required actions, while only nine had not commenced at all for the same reason (**Figure 2.2**). The balance 52 reconditions (60%) were being implemented to some degree. A comparable review of the status of the other BCAP recommendations is not available. However, these actions were through independent decisions taken by the respective institutions.

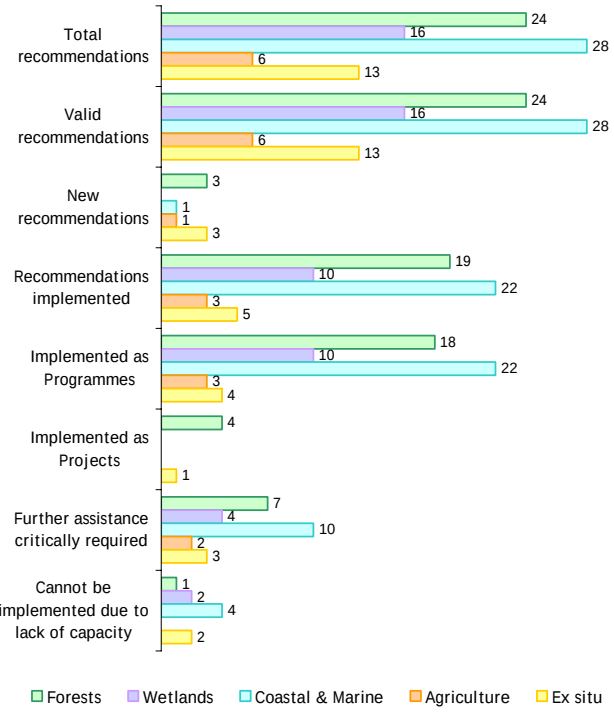


Figure 2.2 System wise status of implementation of recommendations in the BCAP

Key problems in implementing the national BCAP holistically

While the responsibility for BCAP implementation rests with the Ministry dealing with environment[11], a large number of institutions have to actually implement the individual recommendations. As clearly stated in the BCAP and report of Task Force II for preparation of the Addendum, the MoENR through the BDS should set up implementation mechanisms for the BCAP. The absence of a formal coordination mechanism in place for BCAP implementation has been the prime

[11] Currently the Ministry of Environment and Natural Resources (MoENR)

problem for non-implementation of the BCAP holistically. The mechanism required has been provided in the BCAP, and expanded further during preparation of the Addendum (**Figure 2.1**). Secondly, there are institutional problems as the BDS that should spearhead this activity does not have sufficient senior staff positions; the capable mid level staff do not have the authority to act as required. Further, funds are needed to set up the relevant Task Forces and working groups.

Capacity building within the BDS is also required for circulation of CBD COP decisions to the wider public. Currently these decisions are communicated only to the National Experts' Committee on Biodiversity (NEC), due to constraints in terms of human resources and funds in the BDS. This is vital for dissemination of outcomes of the COP meetings (i.e. country responsibilities and actions, training initiatives, funding opportunities, etc.) to the wider stakeholder group who are involved with implementing the necessary actions. *A GEF funded project to set up appropriate mechanisms to track implementation of national BAPs should be considered by the CBD.*

Overall, it has been found that scientifically prepared plans and policies and existing mechanisms (e.g. for sustainable use, quarantine procedures, sand mining, EIA procedures, etc.) are often over ridden due to lack of awareness of the needs for these procedures and the serious implications of contravening them for economic development and poverty alleviation (MoENR, 2007).

2.3.2 In-country capacity for implementing the CBD

Capacity assessment in 1996 by IUCN Sri Lanka

An appraisal of in-country capacity from secondary sources and interviews was carried out by IUCN Sri Lanka in 1996, resulting in a broad analysis of in-country status for implementing the articles of the CBD, and in many cases sub-articles on the following aspects: (i) status of action (ii) availability of in-country capacity (institutional, manpower), and (iii) Level of importance assigned by the country (in term of low, medium and high). At that time Sri Lanka was considered to have medium to high capacity to implement most sub-articles of Article 8 of the CBD, low capacity to implement Articles 15-19 and medium capacity to implement the other Articles.

Sri Lanka has not addressed Article 15, 8j, 11 and 14 adequately; has addressed other sub-articles of Article 8 and Article 12 adequately, and has to a fair degree sought to address Articles 9, 10, 12 and 13, 17, 18 and 19.

The idea of biodiversity valuation is not widely prevalent and has made little headway towards integration into the national economy since the BCAP (1999). Given the inadequate understanding and conceptualisation of the importance of biodiversity for the national economy within financial sectors (MoENR, 2007), there is little scope as yet for providing incentives (Article 11) such as tax rebates and eliminating perverse incentives (e.g. chemical fertiliser subsidies) at the national level to promote biodiversity conservation.

Table 2.1 provides an indication of threats to biodiversity in the country, promoting sustainable use and facilitating benefit sharing with local communities.

TABLE 2.1: *Key threats to biodiversity* **and mitigation status**

Key threats	Specific issue	Status
Habitat loss and fragmentation	Loss of forests through clearing for development or conversion to monoculture plantations.*	This has been largely halted. There is indication from analysis of satellite imagery that high canopy natural forest may have increased since 1999 (Forest Department Personal communication, 2009).
	Illegal slash and burn cultivation in the dry zone and encroachment for cultivation of cash crops in Wet Zone.*	Encroachments into Wet Zone forests have been halted almost entirely with boundary marking of forests, awareness creation, better relations with local communities and law enforcement. Participatory forest conservation has been piloted in successfully in some Protected Areas in the Wet Zone, resulting in greater participation of communities in forest conservation and lowering of threats from illegal encroachment. The same has been piloted in selected PAs in the Intermediate and Dry Zones by the Forest Department

Key threats	Specific issue	Status
		and Department of Wildlife Conservation. Skills have been built within both departments for participatory Conservation of PAs with the involvement of local people.
	Forest fragmentation* due to establishment of plantation agriculture and human settlements over several hundred years in the biologically rich Wet Zone.	Conversion of more than one ha forest to other uses and any clearing of land more than 50 ha have to be preceded by an EIA; also conversion of forests to other uses is low in the biologically rich Wet Zone, and all large forests in the Wet Zone (>10,000 ha) are now managed solely for protection. However, most Wet Zone forests are already highly fragmented, and the long –term viability of the smaller forests (<500 ha) as refuges for biodiversity is of concern due to their isolation.
	Ad hoc reclamation of wetlands.*	Conversion of wetlands of more than 4 ha to other uses requires an EIA, and conversion of paddy lands to other uses is banned. However, land fills in wetlands continue. in urban areas despite laws polices and plans that govern the wetland sector, with the serious loss of flood retention areas and urban wildlife habitats.
	landfills in wetland habitats--particularly in urban areas--for housing and commercial and industrial development.*	See above.
	Indiscriminate allocation of coastal land for construction of tourist hotels and establishment of aquaculture farms in coastal areas.*	All development projects, including establishment of hotels with more than 99 rooms or spread over 40 ha, which ever is applicable, are governed by an EIA procedure.
Habitat degradation	The degradation of freshwater wetlands due to pollution and siltation from unsustainable land use.*	This problem is continuing despite action taken to regulate pollution through the Environmental Pollution License (EPL) scheme. This is due to poor monitoring after the licence is given to enforce adherence to the prescribed pollution limits due to lack of trained staff. Siltation and sediment deposition in coastal waters continues due to poor land use practices.
	Logging of Wet Zone forests in the past.	Logging by the state and large scale illegal logging in natural forests have been completely stopped due to a moratorium on logging since 1990. Illegal felling of valuable timber occur as localised activities in the forests of the sparsely populated Dry Zone, but this has been greatly halted in Wet Zone forests with good law enforcement and participation of local people in forest conservation in forests where community mobilisation programmes have been initiated.
	Ddegradation of coastal ecosystems such as mangroves, lagoons and estuaries, due to unsustainable fishing practices, over-exploitation of resources, pollution.*+	These problems are addressed in the current Coastal Zone Management Plan (2004) with specific recommendations. However, these problems continue due to poor enforcement of laws and regulations.
	Unauthorized encroachment and land reclamation to	Same as above.

Key threats	Specific issue	Status
	convert coastal ecosystems to other uses.*+	
	Severe degradation of near shore coastal reefs, especially in the southern region, due to coral mining for production of lime.*+	This has been reduced to some extent by law, and there is a ban on the use of coral based lime in government departments. However, this problem continues.
Over exploitation of biological resources	Over collection of inland and freshwater wetland bio-resources and destructive harvesting practices causing loss of populations among many plant and animal species.*+	The use of destructive fishing practices in inland wetlands, such as irrigation tanks, is banned under the fisheries ordinance. However these practices do continue in some areas, especially in the large Dry Zone tanks.
	Over collection of coastal food fish and lobsters.*+	Depletion of the coastal food fishery is addressed by the government by promotion of deep sea fishing, which however has its own problems. During the aftermath of the 2004 tsunami, distribution of day boats aggravated the problem by increasing the number of people engaged in the coastal fishery. Collection of gravid lobsters has been banned, but collection is still not sustainable.
	Over collection of marine and freshwater ornamental fish.*+	While some captive breeding programmes are in place, much of the collection (particularly the more attractive forms) is still from the wilds, which is not sustainable.
	Over harvesting of medicinal plants, and species that provide raw materials for cottage industries (such as rattan) or are of subsistence value as food items and wood for posts, poles and fuelwood from forests.*	Destructive collection of non-timber forest products has been greatly reduced in lowland Wet Zone forests managed by the Forest Department and in several PAs managed by the DWLC where participatory management was pilot tested. Furthermore, many resources obtained from nature such as rattan and *dorana* are now scarce, and local people depend more on cash crops such as tea (in the Wet Zone) for their cash income. Permits are provided by the Forest Department for extraction of a specified amount of forest resources such as rattan, and for other traditional uses such as kitul tapping for preparation of treacle and jiggery (a candy like local sweetner). Illegal forest extractions that are damaging have been considerably reduced in Wet Zone forests, with greater awareness creation and enforcement activities of forest managers.
	Illegal harvesting of timber from natural forests.	There has been a ban on logging in natural forests since 1990.There are also measures to regulate the transportation of specified wood (logs) of timber value. Timber for sale is provided by the Forest Department from plantation forests, and the government also imports timber for local use. Banning of timber mills within 1 km of a Conservation forest has also helped control this problem.
Loss of traditiona crop and livestock varieties and breeds	Loss of indigenous breeds of livestock and traditional varieties of rice and other food crops due to replacement in farming systems by new high yielding varieties.*	Considerable work is being carried out by the Department of Agriculture to counter this problem by promotion of traditional varieties of rice and vegetables, and other field crops among farmers and NGOs. The emergence of a small but increasing market for traditional varieties of rice has served to make this effective despite relatively lower yields compared to new improved varieties. The DOA also carries

Key threats	Specific issue	Status
		out regular crop improvement using genes from local traditional varieties, especially with regard to rice and maize. In contrast. This aspect has not been as adequately dealt with for livestock, although documentation of traditional breeds commenced some time ago. Traditional varieties and wild relatives of rice, grains, yams, fruits, spices, vegetables, etc. have been conserved within the research institutions of the Agriculture Department and the Plant Genetic Resources Centre, and is made available to farmers in small quantities for propagation.
	Loss of associated traditional knowledge with the loss of traditional varieties of crops developed over thousands of years.**	The solutions to this problem has been looked into at length during the preparation of the Addendum, but has not been adequately addressed as yet.
	Soil erosion and loss of biodiversity among soil organisms.*	Soil conservation is governed by the Soil Conservation Act of No. 25 of 1951 as amended in 1996. Enforcement by the DOA is, however, inadequate. DOA is promoting organic farming for rice and horticultural crops on a pilot scale in a bid to reduce the over-use of chemical fertilisers, pesticides and weedicides. Several exhibition centres have been set up to create awareness among farmers.
Pollution	Pollution of inland freshwater and coastal wetlands (i.e. lagoons, estuaries) and associated marshes due to contamination with fertilizers, pesticides, weedicides, sewage, chemical compounds from shrimp farms in coastal areas, and dumping of solid and untreated industrial wastes.*+	The pollution of inland waters with agrochemicals, sewage and industrial effluents is addressed by various laws, but this problem continues due to weak enforcement. Reduction of industrial pollution is addressed by the National Environmental Act amendment Act No. 56 of 1988 which makes Environmental Pollution Licences mandatory for all industries. However, monitoring is poor after the license is given. The DOA is attempting to wean people away from inorganic to organic fertilisers and pesticides (see above), but these efforts are slow in reaching the farmers due to insufficient extension effort at the provincial level. This is mainly because agricultural extension has been decentralised and is now under the respective provincial agricultural ministries, while the research institutes that engage in pilot testing initiatives such as organic farming are under the central administration.
	Pollution of beach ecosystems by use as dumping grounds for solid waste.*+	This is addressed in the Coastal Zone Management Plan of 2004, but it continues in some areas due to inadequate enforcement of the Coast Conservation Act. The MoENR has launched a major project to address the problem of unsanitary dumping of solid waste.
	Pollution of lagoons and estuaries.*+	This is addressed in the Coastal Zone Management Plan (CZMP), but the problem continues in some areas. This is mainly because implementation of the CZMP involves a large number of stakeholders.
	Release of waste oil and tar from ships into coastal waters and accidental oil spills.+	This problem is addressed in the Coastal Zone Management Plan. The Marine Pollution Prevention Authority (MPPA) that had a mandate in this regard has been now strengthened and renamed as the Marine Environment Protection Agency.
Human - wildlife conflicts	The disruption of continuous stretches of forest and	This problem has been of long-standing and has resulted in aggravating the human-wildlife conflict in Sri Lanka. The

Key threats	Specific issue	Status
	wildlife corridors in the Dry Zone for establishment of human settlements, irrigated agriculture and chena cultivation.++	capacity of the Department of Wildlife Conservation, which is responsible to address this problem, has been built through local and overseas training under the recently concluded Protected Area Management and Wildlife Conservation Project. A total of 314.5 km of electric fencing and 53 km of live fencing have been installed at strategic locations to address the human-elephant conflict.
Spread of invasive alien species	Accidental and intentional introduction of alien invasive plants and animals into wetlands.*	This is a burgeoning problem in Sri Lanka with impacts felt in agricultural systems, wildlife parks, and wetlands. A proposal for Strengthening Capacity to Control the Introduction and Spread of Invasive Alien Species (IAS) in Sri Lanka, is being formulated with UNDP/GEF aid. The DOA is also actively engaged in identifying biological control agents for several IAS and testing their suitability prior to release in the country.
	Accidental introduction of alien invasive plants and animals into terrestrial ecosystems.*	Same as above.
	Release of ballast water within territorial waters.+	Sri Lanka is considering ratification of the Convention on Ballast Water.
Increasing human population density	Increased pressure on natural ecosystems and species, particularly around the species rich Wet Zone forests have increased the risk of forest encroachment and poaching.*	Boundary marking of most forests under the Forest Department and the Department of Wildlife Conservation (DWLC) through the Forestry Resources Management Project and the Protected Area Management and Wildlife Conservation Project respectively have helped to limit encroachment into natural forests.
	Escalation of fragmentation and degradation of home gardens in the Wet Zone that are important habitats for fauna and flora and repositories of horticultural biodiversity.*	Not addressed as yet.

* Threats addressed in the BCAP. + threats addressed in the Coastal Zone Management Plan. ** Additional threats addressed in the Addendum to the BCAP.

2.4 Domestic and international funding dedicated to biodiversity conservation

2.4.1 Domestic funding

There are several organizations in the state sector with mandates and major responsibilities to fulfil national obligations under the CBD. They are often constrained due to inadequate national budgetary allocations. Often (but not always) funding limitations are a serious barrier to carrying out mandated actions for biodiversity conservation, sustainable use of bio-resources, and benefit sharing. These state agencies consequently depend heavily on external project funding. Some of these activities often come to an abrupt halt after the projects ceases due to lack of institutional funding from the national budget, and are not sustained in the long-term.

Currently, the Ministry dealing with Plan Implementation collates the annual plans and budgets proposals sent by the planning cells in line ministries. The Department of National Planning and the budget division of the Treasury have the power to veto and determine the actual allocation of funds to the various agencies. Part of the problems of obtaining adequate budgetary allocation is inadequate institutional capacity for negotiation and preparation of strong project proposals and realistic budgets during the annual national budget allocation process.

The Forest Department depends on external funding for 60-70% of their programmes, but could become considerably independent if at least funds from timber supplied to the State Timber Corporation are channelled back to the Department. In contrast 50% of funds gained by the Department of Wildlife Conservation from the National Parks is released back to the Wildlife Preservation Fund (WPF) since 2002. Given the paucity of national funding available for biodiversity conservation and management, some conservation agencies lack capacity to access external funding for action needed for biodiversity conservation, and some lack capacity to maximise the funds provided. This has a spin-off effect as poor performance reduces further chances to secure donor funding, and necessitates repeatedly seeking more funds to achieve the same long-term conservation goals.

2.4.2 External funding

Due to limitations in national funding, state agencies dealing with biodiversity conservation consequently depend heavily on external project funding, but these activities tend to come to an abrupt halt after the projects cease due to lack of institutional funding from the national budget, and are not generally sustained in the long-term. A review of national and donor funding for biodiversity conservation carried out in 1995 showed that 92% of funds for biodiversity conservation funding from 1991-1994 were from external sources. Of the balance 8% from in-country sources, 99.6% was government funding. At the time, much of the external donor funding (62.3%) was from 12 bilateral donors, that also funded a majority of the projects. Great Britain was the main donor followed by USA (Dela, 1995). At present, the government contribution has increased, and while all major projects depend on external donor funding, the main donors are multilateral donors with GEF funds accounting for much of the projects.

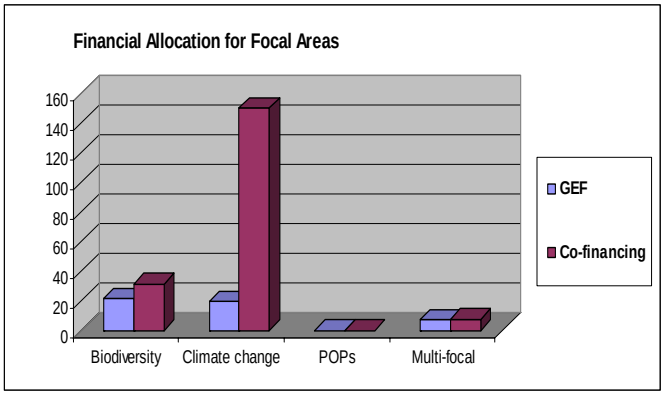


Figure 2.3: Total GEF allocation per Focal Area for Sri Lanka in US $ million (1992-06) showing allocation for biodiversity conservation

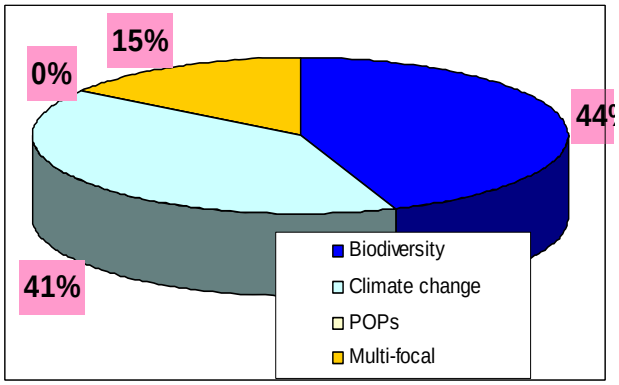


Figure 2.4 : Percentage of the GEF allocation for Sri Lanka per Focal Area in US $ million (1992-2006) showing % allocation for biodiversity conservation

Source: National GEF Strategy for Sri Lanka, MoENR, 2006

TABLE 2.2: Major donor funded projects with implications on biodiversity conservation in Sri Lanka during 1999 – 2009

Funds in US $

Project	Donor/s	Total allocation (US $)
Development of Wildlife Conservation and Protected Areas Management	UNDP/GEF	GEF: 4.087 mill Total: 8.38 mil
Conservation and Sustainable Use of Medicinal Plants and preparation of a national Biodiversity Action Plan.	World Bank/GEF	GEF: 4.57 mil; GOSL Co-Fin. 0.80 mil, Total: 5.37 mil
Participating in the Clearing House Mechanism of the CBD	UNDP/GEF	0.008 mil (Enabling activity)
National Biosafety Framework Development Project	UNDP/GEF	GEF: 1.58 mil; GoSL:0.77mil. Total: 2.34 mil
Conservation of Biodiversity through Integrated Collaborative Management in Rekawa, Ussangoda, and Kalametiya Coastal Ecosystems	UNDP/GEF	PDF 20,000, GEF:729,670 Co-financed by: CCD/ADB-CRMP:1,134 mil
Conservation of Globally Threatened Species in the Rainforest of Southwest Sri Lanka	UNDP/GEF	GEF: 0.75 mil GOSL Cofin: 0.226 mil Total: 0.976 mil
Development & Application of Decision-support Tools to Conserve & Sustainably Use Genetic Diversity in Indigenous Livestock & Wild Relatives	UNEP/GEF	GEF PDF B funds: Total: 6.912 million
Integrating Economic Values into Protected Area Management in South Asia	GEF/IUCN	GEF (PDF A):25,000 IUCN Regional Economic Prog:8,000 IUCN & other Project partners:9,600 Total PDF A: 42,600
Protected Area Management and Wildlife Conservation Project*	ADB/WB-GEF/Government of the Netherlands (GON)	ADB 12 mil; GEF grant: 9 mil; GON: 4 mil, coffin GOSL & beneficiaries: 8.5 mil (including in kind) Total: 33.5 mil.+
Building Capacity for Effective Participation in the Biosafety Clearing House (BCH)	UNEP/GEF	GEF: 49,000. GOSL: 4,220; Total: 63,200
In-situ Conservation of Crop Wild Relatives Through Enhanced Information Management and Field Application	UNEP/PGRI	GEF Trust Fund: 6.612 mil; Co-fin: 6.517 mil; Total:12.679 mil
National Capacity Needs Self-Assessment (NCSA) for Global Environmental Management	UNDP/GEF	GEF: 2.0 mil; GOSL: 20,750
Strengthening capacity to control the introduction and spread invasive alien species in Sri Lanka	UNDP/GEF	GEF 5.27 million
Coastal Resources Management Project**	ADB and the Government of the Netherlands	80 million from ADB the Netherlands Government and the Government of Sri Lanka.
The Environmental Action 1 Project	World Bank	WB: 20.24

Project	Donor/s	Total allocation (US $)
The Forest Resources Management Project	ADB	ADB: 25 mil GOSL and beneficiaries 14 mil
Sri Lanka Australia Natural Resources Management Project (SLANRMP) for poverty reduction through improved natural resource management	AusAid	AusAid: 9.6 mill AUS $ (approx US $ 8.2 mill) GOSL: SLRs 6 million
Upper watershed management Project	ADB	ADB: 23.7 million
Aquatic Weeds Management	FAO	FAO: 0.14 million
Mainstreaming biodiversity conservation and sustainable use for improved human nutrition and wellbeing	UNEP/GEF	GEF: 1.39 million

Sources: GEF Strategy for Sri Lanka, 2006 for all GEF funded grants; * PAM &WC project completion report, 2009 and CZMP, 2004** and Others http://www.erd.gov.lk/publicweb/LOANINFOR/Environment.pdf. For the PAM &WC project* the entire loan was not utilised and only 28 mil was used at the end of the project.

Chapter 3

3.1 Introduction

The Conference of Parties to the CBD (COP 2) calls for Parties to (a) develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity, and to (b) integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies. This concept is reiterated in the "Ecosystem Approach" which the CBD COP has decided should be the primary framework of action for Parties to be taken under the CBD. According to the definition by CBD COP, the 'Ecosystem Approach' is in essence a generic strategy for integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable manner with a stress on 'societal choice' and participation of all sectors of society in the conservation and management of biodiversity. Adopting this approach depends on effective integration of biodiversity concerns into sectoral strategies and cross-sectoral strategies, plans, policies and programmes at the national level.

This chapter deals with the status of sectoral and cross-sectoral integration of biodiversity concerns in Sri Lanka to promote the conservation and sustainable use of biodiversity As such this chapter is divided into the following sections:
Section 3.1: provides the introduction to this chapter.
Section 3.2: deals with the extent and nature of sectoral integration of biodiversity conservation concerns in terms of institutional arrangements, laws, mandates, plans, policies and programmes/projects.
Section 3.3: deals with the extent of cross-sectoral integration of biodiversity conservation concerns with other sectors also dependant on biodiversity, development related agencies and the business sector.
Section 3.4 gives an overview of mainstreaming biodiversity into sectoral and cross-sectoral strategies and plans
Section 3.5 deals with integration of biodiversity concerns into implementation of other Conventions at the national level.

This chapter has drawn largely on wide stakeholder consultations via questionnaire surveys and roundtable meeting on cross-sectoral support for biodiversity conservation and adopting the ecosystem approach and discussions with high level administrators during institutional visits and discussions with communities, NGOs, the business community and other members of the public that were carried out during the 2005/2006 GEF funded National Capacity Needs Self Assessment Project for preparation of the thematic report on Biodiversity. The chapter has also drawn on interviews with officials of sectoral institutions and the Department of Agriculture for preparation of this report.

3.2 Sectoral integration of biodiversity

3.2.1 The Environmental Sector

The commitment by the State for environment conservation in Sri Lanka is enshrined in the 1978 (current) Constitution of the Democratic Socialist Republic of Sri Lanka. Article 27(14) of the Constitution decrees that "The State shall protect, preserve and improve the environment for the benefit of the community." Article 28f 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."[1] While these provisions are not legally binding there are a large number of laws that promote biodiversity conservation in Sri Lanka. The constitution also vests "sovereignty" in the "people" that is inalienable; the executive, the legislature and the judicial system are merely the instruments through which "sovereignty" is expressed (MoENR, 2007) . Executive or legislative action that goes against the principle of safeguarding Sri Lanka's Natural Resources by its citizens (as this is a duty and not an option) can be declined by the Supreme Court as unconstitutional.

The 13th Amendment to the Constitution of Sri Lanka of 1987 introduced Provincial Councils as a new level of regional governance resulting in a major shift in government policy to decentralise and devolve many functions of the Central Government to the Provinces. Provincial Councils are empowered with legislative and executive powers over several subject areas including the environment, and may, thus, enact laws pertaining to the environment within the area under its control, but they cannot supersede or conflict with laws passed by Parliament (MoENR, 2002).

According to a study of Environmental Governance in Sri Lanka (PILF, 2005) the overall effectiveness of key environmental institutions at the national level for promoting environmental conservation ranked 2 on a scale of 0-4.

Institutional arrangements

The Ministry of Natural Resources and Environment (MoENR) is mandated for: (a) facilitating sustainable development by the promotion of sound environmental management, (b) monitoring and reporting progress of the National Environmental Acton Plan and its periodic revisions, and (c) formulation of all national policies in relation to environmental protection and management. It is responsible for preparation and periodic revision of the National Environmental Action Plan (NEAP). The national Biodiversity Secretariat (BDS) (see Chapter 2) functions under this ministry and is responsible for facilitating and formulating policies and plans for national biodiversity conservation, carrying out specific responsibilities assigned to it in the BCAP and Addendum, ensuring that national obligations under the Convention on Biological Diversity and the Cartagena Protocol are met with, and that the country participates in training and/or funding for COP determined activities for implementation of the CBD.

The main sectoral institutions comprise the Forest Department (FD), The Department of Wildlife Conservation (DWLC), the Central Environmental Authority (CEA) and the Marine Environment Protection Authority (MEPA) that function under the MoENR. The policies related specifically to biodiversity conservation in forests and wetlands are prepared by the MoENR together with the relevant sectoral agency. The CEA is the main agency for implementing laws and policies pertaining to general environmental conservation, the FD, and DWLC, Coast Conservation Department (CCD) and Local Authorities deal with formulation and enforcement of laws in their respective spheres. The CCD functions under the Ministry dealing with fisheries.

TABLE 3.1: **National level stakeholders for implementing the CBD and the national BCAP**

Primary Stakeholders*	**Secondary stakeholders:**	
	Group (i)+	**Group (ii)x**
Ministries: Ministry of Environment and Natural Resources; Ministries dealing with indigenous medicine, Foreign Affairs, Agriculture, Lands, Livestock & Irrigation and fisheries and aquatic resources.	*Ministries:* Plantation industries; Trade; Science & Technology; Power & energy; Education (and relevant institutions under it); Tourism; Finance and planning; Urban development water supply.	*Ministries:* Ministry dealing with health Ministry dealing with tourism
Main state institutions Forest Department (FD), Department of Wildlife Conservation (DWLC), National Zoological Gardens (NZG), The National Botanic Gardens (NBG), Central Environmental Authority (CEA), Department of Animal Production & Health (DAPH), Department of Agriculture (DOA) and associated research institutions (FCRDI, HORDI, SCPPD, RRDI, etc.) plus other divisions under it; Plant Genetic Resources Centre (PGRC) – also under the DOA, but with special role for *ex-situ* conservation; Department of Export Agriculture (DEA); Urban Development Authority (UDA); Coast Conservation Department (CCD);Dept of Fisheries & Aquatic Resources (DFAR); Marine Environmental Protection Authority	*State institutions* Mahaweli Authority of Sri Lanka (MASL) Department of Ayurveda Attorney General's Department. Legal Draftsman's Department Department of National Planning The Police Department Meteorological Department. Sri Lanka Land Reclamation Development Authority (SLRDA) The National Science Foundation (NSF) Sri Lanka Standards Institute (SLSI) Sri Lanka Ports Authority (SLPA) Department of Censes & Statistics Registrar of Patents and Trademarks Registrar of Pesticides	*State institutions* Department of Small Industries Geological Survey and Mines Bureau (GSMB) Aquaculture Development Agency (NAQDA) State Timber Cooperation (STC) State institutions in the transport sector State Institutions dealing with power and energy

Primary Stakeholders*	Secondary stakeholders:	
	Group (i)+	Group (ii)x
(MEPA); Sri Lanka Customs; Department of National Museums (DNM). *Research institutions* National Aquatic Resources Research and Development Agency (NARA) Coconut Research Institute (CRI) Tea Research Institute (TRI) Rubber Research Institute (RRI) Sugarcane Research Institute (SRI). Veterinary Research Institute (VRI)	*Research institutes* Universities & other academic/research Institutes (for education and research) Council for Agricultural Research Policy (CARP) Bandaranaike Memorial Ayurvedic Research Institute (BMARI) Industrial Technology Institute (ITI) *Civil society* Environmental NGOs: both National and International that focus specifically on the environment. Media institutions -(press, T.V, radio) Journalists' fora. Members of the public interested in biodiversity conservation in various organisations.	*Private sector* Institutions to be represented by the Chambers of Commerce Industries (some will be included above) *Civil Society* represented by various organisations that may impact on environmental issues-such as Chambers of Commerce.
Provincial Environmental ministries	*Regional/local:* Provincial Councils (PCs); District/Divisional Secretariats; Local Authorities (LAs); Community Based Organisations adjacent to forests (CBOs)	

Source: Adapted from the *Thematic Report on Biodiversity for the National Capacity Self-needs Assessment Project (MoENR, 2007)*

***** Agencies/institutions with a mandate for some aspect of biodiversity conservation. **+**Institutions/organisations (state or other) with no definite mandate for biodiversity conservation in terms of implementing articles of the CBD and the recommendations of the BCAP, but who should/or have a major role to play in implementing them. * Institutions/organisations (state or other) with no mandate for biodiversity conservation in terms of implementing articles of the CBD and the recommendations of the BCAP, but who may adversely or positively have major impacts on implementing them.

The Forest Department

This department is engaged in conservation and management of considerable land under natural forest, including much of the biodiversity rich Wet Zone forests that are protected. Forest management practice has veered towards biodiversity conservation, although it is accepted that complete restriction of the use of forest resources by local people is counter-productive to achieving forest biodiversity conservation, except in biologically sensitive areas that require strict protection. Community participation for forest management in Dry and Intermediate Zone forests is practised, and staff capacity has been built to implement this concept.
Source: Dela, 2003

The Department of Wildlife Conservation

This department manages six categories of lands that have been gazetted as Protected Areas under the Fauna and Flora Protection Ordinance No. 2 of 1937 (FFPO) and its subsequent amendments (see details in Appendix IV). Its mission is "to conserve wildlife and nature by sustainable utilization of men, materials and land through participatory management, research education and law enforcement and ensure the maintenance of biodiversity and forest cover as exists today." Consequently, the plans and programmes of the DWLC are directly related to Article 8 of the CBD. The DWLC requests an IEE or EIA for developmental activities in areas within one mile from the boundary of any National Reserve declared under the FFPO, and is a project approving agency under the NEA. It also has to prepare draft amendments to the FFPO periodically.

The Central Environmental Authority

The Central Environmental Authority (CEA) has legal provision under the NEA to control environmental pollution and to mitigate the adverse impacts of development activities through legally binding EPL[12] and EIA procedures respectively. The CEA is also empowered with monitoring industrial discharge of effluents into waterways, air emissions and noise pollution, and is the regulatory authority to facilitate standard setting by preparation of guidelines for ambient water standards, ambient air quality standards, mobile source emission standards, industrial emission standards and interim stationery sound emission standards. The standards set according to these guidelines are gazetted by the MoENR. Under the NEA, the CEA also can declare environmentally sensitive areas (EPAs). Eight EPAs have been declared to date. While EPAs do not have total protection, the CEA allows only identified activities within these areas and all development activities are monitored. A special unit for wetland conservation has been established within the CEA as per a recommendation from the BCAP review during preparation of the 2007 Addendum.

The Coast Conservation Department (CCD)

This department is located under the Ministry dealing with fisheries, but it is the prime agency responsible for coastal issues pertaining to coastal area conservation in Sri Lanka. Its mandate provides it with a key role to play in conserving and managing coastal and marine biodiversity according to the periodically revised Coastal Zone Management Plan (CZMP). The CCD is responsible for preparation of the CZMP.

The Marine Environment Protection Authority

Formerly the Marine Pollution prevention Authority, it was renamed as the Marine Environment Protection Authority and strengthened by the amendment Marine Pollution Prevention Amendment Act No 35 of 2008. The MEPA is responsible for prevention and prompt remedial action in the event of marine pollution, including a major oil spill in Sri Lankan waters, or adjacent waters that may affect the country's marine environment (*Article 14 of the CBD*), and for conservation of marine biodiversity. The MEPA has identified and mapped environmentally sensitive marine areas using GIS (stored in a database) (*Article 7d*) and has to address the threat of invasive species from ships' ballast waters *(Article 8h)*.

3.2.2 Decentralisation of biodiversity conservation

Provincial Ministries of Environment have a role to play in biodiversity conservation matters at the regional/local levels. Seven Provincial Biodiversity Conservation Profiles with Action Plans have been prepared through a consultative process and will be implemented through the Provincial Councils with their own budgets. This process explored integrating the BCAP into provincial plans, identification of major causes and reasons of provincial biodiversity loss, and preparation of provincial priority lists according to the Addendum (to the BCAP) recommendations.[13]

3.2.3 Integrating biodiversity conservation into sectoral plans

Sri Lanka has experienced a resurgence of state commitment for environmental management, fostered by global concern for sustainable use of the earth's natural resources. There is increasing awareness nationally about the importance of a healthy environment for national economic development. This has lead to a consciousness in the environmental sector that environmental management is essential to secure socio-economic advancement.

Overall, there are about 80 laws to conserve Sri Lanka's environment, many of which are of direct relevance for conservation and sustainable use of biological diversity. The main enactments in this regard are given in **Table 3.2**. Of particular significance are periodic revisions of the Flora and Fauna Protection Ordinance and the Forest Ordinance to enhance protection of wild biodiversity. Sri Lanka has also enacted legislation on Intellectual Property Rights (i.e. The Intellectual Property Act No. 36 of 2003).

The introduction of alien invasive species and biosafety are not felt to be adequately covered by the existing laws, and this is due to be rectified by a new Act that will address invasive species. The export of crop and livestock biodiversity is under the purview of the Department of Agriculture (DOA) and the Department of Animal Production and Health (DAPH), and exporters and importers of crops and livestock (and importers of any biological material) have to comply with the Animal Disease Act No. 33 of 1992 and the Plant Protection Act No. 35 of 1999. While there are no special

[12] EPL= Environmental Protection License; EIA = Environmental Impact Assessment

[13] The discussions have not covered the main BCAP recommendations, which is an impediment to implement the BCAP holistically.

laws concerning access to genetic resources, the existing legal framework arsing from the Flora and Fauna Protection Ordinance and the Forest Ordinance covers the granting or denial of a legitimate application made to the Government of Sri Lanka for Transfer/Access of Genetic Resources by another Country Party to the CBD as well as natural and legal persons from these countries. This also covers similar requests from other "non-CBD Party" countries.

TABLE 3.2: **The main legislation relating to environmental conservation and management in Sri Lanka**

Legislation	Conservation measures
The Forest Ordinance No. 16 of 1907, and its subsequent amendments, including Act no 23 of 1995.(a new Forest Conservation Act is in the draft stage).	The Forest Department is responsible for the implementation of this law (FO) which has been subject to many revisions to make provision for the protection of state forests from unlawful felling, clearing, encroachment, removal of produce, etc; the declaration of forests as Reserve Forests: the control of felling and other forms of exploitation in forests; and the transportation of timber. The 1995 amendment has created Conservation Forests. While encroachment and illicit felling of timber from Wet Zone forests has been largely controlled, some illicit activities continue in State forests.
The Fauna and Flora Protection Ordinance No. 2 of 1937, and subsequent amendments including Act of 2009.	The Department of Wildlife Conservation is primarily responsible for the implementation of this law (FFPO) which recognises six categories of wildlife reserves. This Act, besides protecting animal and plant life within the national reserves, has provision to protect certain categories of animals and plants wherever they are found and states the penalties for violation of the law. For post faunal groups there is negative listing so that most species un the vertebrate groups are protected. The Act also lists penalties for violation of the law. However, enforcement of this Act remains weak with respect to protection of all species listed under this Act. In contrast, the Act requires a permit for export of any wild plant or animal or their parts, and this is enforced by the Customs Department at ports of exit from the country.
Felling of Trees Control Act No. 9 of 1951.	The Forest Department is the implementing agency for this act, which makes provision for the prohibition, regulation or control of the felling of specified valuable tree species, including cultivated species such as jak found in home gardens. This Act is largely ineffective with respect to cultivated species, particularly in urban areas.
The National Heritage Wilderness Area Act No. 3 of 1988.	The Forest Department is the implementing agency for this act, which was enacted to enable the preservation of unique natural ecosystems under the jurisdiction of the Forest Department and the genetic resources in them. Only the Sinharaja forest has been declared under this Act.
Soil Conservation Act, No. 25 of 1951; amended in 1996.	This Act empowers the Director of Agriculture to undertake surveys and investigations for the purposes of ascertaining the nature and extent of land degradation due to various factors including floods, droughts, salinisation, desertification, siltation and soil erosion measures on a watershed basis. Implementation of this Act is weak.
Coast Conservation Act No. 57 of 1981, and the amendment Act No.64 of 1988.	This Act requires the Coast Conservation Department to survey the Coastal Zone and inventory the resources available therein, including coastal ecosystems and material regularly removed for commercial or industrial purposes from this area, and to draw up Coastal Zone Management Plans periodically. The Act vests the administration, custody and management of the coastal zone in the island, while the responsibility of administering and implementing the Act devolves on the Director of the Coast Conservation Department who has to issue permits for all development activities undertaken within the area designated by law as the coastal zone. This requires calling for an Environmental Impact Assessment (EIA) before permitting any such activities.

Plant Protection Act No. 35 of 1999 (replacing Plant Protection Ordinance No.10 of 1924).	The Director of Agriculture is the administering authority under this Act which controls the introduction of noxious plants, pests and diseases of plants into Sri Lanka. This Act will be revised to better address alien invasive species, GMOs, and LMOs (note: a new Act to specifically cover IAS is being proposed).
Water hyacinth Ordinance No 9 of 1909	This controls the introduction and proliferation of water hyacinth and other weeds and invasive plants in the country.
The National Zoological Gardens Act no.14 of 1982	This Act set governs the management and administration of the National Zoological Gardens.
The Botanic Gardens Ordinance No. 31 of 1928.	This deals with *ex-situ* conservation of plants, and concerns the management and administration of the National Botanic Gardens.
Fisheries Ordinance No. 24 of 1940 and its amendments, the latest being The Fisheries and Aquatic Resources Act No. 2 of 1996.	This Act which governs the fisheries sector promotes measures for the integrated management, regulation, conservation and development of fisheries and aquatic resources in Sri Lanka, and addresses the protection of fish and other aquatic resources. It makes provision for the State to set aside marine areas as fisheries reserves, as and where necessary, for replenishments of wild stocks. While this Act covers all aquatic fauna and flora, it does not override the FFPO and the FO[+]
Urban Development Authority Law No 37 of 1978, as amended by subsequent Acts, the recent ones being Act No. 44 of 1984 and Act No. 4 of 1992.	This law served to establish the Urban Development Authority (UDA) to promote the integrated planning and implementation of social, economic and physical development of areas declared as "Urban development areas". The Act also provides for the development of environmental standards and schemes for environmental improvement in areas identified as UDA areas.[+]
The National Environmental Act No. 47 of 1980 and the amendment No. 56 of 1988. (a new National Environmental Protection Act is being drafted)[+].	This Act created the Central Environmental Authority, and the amendment Act of 1988 empowered all project approving agencies to obtain an Environmental Impact Assessment (EIA) from any developer for prescribed developmental projects and for control of environmental pollution through the issuing of Environmental Pollution Licences (EPLs). This Act also provides for identification of environmentally sensitive areas termed Environment Protection Areas (EPAs) out side PAs, including biodiversity rich areas Protected Areas. As such it complements the FFPO and the FO.
The Marine Pollution Prevention Act No.59 of 1981 and amended by the Marine Pollution Prevention Act No.35 of 2008 which became effective from 01.01.2009.[+]	This MPPA of 1981 enabled the establishment of the Marine Pollution Prevention Authority (MPPA) and provided for the prevention, reduction and control of pollution in Sri Lankan waters, and for giving effect to international conventions that Sri Lanka is a signatory to for the prevention of pollution of the sea. The 2009 revision of this Act has strengthened the MPPA and renamed it as the Marine Environment Protection Agency.

Source: De Silva (2000), MEPA (1991); Manchanayake and Madduma Bandara (1999), Madduma Bandara (1999, 2000), Central Bank, 1999. + personal communication with relevant agencies

More than 30 state institutions are involved with some aspect of management and protection of the environment and natural resources in Sri Lanka. Those with greatest responsibility in this sphere are the sectoral agencies Forest Department (FD), Department of Wildlife Conservation (DWLC), Central Environmental Authority (CEA), the Marine Environment Protection Authority (MEPA), and the Coast Conservation Department (CCD) that is located in the fisheries sector.

TABLE 3.3: **Integration of biodiversity concerns into policies/strategies of the environmental sector.**

Area of purview	Policies / plans/ laws that have a major bearing on biodiversity conservation	Key programmes/ projects that address biodiversity conservation
Environment	The **National Conservation Strategy** of 1988. **Introduction of Environmental Impact Assessments t**o all development projects and an **Environmental Pollution Licensing** Scheme under the revised NEA of 1988. Creation of a **Cabinet Ministry** to handle Environmental affairs in 1990. Setting of **environmental standards** for ambient air quality (gazetted in 1994), mobile source emission, industrial emissions and interim stationery sound emissions. Preparation of the **National Environmental Action Plan** in 1991 and its systematic revision periodically, with the present Caring for the Environment (MoENR, 2003). The current NEAP recognises that biodiversity conservation needs cross-sectoral action, and considers biodiversity as an integral part of the environment, and stresses that implementation of the BCAP is absolutely 'vital'. **The National Environmental Policy (2003)** addresses management of biodiversity as consistent with viability of ecological processes; concurs that traditional knowledge/practices will be respected during environmental management; and includes management needs to address invasive species and LMOs; respond to climate change; and promote the economic valuation of environmental services and commitment for restoration of damaged environments.	The BDS Carried out the component to strengthen capacity for coordinated biodiversity planning under the ADB/GEF/GON funded **Protected Area Management and Wildlife Conservation** (PAM &WC) **Project**. (*relevant for Article 6b*) **The Environmental Action 1 Project** (commenced in 1997 for five years) enhanced institutional capacity for environmental conservation and regulatory aspects. Amongst many other activities, this provided training for CEA staff on biodiversity conservation and management. **The Crop Wild Relatives Project** carried out by the MoENR in collaboration with the DOA to identify the status of wild crop relatives conservation in Sri Lanka in respect of *in-situ* and *ex-situ* activities. (*relevant for Article 8 and 10*) **The National Biosafety Framework Development Project** (May 2003-2005) *(supports Article 19)* to ensure that the risks due to modern biotechnology and its products will be minimized and biodiversity, human health and environment will be protected in a maximum way; the transboundary movements of GMOs would be regulated through formulation of relevant policies, regulations, technical guidelines and establishment of management bodies and supervisory mechanisms. This resulted in a comprehensive National Biosafety Framework of 2003, a database to be made available on the web, and a national policy on biosafety.
Forestry	**The Forestry Sector Master Plan of 1995** covering 1995-2020, has a chapter dedicated to biodiversity conservation in the forestry and wildlife sectors and addresses in detail the needs, issues and options for development of forest areas to conserve indigenous terrestrial biological resources, with involvement of local people in the planning and management of Protected Areas. These	**The Forestry Sector Development Project** (FSDP) which strengthened capacity to establish forest plantations to supply timber without exploiting the island's natural forests. **Environmental Management in Forestry Development Project** (EMFDP) which commenced in 1991, carried out the Accelerated Conservation Review of 31

Area of purview	Policies / plans/ laws that have a major bearing on biodiversity conservation	Key programmes/ projects that address biodiversity conservation
	concerns were integrated into the National Biodiversity Conservation Action Plan and its Addendum. **The National Forest Policy of 1995** deals with biodiversity conservation and participatory management of forest with local people. This policy also emphasises the importance of retaining the present natural forest cover and increasing overall tree cover in areas, including non-forested areas.	lowland rain forests followed by the National Conservation Review (for biodiversity assessment) of natural forests in the country *(relevant for Article 7(a) and Article 18);* setting up of a database on forest biodiversity (the Environmental Information Management system-EIMS) *(relevant for Article 7(d));* comprehensively surveying traditional uses of forests by local communities and their impact on forest biodiversity *(relevant for Articles 8(j)).*[14] **Community Participation Project** (1982-1990) and the **Participatory Forestry Project** initiated in 1993 that led to understanding of the role of local people in forest conservation. *(relevant for Article 8)* The GEF/UNDP funded **Southwest Rainforest Conservation Project**[14] of the Forest Department (2000-2006) *(relevant for Article 8)* The **Forest Resources Management Project** (FRMP) [14] [see details in Appendix IV) *(relevant for Articles 8, 10, 11, 12, 13).* **Sri Lanka Australia Natural Resources Management Project (SLANRMP**) [14] for poverty reduction through improved natural resource management *(relevant for Articles 8, 10 and 11)*
Wildlife	**The National Wildlife Policy of 2000** has taken into account the needs of biodiversity conservation.	The Department of Wildlife Conservation carried out the Protected Areas Management Project as an investment programme implemented through the Global Environmental Facility Project (1992-1998) to strengthen the capacity and capability of the DWLC for preparation of a resource inventory based viable management plans for protected areas *(relevant for Article 8b); p*iloting an eco-development plan for a wildlife area to test implement participatory management *(relevant for Article 8(j));* supporting wildlife research with specific emphasis on management utility of results *(relevant for Article 12(b)); d*eveloping capacity to minimise human elephant conflict and conservation of elephants *(relevant for Aricles 8(c) and (d));* Carrying out multimedia based awareness campaigns,

[14] see details in **Appendix III**

Area of purview	Policies / plans/ laws that have a major bearing on biodiversity conservation	Key programmes/ projects that address biodiversity conservation
		specially addressing park visitors, local communities and students *(relevant for Article 13).* **The Protected Area Management and Wildlife Conservation (PAM&WC)** Project [15] was *relevant for Articles 8, 10, 11, 12, 13.*
Wetlands	**The National Wetlands Policy of 2004** deals with conservation of wetlands. The National Watershed Management Policy of 2004 The NEA has provisions to control clearing of wetlands.	**The Wetland Conservation Project (WCP)** Phase I initiated by the CEA in 1991 heralded significant measures for the conservation of wetlands in the island, and was instrumental in prioritizing wetlands for conservation and management. This involved identification of 84 key wetland sites; carrying out site surveys and preparing site reports for 26 wetlands of which ten are also management plans (*Article 8b*). These plans envisage a sustained yield of multiple benefits with minimum resource use conflicts within a framework of preserving the ecological, cultural and social values of the wetlands. The project also created public awareness on wetlands and their values (*Article 13),* developed methodologies for conservation, setting up a digital database on wetlands (*Article 7d*), developed a wetland evaluation system, and formulated criteria for selection of wetlands for total conservation. **The Integrated Resource Management Project (IRMP)** focused on two selected wetlands (Muthurawela Marsh and the Negombo Lagoon) on pilot scale implementation of Management Plans. Some SAM sites under the CCD were also identified as wetland sites requiring conservation and management ((*Article 8*).
Coastal and Marine	The Coast Conservation Act No. 57 of 1981 (CCA) vested the administration, control and custody of the Coastal Zone in the Republic of Sri Lanka. Together with the 1988 amendment, the CCA provides the legal foundation for activities in the Coastal Zone. The National Coastal Zone Management Plan (CZMP) is the main instrument that influences implementation of programmes and enforcement in the Coastal Zone. Initially prepared in 1991, this is updated periodically by the CCD. All relevant recommendations in Sri	**The Coastal Resources Management Project (CRMP)[15]** with funds from the ADB and the Government of the Netherlands *(addresses Article 8 and 7)* carried out mapping of coastal habitats and sites of archaeological, historical and scenic value; and addressed erosion management and controlling of coastal water pollution, habitat conservation, identification of coastal land use patterns, and identified coastal sites for future development. .

[15] see details in Appendix IV

Area of purview	Policies / plans/ laws that have a major bearing on biodiversity conservation	Key programmes/ projects that address biodiversity conservation
	Lanka's BCAP pertaining to coastal and marine habitats and species have been incorporated into the current Coastal Zone Management Plan of 2004.	
	The National Action Plan for Protection of Marine and Coastal Environment from Land based activities of 1999, which covers impacts of inland sand mining, land degradation, coastal erosion and coastal pollution from industries on the marine environment.	The MEPA has commenced a programme of work to implement the Marine Pollution Prevention Act and for surveillance and regulation of activities within its area of authority,
	The National Oil Contingency Plan (NOSCOP) to deal with national arrangements for responding to oil spills in the marine environment.	

Source: Adapted from institutional surveys and Thematic Report on Biodiversity for the National Capacity Needs Self Assessment Project (MoENR, 2007)

3.3 Cross-sectoral integration of biodiversity conservation concerns

3.3.1 Institutions responsible for biodiversity conservation

A large number of institutions are stakeholders in conserving and managing biodiversity in SrI Lanka, either through direct protection, management of bio-resources or through negative impact. They are listed in **Table 3.1.** Apart from the main sectoral institutions that are directly mandated with biodiversity conservation, many others such as the Ministry dealing with Fisheries, the Department of Fisheries and Aquatic Resources (DFAR), the Department of Agriculture (DOA) and the institutions that function under it, the Department of Animal Production and Health (DAPH) that deals with livestock, the Urban Development Authority (UDA) and the Sri Lanka Land Reclamation & Development Corporation (SLLRDC) also play a considerable role in biodiversity conservation through their respective mandates. The ministry dealing with policy planning and implementation is the key agency responsible for formulation of national development policies. The National Planning Department is under this ministry, and deals with policy planning and implementation. It also plays a strong role in the development of the national medium-term macroeconomic framework and sectoral programmes that have an impact on biodiversity conservation.

Networking that worked in the 1990s

The ministry of environment established and maintained a network of mid level Biodiversity Liaison Officers in all stakeholder ministries, departments and agencies to facilitate the preparation of the BCAP during the mid 1990s. Through this network, as well as regular consultations with network members, the ministry kept stakeholder agencies interested in the BCAP process. These officers were trained in skills required for biodiversity conservation through the Biodiversity Skills Enhancement Project (BSEP) that involved several field visits. In addition, the ministry conducted a series of awareness programmes for state officials at various levels, commencing with the Secretaries of Ministries. This ensured wide participation in the BCAP preparation process. However, due to the considerable time lag between preparations of the draft BCAP and its publication, the lack of an effective communication strategy to involve the stakeholders in its implementation, coupled with the lack of funds and required capacity in the MoENR has precluded its implementation in a holistic manner,

Table 3.4 deals with status of cross-sectoral integration of biodiversity conservation in institutions that are not directly concerned with environmental conservation, but nonetheless contribute towards biodiversity conservation.

Overall, biodiversity considerations are well integrated into the plans, policies and strategies within these agencies, except in the livestock sector. Even so, there are some gaps in implementation due to institutional and individual capacity deficiencies, including inadequate funds and skilled staff.

TABLE 3.4: **Key state agencies outside the environmental sector that deal with important aspects of biodiversity conservation**

Sector	Institutions, mandates and nature of integration	Actions related to biodiversity conservation
Fishery sector *(Institutions under the Ministry of Fisheries Aquatic Resources))*	The Ministry of Fisheries and Aquatic Resources (MFAR) and its line agencies also have a role to play in conservation of marine and coastal biodiversity. Among these are the Coast Conservation Department, Department of Fisheries and Aquatic Resources (DFAR) and the National Aquatic Resources Research and the Development Agency (NARA) which is the prime national institution for research in the coastal and marine areas and inland aquatic areas. According to the Fisheries Act of 1996, nine Fisheries Management Areas have been identified, but no Fisheries Reserves have been declared as yet although it is possible under this Act.	The Coastal Resources Management Project (CRMP) from 2000-2006 with funds from the ADB and the Government of the Netherlands (GON) was a major initiative of the then Ministry of Fisheries and Ocean Resources. Several components of this project promoted biodiversity conservation, by way of enhancing institutional capacity within key agencies of the Ministry of Fisheries and Aquatic Resources (MFAR). The ministry dealing with fisheries has already initiated action to revise the existing Fisheries Laws and Regulations and to strengthen monitoring, controlling and surveillance (MCS) capabilities to facilitate effective fisheries management and prevent over-use of resources and destructive fishing (this is called for in the BCAP). It will also incorporate cleaner production concepts and practices into the fisheries production processes and services to ensure the preservation and the protection of the environment.
	The Department of Fisheries and Aquatic Resources (DFAR) is mandated to formulate/reform conservation policy/laws/regulations in the fisheries sector, and to promote or implement relevant laws and policies. The DFAR has identified adverse fishing methods that are detrimental to marine organisms and remedial action has been taken; NARA has worked on identifying adverse practices, while the CCD has addressed this in the CZMP. The activities of the CCD are addressed under section 3.2.1 and in **Table 3.5**.	DFAR is mandated with conservation and sustainable use of marine biodiversity through the Fisheries Act No 2 of 1996. Under this Act, the Minister responsible for fisheries can declare fisheries reserves when and where necessary. Many of the recommendations in the BCAP with regard to food fish and ornamental fishery are reiterated in the policies and plans of this sector. All relevant recommendations in Sri Lanka's BCAP pertaining to fishery resources are incorporated into the current CZMP of 2004.
	The National Aquatic Research and Development Agency (NARA) is mandated with monitoring and inventorying aquatic biodiversity and has carried out scientific biodiversity surveys and assessments of coral reefs and other important marine systems. NARA also maintains a gene bank of fish.	Coral reefs have been surveyed through the **coral reef research programm**e which commenced in 1985. A survey of coral reef fish and invertebrates and the socio-economic status of user communities was done through the **Sri Lanka Marine Ornamental Fishery Project (1995-**

Sector	Institutions, mandates and nature of integration	Actions related to biodiversity conservation
		1998) in collaboration with the Marine Conservation Society (UK).
Agricultural sector *Institutions under the Ministry of Agriculture*	The Department of Agriculture (DOA) is mandated to deal with rice and other field crops, horticultural crops root and tuber crops, ornamental plants and plants of medicinal values. It also deals with formulation/reform of policy/law/and regulations pertaining to the agricultural sector; setting up institutional coordination; research at ecosystem, species and genetic levels; survey and documentation of anthropological and cultural values of agro-biodiversity; sustainable use of agrobiodiversity; taxonomic studies for food crops; survey, inventory and monitoring and setting up *ex-situ* conservation centres (including seed banks); *ex-situ* management of species and artificial propagation of endangered species - including tissue culture); and information management and database development for food crops. The AgBiotech Centre (linked with the Agricultural Faculty of the University ofPeradeniya) has up-to-date facilities for preservation of both plant and animal germplasm and for biotechnology using genetic resources. This facility is, however, under utilised.[16] The lack of specific institutional mechanisms for conservation of useful germplasm of micro-organisms has been highlighted in the BCAP, but this has received little attention. There are several divisions, centres and research institutes under the DOA that play a vital role in conserving and sustainably using ago-biodiversity. These are the: Horticultural Research and Development Institute (HORDI), Rice Research and Development Institute (RRDI), Field Crops Research and Development Institute (FCRDI), Seed Certification and Plant Protection Centre (SCPPC), Extension and Education Division and the Seed and Planting Materials Division. The Plant Genetic Resources Centre (PGRC) is the main repository of crop germplasm in the country, including wild and traditional varieties. Accordingly its functions include exploration, evaluation, seed conservation,	The agricultural sector policies and plans and research plans considerably address conservation of the country's agro-biodiversity. Among these are the comprehensive National Agricultural Research Plan (NARP) of 1999 for the National Agricultural Research System (NARS) and its revision. The present agricultural research policy is based on demand driven research on the food crop sector that is productive, eco-friendly, sustainable, economically viable and socially acceptable. The National Agricultural Research Plan follows this trend. A special project of the DOA promotes organic agriculture for the export market, but currently the marketing is done locally by NGOs. **The Integrated Plant nutrition system (IPNS)** has been initiated to reduce the use of artificial fertiliser. Integrated pest management is also promoted by the DOA, especially for vegetables and rice. Dissemination of this knowledge to farmers is constrained by the fact that the extension services are decentralised and under provincial DOAs while the research instates are under the Central government. HORDI maintains field germplasm of traditional varieties, and provides limited seed of traditional varieties to farmers. It also has field gene banks. Similarly the other research institutes, especially the RRDI maintain field gene banks and field trials of new improved varieties using genes of traditional varieties. The DOA also has set up field trials of organic agriculture for pilot testing with farmers. Overall the future research thrust of the DOA is consonant with concepts inculcated in the CBD through promotion of crop improvement by the use of global and domestic genetic resources;

[16] Similar facilities are available in the Institute of Biochemistry, Molecular Biology and Biochemistry , which is affiliated with the University of Colombo.

Sector	Institutions, mandates and nature of integration	Actions related to biodiversity conservation
	biotechnology and data management (MoENR, 2007).The activities of the PGRC are important for conservation of plant genetic diversity. Over 12,000 accessions are held at the PGRC at present.	research on crop production through use of bio-technology, bio-fertilisers, protected agriculture, biodiversity conservation and management of eco-systems; and cost effective environmentally friendly technology for sustainable farming systems (including organic farming), nutrient and water management and pest and disease management.
	The Seed Certification and Plant Protection Centre (SCPPC) is responsible for the implementation of the Plant Protection Act No. 35 of 1999 (by the National Plant Quarantine Service) and the Control of Pesticides Act No. 33 of 1980 as amended by Act No. 6 of 1994 by the Registrar of Pesticides.	**The Crop Wild Relatives project** implemented by the MoENR and the DOA has documented 672 species of wild relatives (of which 122 are endemic) of 238 food crops, under 54 families.
Livestock sector *Institutions under the Ministry dealing with livestock*	The Department of Animal Production and Health (DAPH) is concerned with research and development in the livestock sub-sector and conservation of important indigenous livestock species and germplasm.	Although conservation of economically important indigenous animal species and the use of traditional varieties of domestic cattle and poultry for livestock breeding is the responsibility of both the
	The VRI functions under the DAPH and is mandated to carry out research on all aspects of animal breeding and genetic improvement. However, it is hampered by staff shortages and funding.	DAPH and the VRI, the policies and strategies in the livestock sector have not given adequate emphasis for conservation of traditional varieties of livestock. However, these agencies are aware about their importance for livestock improvement through breeding.
Urban development	The Urban Development Authority (UDA) is mandated to promote the integrated planning and implementation of social, economic and physical development of areas declared as "Urban Development Areas" under the UDA Act with the overall vision of guidance, facilitation, and regulation of urban development through innovative and integrated physical planning. The UDA monitors urban areas, including 1 km inland from the coast along the entire coastline.	The Urban Development Authority (UDA) was set up under the Urban Development Authority Law No. 41 of 1978. The environmental division of the UDA deals with environmental considerations during urban planning. Accordingly, the UDA has prepared Wetland Regulations and Wetland Zoning in the Western Province for application in urban development programmes. The planning committee of the UDA looks into all environmental aspects of urban development within and outside the coastal areas. There are also monitoring and coordination committees for each major project undertaken by the UDA. However this does not always happen in practice.

Sector	Institutions, mandates and nature of integration	Actions related to biodiversity conservation
***Ex-situ* conservation facilities for fauna and flora.**	The **National Botanic Gardens** (NBG) has five botanic gardens under it at Peraeniya, Hakgala, Henerathgoda, Gampaha, Sitawake (Awissawella) and Mirijjawila (Hambantota District). One objective of the NBG is to play a special role in *ex-situ* conservation of national plant biodiversity. Among its other objectives are public education on plants, development of technologies related to exploitation of lesser known and under-utilised plants, and development of ornamental and amenity horticulture. While most species in the older NBGs are exotics, the NBG has recently commenced propagation of endemic species–such as orchids, that is of direct use for conservation of threatened species. The new botanic gardens at Marijjawila and Awissawella will focus on conservation of indigenous plants.	
	The objectives of the **National Zoological Gardens** (NZG) are conservation, animal welfare, breeding and research, education and exhibition. The zoo now supports biodiversity conservation by breeding some rare and endangered species, with special emphasis on endemic fish species; special features to promote conservation of indigenous species include the walk-in aviary for indigenous birds, the small cats zone and the butterfly garden. A safari park, capacious aquarium are planned and a new zoological gardens (at Pinnawela).the later will contain a Sri Lanka section featuring indigenous species, where captive breeding will be tested.	The NZG is constrained due to the lack of a clear policy for *ex-situ* conservation of fauna in the country. There is also insufficient interaction between the *in-situ* conservation agencies and the NZG.

TABLE 3.5: Cross-sectoral integration of biodiversity considerations into management strategies/plans of the CCD

Functions of the CCD	Activities relevant for biodiversity conservation
Regulatory	• Banning of all activities pertaining to sea coral mining • Permits from CCD made mandatory for all development activities in the Coastal Zone
Education and awareness	• Dissemination of knowledge through printed materials on the value of, and issues pertaining to coastal habitats • Inclusion of facts about problems affecting coastal habitats into the secondary school curriculum • Conducting awareness programmes on different coastal habitats for school children, teachers and key stakeholders

Planning and policy development	• Conservation of coastal habitats through Special Area Management (SAM) Plans at Hikkaduwa Marine Sanctuary and the Rekawa lagoon. • 57 SAM and Areas of Particular concern (APC) sites are proposed (of these 8 SAM sites have been established.
Monitoring	• Implementing a monitoring programme on coral and sand mining and water quality testing in coastal areas
Research	• Supporting research on coral reefs and mangroves • Coastal water quality monitoring
Co-ordination with other sectors	• At the national level: Coast Conservation Advisory Council. • At the local level: The Coast Conservation Coordinating Committee, Steering Committees and Community Coordinating Committees (CCCs). The environmental sector agencies dealing directly with biodiversity considerations are included in these committees so that these concerns are addressed in the Coastal Zone Management Plans.

Source: CZMP of 2004

Table 3.6 provides an assessment of mainstreaming biodiversity into the development sectors. This table is by no means exhaustive, but is provided as an indication of the nature of cross-sectoral integration of biodiversity concerns into other sectors as relevant to *Article 6b*. Biodiversity concerns are not adequately integrated into the plans, policies and programmes of the agencies of the development sector. Most development sector agencies do not give adequate attention to threats to biodiversity when preparing and carrying out their plans and programmes (MoeNR, 2007).

TABLE 3.6: **Status of cross-sectoral integration of biodiversity concerns within the state sector agencies and the private sector**

Type	Institutions and level of integration Plans
Land reclamation (wetlands)	The Sri Lanka Land Reclamation & Development Corporation (SLLRDC) is mandated with some aspects of wetland conservation.
Financial planning institutions	Biodiversity valuation has made little headway towards integration into the national economy since the BCAP (1999), but a special Taskforce dealt with biodiversity valuation and mainstreaming economics of conservation during preparation of the Addendum to the BCAP. Even so, there is inadequate understanding and conceptualisation of the importance of biodiversity in the national economy, so that scope for providing financial incentives such as tax rebates and eliminating perverse incentives (e.g. chemical fertiliser subsidies) at the national level to promote biodiversity conservation is low.

National planning and development	Biodiversity is perceived mainly in terms of forest, parks and protected areas, (for tourism) and species that require conservation, but not as a vital component of fishery, agriculture, industry, etc. on which the national economy depends. While environmental considerations such as are solid waste management and EIAs are increasingly deemed as important, biodiversity conservation has not been adequtely intergraded into the plans and programmes of this sector. The National Development Strategy: *Mahinda Chintana:* Vision for a new Sri Lanka – A 10 year horizon development framework for 2006-201 complements the approach taken for implementing the CBD.	National Physical Planning Policy (2001 and 2005) include Protected Areas, and takes into consideration watersheds when establishing infrastructure development, but fails to consider impacts on biodiversity in the policies for infra-structure development.
Tourist sector	Corporate social responsibility for biodiversity conservation is acknowledged in the tourism sector and there is overall understanding that: (a) tourism depends on biodiversity, and (b) responsible tourism can be a tool for conservation. However, there is poor perception of biodiversity conservation requirements at policy, institutional and operational levels in the tourism sector. This is particularly acute at the higher administrative levels. Biodiversity concerns are not well integrated into the activities of the ministry dealing with tourism, and the related agencies under it when they prepare and carry out their plans and programmes. There is also inadequate perception of what is required for eco-tourism.	
Transport sector	All transport related projects require EIAs, but biodiversity considerations are not adequately intergraded into these procedures, nor are they adequately integrated into this sector. This is partly because biodiversity concerns are not integrated into the graduate courses of civil engineers, although general environmental consideration (climate, soil stability, etc) are addressed.	
Mining sector	Biodiversity concerns are not integrated into the activities of this sector, and there are problems due to conflicts of interest between the environmental sector agencies and the Geological Survey and Mines Bureau (GSMB) that awards permits for inland mining operations and the Gems and Jewellery Authority.	
Industrial sector	It is legally mandated for industries to obtain annually renewable Environmental Pollution Licences for medium and high polluting industries that have to adhere to prescribed standards where certain specifications have to be met with. There is poor perception of the links between biodiversity conservation and potential for the industry. Biodiversity is generally considered the realm of 'scientists, government and conservationists, except for tourism, ornamental plants and animals. There is poor understanding of biosafety, the potential for genetic resources in the pharmaceutical industry; the vast potential for floriculture and vegetable production using biotechnology, or the potential to produce biofertilisers, bioweedicides, biogas, etc. using indigenous genetic resources. Industries that are listed as prescribed projects require EIAs. These include waste generating industries beyond a specified limit, and industrial estates and parks exceeding 10 ha.	
Energy sector	Biodiversity concerns are poorly integrated into the activities of this sector, although establishment of energy projects require EIAs.	
Health Sector	The Government of Sri Lanka provides free health care services through an extensive network of health care institutions – dispensing	The World Bank/GEF funded project for the conservation and sustainable use of medicinal plants in Sri Lanka directly

	both western and traditional (i.e. Ayurvedic, Unani, Sidda) medicines- The number of traditional medicine practitioners in the category of Ayurvedic physicians – who depend almost entirely on biological resources for their medicines - has risen over the years from over 14,000 in 1998[f] to 18,651 in 2007 (CB report of 2007).	targeted traditional knowledge associated with medicinal plant use, cultivation and marketing of medicinal plants. Whilst technical assistance has been provided through this project by expatriate and local senior level experts to the Bandaranaike Memorial Ayruvedic Research Institute for technology development, research, information collation and database development, the expected capacity building gains from training in the BMARI are seen as modest (MoENR, 2007).

Source: Surveys and roundtable Meeting on Obtaining Cross-sectoral Support for Biodiversity Conservation: Aadopting the Ecosystem Approach. for preparation of the Thematic Report on Biodiversity for the National Capacity Self-needs Assessment Project (MoENR, 2007; CB, 2008)

Efforts have been taken to promote environmental concerns into development by the introduction of EIA procedures (**Table 3.7**), which have a bearing on biodiversity conservation and implementation of Article 14. The National Environmental Act (NEA) No. 47 of 1980 formed the first comprehensive piece of legislation on environmental management in Sri Lanka, and Environmental Impact Assessments (EIAs) to all development projects were introduced in 1984 through a Cabinet decision. Overall, mainstreaming biodiversity considerations into environmental sector plans and programmes has been satisfactory, except in the area of Environmental Impact Assessment.

TABLE 3.7: **Inclusion of biodiversity consideration in EIAs**

Law	Action
The National Environmental Act No. 47 of 1980 and the amendment No. 56 of 1988.	Under the National Environmental Act (NEA) the CCD is the Project Approving Agency (PAA) for any prescribed development project[17] in the coastal zone; the UDA, DWLC and the FD are also among the PAAs under the NEA for inland areas as relevant for the area/ecosystem under assessment. However, there are deficiencies in the NEA for EIA procedures of development activities to cover biodiversity considerations adequately.
The Fauna and Flora Protection Ordinance amendment Acts No. 49 of 1993 and its amendment of 2009.	The Department of Wildlife Conservation can request an IEE or EIA for developmental activities in areas within one mile from the boundary of any National Reserve declared under section 2 of the Flora and Fauna Protection Ordinance of 1937 and its amendments
The Forest Ordinance amendment Act no.23 of 1995	The Forest Department can request an IEE or EIA for specified developmental activities in areas within 100 m from the boundary of any Conservation Forest declared under the FO.
Coast Conservation Act No. 57 of 1981, and the amendment No.64 of 1988.	The Director Coast Conservation can call for an EIA for any development activity that falls entirely within the Coastal Zone, but generally EIAs are requested only for prescribed projects listed in the National Environmental Act of 1988.

MOENR, 2002. State of the environment in Sri Lanka: a national status report prepared for SAARC

[17] The NEA has a list of prescribed projects or development activities of specified magnitudes for which an IEE or EIA is a mandatory requirement.

While EIAs are mandatory for development projects under four laws that govern biodiversity conservation in Sri Lanka, these EIAs do not give adequate attention to requirements of all aspects of biodiversity conservation. Furthermore, the in-country capacity for carrying out Biodiversity Impact Assessments (BIAs) is limited. However, the national BCAP has identified as an indicator of BCAP implementation, the presence of well formulated effective legislation for incorporating of EIA procedures for recognising biodiversity concerns.

Overall deficiencies in the EIA process in Sri Lanka have been identified as:

- Absence of a biodiversity database in a central institution/s to refer during the EIA process to discern baseline scenario to infer possible loss of biodiversity in an area earmarked to undergo development
- Few institutions/NGOs/trained individuals in Sr Lanka are capable of a valid EIAs. Hence the CEA or PAAs have a very limited group of experts (less than 25) to carry out EIA or evaluate an EIAs.
- Biodiversity Impact Assessments (BIAs) are not mandatory in any of the current EIA procedures. There are very few trained people in the country to carry out BIAs even if they became mandatory.

Source: NCSA Thematic Assessment Report on Biodiversity, 2007

3.4 Overview of mainstreaming biodiversity into cross-sectoral strategies and plans

Several positive steps have been taken since 1990 to further biodiversity conservation in Sri Lanka. They are the creation of the Ministry of Environment (MoENR) and the establishment of a Biodiversity Secretariat/Division in the Ministry. This division is responsible for formulation and coordination of all policy matters relating to biodiversity conservation, and preparation of the national Biodiversity Conservation Action Plan (BCAP) in 1999, and an Addendum to this in 2007. Both documents give specific recommendations that are adequate to conserve and sustainably manage Sri Lanka's biodiversity. The BCAP promotes integration of biodiversity concerns into sectoral and cross-sectoral plans and programmes. However, such integration has been less than anticipated. This is mainly due to the lack of a functioning mechanism for implementing the BCAP in a holistic manner that will enable coordination of activities related to conservation and management of biodiversity in the public and private sectors.

Even so, strong attention is given to biodiversity concerns within the environmental sector covering the forestry and wildlife, wetlands, and coastal and marine systems. Other environment related sectors that depend on bio-resources such as agriculture and fisheries sectors (with the exception of the livestock development sector) have also included biodiversity conservation and use into their policies, plans and programmes, but this is due to the efforts of the agricultural sector and individual institutional efforts. In contrast, integration of biodiversity conservation into the development sector (including the service sector, such as road development, telecommunications) and the business (industrial) sector has been inadequate.

A detailed situation analysis carried out during the GEF funded National Capacity Needs Self Assessment (2005-2006) clearly showed that in-country capacity should be strengthened to: (a) integrate conservation and sustainable use of biological diversity into sectoral and cross-sectoral (i.e. especially those of the development sector) plans, programmes and policies, and (b) prepare and implement biodiversity plans and policies with the required cross-sectoral support**.** (MoFE, 2007).

3.4.1 Mechanisms for cross-sectoral integration of biodiversity concerns

In the past, poor co-ordination characterized environmental management in Sri Lanka, due to the fragmented nature of responsibilities for environmental policy planning, management and implementation resulting from the large number of institutions and agencies involved - at both the national and local level- and the plethora of laws that govern them. This applies to the coordination required to integrate biodiversity concerns into sectoral and inter-sectoral strategies, plans and programmes. There is a recognized need for formal and functional mechanisms and regular activities to maintain the interests of partner agencies for biodiversity concerns to be effectively integrated into sectoral and corporate planning.

Baseline survey report. NCSA, 2006

The MoENR monitors and coordinates the implementation of the National Environmental Action Plan (NEAP). However, the former Committees on Environment Policy and Management (CEPOMs) that were used for this purpose are non-existent now. This is expected to be replaced by a Committee headed by the President to coordinate sectoral and cross-sectoral environmental activities in keeping with the National Development Strategy: *Mahinda Chintana*: Vision for a new Sri Lanka. This mechanism will be beneficial for mainstreaming biodiversity concerns into the activities of development agencies, but this will not preclude

the need for a mechanism to implement the BCAP.

The most effective coordination process to date has been the wide stakeholder discussions prior to preparation of policies, strategies, management plans or action plans within the environmental as well as other related sectors such as agriculture, fisheries, urban development and coast conservation, for which representatives of the MoENR, Forest Department, Department of Wildlife Conservation and the Central Environmental Authority and key environmental NGOs are invited. However, the present inter-institutional coordination by the BDS and other conservation oriented state agencies (FD, DWLC, CCD, CEA, etc.) is not sufficiently effective to obtain commitment from other agencies required for policy/plan/programme implementation. Steering Committees set up for major projects involve participation of conservation agencies resulting in biodiversity concerns being addressed in the policies, plans and programmes of these sectors at promote addressing biodiversity considerations. On the other hand such consultations are rare with the development agencies or the private sector in general.

Proposal for a national biodiversity (or environmental) communication initiative

Building capacity in the BDS/MoENR is required to conduct a well planned communication initiative, based on a well planned CEPA strategy that targets the critically important institutions and stakeholder groups having significant impacts on biodiversity (including policy makers and planners at the highest level, development sector agencies and the business sector), to obtain their support for implementing the BCAP and its Addendum. The initiative should:

(a) target high level policy makers, planners and administrators (at central and regional levels) in selected important development sector agencies that impact on or rely on heavy use of components of biodiversity; and the business sector through customised activities, and

(b) Build skills for CEPA in state agencies responsible for biodiversity conservation (FD, DWLC, DOA, CCD, DFAR, NZG and NBG) and selected environmental NGOs for effective biodiversity communication through training of trainers initiatives and product development (corporate presentations, CDs, etc.).

(c) Instilling skills in agencies responsible for *in-situ* and *ex-situ* conservation to better market their activities to financial and development sector organisations and funding agencies (including building skills for project proposal writing and budget preparation (i.e. to access both national and donor funding).

Source: the NCSA Thematic Report on Biodiversity, 2007.

3.5 Integration with other conventions

Sri Lanka's overall political commitment to biodiversity and environmental conservation in Sri Lanka are reflected in the ratification of 36 Multi-lateral Environmental Agreements (MEAs), many of which influence biodiversity conservation. The main conventions in this regard are given in **Table 3.8** below. Among these are four other biodiversity-related conventions (i.e. CITES, Convention on Migratory Species, Ramsar and the World Heritage Convention), the two other Rio conventions (UNFCCC, UNCCD). A number of activities and programmes have been taken place to facilitate obligations under these conventions.

Within the MoENR, the Biodiversity Division deals specifically with all aspects of policy and plans related to national biodiversity conservation, and national responses to obligations under the Convention on Biological Diversity and the Cartagena Protocol. This division services the United Nations Framework Convention on Climate Change and its related protocols; The Pollution Management and Control Division services the Stockholm Convention on Persistent Organic Pollutants (POPs) and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989), and deals with policies and strategies to eliminate POPs impacts in the country.

TABLE 3.7 **: Conventions that influence biodiversity conservation to which Sri Lanka is a signatory**

Convention	Focal point	Links with CBD
Convention on International Trade in Endangered Species Of Wild Fauna and Flora (1973)- CITES	Department of Wildlife Conservation	Sri Lanka enforces CITES, which helps protect endangered species from over-exploitation (*CBD Article 8k*) by means of a system of import/export permits that are provided by the focal point.
Convention on the conservation Of Migratory Species of Wild Animals (BONN Convention)	Department of Wildlife Conservation	There is in-county commitment for conservation of migratory bird species and their habitats as well as migratory marine mammals (supports *CBD Article 8*).
Convention on Wetlands Of International Importance Especially As Waterfowl Habitat (1971)/Ramsar Convention	Department of Wildlife Conservation	Being a signatory to this convention helps deal with stemming the progressive encroachment into and loss of wetlands now and in the future. The Bundala National Park, Anawilundawa Sanctuary and the Maduganga Sanctuary have been declared under the Ramsar Convention on wetlands of International Importance. This has helped conserve these important wetland habitats in the country. (supports *CBD Article 8*).
World Heritage Convention	Ministry of Environment and Natural Resources (Natural Resources Division)	Under this convention the Sinharaja forest has been declared a natural World Heritage Site underscoring the importance of this site which harbours a large number of endemic species. Sri Lankan has recently nominated the Central Highlands' World Heritage Site (comprising Knuckles Conservation Forest, Peak Wilderness Nature Reserve and the Horton Plains National Park) for recognition by UNESCO as a natural and cultural (mixed) World Heritage Site. (supports *CBD Article 8*).
United Nations Convention To Combat Desertification((UNFCCC)	Ministry of Environment and Natural Resources	As a signatory to this Convention Sri Lanka is committed to regulate levels of greenhouse gas concentrations in the atmosphere so as to avoid the occurrence of Climate Change that would impede sustainable economic development, or comprise initiatives in food production. This also includes adverse impacts on species and ecosystem, both natural and human modified. While little research has been carried out as yet on the impact of climate change on wild biodiversity, analysis of climatic trends in Sri Lanka have already shown: (a) that minimum and maximum temperatures have clearly risen around the island, (b) a significant trend for increased rainfall variability in most parts of the island, and (c) prolonged droughts that could result in more pronounced water scarcities in the Dry Zone– all of which will affect the country's natural and cultivated biodiversity. Cross-cutting issues that are common to both the UNFCCC and the CBD and should be addressed jointly were identified during the NCSA. (see more details in Appendix III)
United Nations Convention To Combat Desertification in Those Countries Experiencing Serious Drought And / or Desertification (UNFCCD)	Ministry of Environment and Natural Resources	Sri Lanka is a signatory to this convention which helps combat desertification and mitigate the effects of drought in countries affected with effective action at all levels. Although Sri Lanka has no deserts, specific regions in the island are vulnerable to desertification through salinization and reduced water for human needs. This Convention is supported by international corporation

		and partnership arrangements in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in those areas. Cross-cutting issues that are common to both the UNFCCD and the CBD and should be addressed jointly were identified during the NCSA.
Stockholm Convention on Persistent Organic Pollutants (POPs convention)	Ministry of Environment and Natural Resources	No specific links have been established between the CBD and this Convention. Even so, meeting its requirements have a positive impact on biodiversity. Considerable work has been carried out at the national level to comply with the requirements of this Convention, such as the National Implementation Plan (NIPS) for the control of persistent organic pollutants. (see more details in Appendix III)
United Nations Convention on The Law Of the Sea. (UNCLOS)	Marine Environment Protection Authority	The goal of this Convention was to set up a comprehensive new legal regime for the sea and oceans and, as far as environmental provisions are concerned, to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment has ramifications on conservation and sustainable use of marine biodiversity.

Chapter 4

4.1 Introduction

4.1.1 The 2010 Biodiversity Target

In April 2002, the Conference of the Parties (COP) to the CBD outlined a Strategic Plan with the 2010 global biodiversity target via decision VI/26. The mission of the plan was to commit parties to promote a more effective and coherent implementation of the three objectives of the Convention, and to achieve by 2010 a significant reduction in the current rate of biodiversity loss at the global, regional, and national levels as a contribution to poverty alleviation and to benefit all life on earth. The Plan had four strategic goals, and broad objectives (targets) under each of them (see section 4.4 this chapter). This 2010 biodiversity target was subsequently endorsed by the World Summit on Sustainable Development and the United Nations General Assembly, and was incorporated as a target under the seventh Millennium Development Goal to ensure environmental sustainability to "reduce biodiversity loss, achieving by 2010 a significant reduction in the rate of loss". The COP responded by developing a framework to enhance the evaluation of progress to achieve the goals of the Strategic Plan and the 2010 Biodiversity Target through decision VII/30. This framework has seven focal areas, and goals and sub-targets for each of them. The global goals and sub-targets were further refined and presented in decision VIII/15 of the COP and have links to the Millennium Development Goals.

The development of global indicators to evaluate status on reaching the global targets is supported by the 2010 Biodiversity Indicators Partnership, which coordinates the delivery and communication of a suite of indicators to measure progress towards the 2010 Biodiversity Target. Over 40 Partners, coordinated by the World Conservation Monitoring Centre of the United Nations Environment Programme (UNEP-WCMC), have formed this partnership to promote the delivery and reporting of indicators that measure progress towards 2010. Country Parties are expected to develop national indicators based on the global targets.

Section 4.2 of this chapter summarises the progress made towards achieving the 2010 target in Sri Lanka, using the provisional framework of goals and targets adopted by decision VIII/15 of the COP to the CBD. For each goal and global target of the provisional framework, information is provided on:

(a) relevant national targets;
(b) progress made to Incorporate the adopted global targets and provisional national targets into relevant sectoral and cross-sectoral strategies, plans and programmes; and
(c) Indicators used to measure progress, using global indicators as well as provisional national indicators.

For ease of summarising, the information in this section is presented using a tabulated format using the global and proposed national indicators.

Section 4.3 assesses the extent to which actions taken to implement the BCAP and related sectoral and cross-sectoral plans have contributed to progress towards these goals and objectives, and the main obstacles encountered.

Section 4.4 addresses the Goals of the Strategic Plan and identifies the major obstacles encountered in meeting, or contributing to the relevant goals and objectives of the Strategic Plan.

Section 4.5 provides a brief summary of progress relating to the Cartagena Protocol on Biosafety.

4.2 Progress Towards the 2010 Target

4.2.1 Approach adopted for evaluation

The Biodiversity focal point in Sri Lanka commenced the preparation of national targets and indicators as relevant for the provisional list of global headline indicators proposed by the CBD for each of the seven focal areas to be evaluated. The provisional national targets have been selected to conform with the global targets. The global and national indicators have been classified according to four categories (**Table 4.1**).

Most of the global indicators have been adopted at the national level. In addition several new indicators (I.e. apart from the global indicators) that were felt to be important at both national and global levels are presented (MoENR, 2009 draft report on identification of national indicators). However, they have yet to be finalised after further discussion. The status of progress toward the 2010 targets is presented in terms of the global indicators and draft national indicators that have been proposed for adoption to date. For some of the global indicators, the relevant information for assessment was not available, and are not adopted at the national level.

TABLE 4.1 **: Categories of indicators**

Evaluation Indicator and category (no)	Indicator category definition details
Status Indicators (1)	Actions to determine status of a particular indicator
Process/Input Indicators (2)	Actions to establish processes and/or mechanisms to achieve targets
Response Indicators (3)	Actions to address specific issues
Sustainability indicators (4)	Actions to ensure sustainability

Note: category number of indicator is in parenthesis, and these numbers are used below in section 4.2.4

4.2.2 Global Indicators that could not be used due to the lack of information.

Focal Area	Global Headline Indicator
Sustainable Use	Ecological footprint and related concepts
Ecosystem integrity and ecosystem goods and services	Trophic integrity of other ecosystems Health and well-being of communities who depend directly on local ecosystem goods and services

Source: MoENR, 2009; Draft report on proposed national indicators

4.2.3. Constraints and limitations in adopting indicators

The indicators provided at the global level are important to track implementation of the CBD provisions, but are limited to outcome indicators (**Table 4.1**). Process indicators that reveal concrete action being taken by Parties, response indicators that show a Party's responses to specific issues, or sustainability indicators that show action by Parties to ensure sustainability of responding to future issues are lacking. As such, given the fact that achieving 100% of the final desired outcome is a difficult task, the global indicators should also have provided some process, response and sustainability indicators. This report recommends that some new global targets that include process, response or sustainability indicators should be adopted by the CBD.

4.2.4. Evaluation of achieving targets

Superscript numbers given for indicators below denote its categories according to Table 4.1

FOCAL AREA 1: PROTECT THE COMPONENTS OF BIODIVERSITY

Goal 1. Promote the conservation of the biological diversity of ecosystems, habitats and biomes

Global Targets:

1.1: At least 10% of each of the world's ecological regions effectively conserved.
1.2: Areas of particular importance to biodiversity protected.

National targets:

- A well established protected area network system of forests and wetlands, having adequate representation of the diverse range of biodiversity found in the country ten years after the BCAP.
- Protective and rehabilitation programmes (for forests) being actively implemented in the six prioritized biodiversity regions of Sri Lanka.
- Wetlands, salt marshes and mangroves protected from unauthorized expansion of prawn farming.
- Well maintained home gardens with high biodiversity having a multitude of indigenous plant species.
- Well formulated, effective legislation for protecting biodiversity.

Focal Area	Global Indicators	Proposed National indicators
Status and trends of the components of biological diversity	• Trends in extent of selected biomes, ecosystems, and habitats. • Coverage of protected areas	• Trends in coverage of protected areas in general and specifically in the biologically rich Wet Zone.[1] • Trends in level of protection afforded to forests, wetlands and coastal and marine areas.[2] • Trends in home garden areas with good 70 % canopy cover.[1] • Trends in ecosystem related research.[2]

Progress:

- **Trends in selected biomes, ecosystems and habitats and increased protection**

TABLE 4.2: **Trends in deforestation and reforestation**

Year	Area reforested (ha)	Extent Deforested
2003	1057	950
2004	805	442
2005	1229	358
2006	1848	173
2007	703	340

Source: Central Bank Annual Report of 2007 (2008)

The trend in forest loss has considerably slowed down, despite a slight upsurge in 2007 (**Table 4.2**) and is still continuing. There is also evidence that biodiversity rich forests logged in the 1970s are now regenerating to climax conditions due to conservation action (M. R Wijesinghe, S.W Kotagama, B J P Singhakumar and IAUN Gunatilleke, personal communication). This is corroborated by the latest satellite imagery (Forest Department, personal communisation), but the data are not yet final.

Forest encroachments and illegal felling has been largely eradiated in the biologically rich Wet Zone forests due to improved management, management as conservation forests, boundary marking of forest reserves and a move towards participatory conservation with the aid of local communities in some of these forests. Effective management measures are reflected in relatively lower loss of forests through encroachment between 2002-2005 (Chapter 1), and trends in deforestation (**Table 4.2**).

Critically important wetland sites for conservation and management have been identified and management plans prepared for them. Degradation and conversion of wetlands is a continuing problem, especially with regard to urban wetlands, despite identification and listing of important wetlands in the country (Chapter 3). The policy on wet land

conservation and re-establishment of a special unit for wetlands conservation in the CEA help address these threats.

In coastal and marine systems too there have been some positive steps to conserve biodiversity rich habitats. Examples are two marine protected areas, several protected mangrove forest patches, the Coastal Zone Management Plan (CZMP) which has incorporated recommendations from the BCAP, identification of Special Area Management (SAM) Sites and several large scale projects such as the Coastal Resources Management Project (CRMP) that dealt with identifying and monitoring coastal ecosystems and management of the fishery resources. Destruction of coral reefs has been reduced to some extent with legal reforms, law enforcement and better field monitoring.

The threats to coastal and marine ecosystems and the species they contain because of over-exploitation of resources and land conversion, are reflected in the vast changes for the worse in many of the coastal systems revealed by the coastal habitat surveys carried out in 2002 (Chapter 1). Inland river sand mining continues with negative impacts on promoting coastal erosion, siltation of coral reefs and destruction of riverine biodiversity, despite identification, exploration, testing and promotion of offshore sand as a viable alternative.

Research on o*ffshore sand as an alternative for river sand*

The total demand for sand countrywide amounted to about 7.3 million m^3 in 2001, of which about three million m^3 (40%) was used in the Western Province, mainly in Colombo. Studies done in Sri Lanka (and elsewhere) showed that offshore sand was suitable for construction; can be obtained with minimum adverse environmental impacts and placed in a stockpile on land at a reasonable cost. Several major construction projects have used offshore sand. A pilot study was carried out trough the Coastal Resources Management Project (CRMP) in the fisheries sector to test the feasibility of using offshore sand as a viable alternative to river sand in the construction industry. This met with encouraging results.
Source: Byrne and Nanayakkara, 2001

Biodiversity in agricultural ecosystems has suffered due to conversion of paddy lands to other uses (e.g. housing and development) and a shift to new high yielding varieties that are heavily dependant on fertiliser and vulnerable to pests and disease. The heavy use of agrochemicals has lead to water pollution from non-point sources (CCD, 2004). Threats to erosion of agricultural biodiversity and over-use of agrochemicals are now being addressed by the DOA, but this is not matched in the livestock sector.

Coverage of PAs and increased levels of protection to key ecosystems

Currently, about 28% of the total land area of Sri Lanka is reserved and administered by either the Forest Department(FD) estimated at 15.1% - 16.1 % and 12.4% for the Forest Department and Department of Wildlife Conservation respectively; as such, more than 60% of closed canopy natural forest, or 55% of all natural forests, lie within the reserves of these two departments (MALF, 1995; IUCN/FAO/FD 1997(i)). Not all forest reserves are set aside for conservation, as in theory they could be used by the FD for multiple-use, However, there has been a moratorium on logging in Wet Zone forests since 1990, and this will be in force until the conservation needs of each forest are definitely identified. In the coastal areas two marine protected areas (Hikkaduwa National Park and the Bar Reef Marine Sanctuary) containing coral reefs have been established by the DWLC. Both are also SAM sites identified by the Coast Conservation Department (CCD). A large number of other SAM sites have been identified by the CCD. More than 20 coastal sites were identified for declaration as Marine Parks and Sanctuaries by the Inter-Ministerial Committee on Marine Parks and Sanctuaries set up by NARA in 1982, but this was not pursued, and many of these sites are now degraded due to natural causes (e.g. El-Nino) as well as human interventions. Twenty mangrove sites have also been protected by the Forest Department along the southwest and north-west coast. Under the National Environmental Act (NEA) the CEA has recently declared eight Environmental Protection Areas (EPAs). Although they are not PAs with legal protection, only identified development activities are allowed in them by the CEA. The Central Environmental Authority (CEA) has also identified 84 wetland sites of importance for conservation and management through the Wetland Conservation Project of 1991-1998. Site reports have been prepared for 26, including 10 management plans. The fisheries sector also has the authority to declare fisheries reserves and fisheries management areas (see Chapter 3)

The PA network of forests has expanded over the years to cover all climatic zones, especially in the Wet Zone. Even so, the declaration of new PAs lacks coordination between the main stakeholders. The Ministry of Environment and Natural Resources (MoENR) has now recognised the need to use of the NCR data and the Protected Area GAP analysis to identify areas new needing protection to conserve wild biodiversity. (see **Appendix III** for details of these initiatives). Capacity building needs and joint steps to be taken for identifying a rational network of PAs jointly by all stakeholders (including those responsible for fisheries, coastal and marine, wetland and agriculture sectors) through a widely participatory process were identified by the MoENR under the National Capacity Needs Self Assessment (NCSA) Project in 2006 (MoENR), 2007). This takes into account the importance of: considering areas for conservation of crop genetic diversity and medicinal plants when identifying PAs, adopting a grassroots approach (as well as the current scientific approach)

for declaration of PAs, and adoption of the ecosystem approach in this process.

FOCAL AREA 1: PROTECT THE COMPONENTS OF BIODIVERSITY continued

Goal 2. Promote the conservation of species diversity

Global Targets:

2.1: Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups.

2.2: Status of threatened species improved.

National targets:

- Institutionalized botanical, zoological and microbial surveys to document existing wild and cultivated species.
- Well formulated effective legislation for protecting biodiversity, especially threatened species that are over collected.
- Reduced collection of protected species of fish and other fauna for trade, and the slaughter of small cetaceans and turtles, and use of illegal fishing gear and poaching.
- Programmes to enhance the populations of species that are under threat due to excessive collection.
- Recovery plans implemented for taxa under the greatest degree of threat.
- Well established programmes for the *ex-situ* conservation and captive breeding of endangered freshwater and marine flora and fauna.
- Alternative sources for coral lime that could mitigate the destruction of this bioresource are identified and used.
- Alternative sources of fuelwood including cultivated woodlots that could minimize the pressure on natural ecosystems for this resource are established and used.

Focal Area	Global Indicators	Proposed additional National indicators
Status and trends of the components of biological diversity	• Trends in abundance and distribution of selected species.[1] • Change in status of threatened species.[1]	• Surveys to identify and monitor trends in species diversity.[2] • Programmes for *in-siitu* conservation of threatened species.[2] • Programmes for captive breeding/cultivation of species threatened with over extraction for commercial use.[3] • Trends in species important in agriculture and livestock breeding.[1] • Alternatives found for species under excessive threat due to unsustainable use.[3]

Progress:

- **Change in status of threatened species.**
- **Trends in abundance and distribution of selected species.**

The 2008 IUCN global list of threatened species contains 534 species found within Sri Lanka, of which 119 are invertebrates, and 280 are plants. The National Red List of 2007 lists 223 species of vertebrates, of which 62% were endemic and amounting to about 33% of all vertebrate species in the island. Likewise 675 flowering plants were also found to be threatened with extinction. Despite very high amphibian diversity, the percentage of threatened species was highest among amphibians, followed closely by mammals. *None of the species in the previous national threat list were found to have moved to a low category of threat due to population recovery.*

- **Surveys to identify and monitor trends in species diversity**.

There have been several institutionalized biodiversity surveys to document wild and cultivated species:

- The National Conservation Review (NCR) of natural forests for investigation of hydrological and biodiversity values.
- Baseline Biodiversity Surveys piloted in seven Protected Areas to assess the status of biodiversity as represented among mammals, birds, herpetofauna (mainly reptiles), freshwater fishes and vascular plants with the aim of replicating the surveys and instigating a regular system of biodiversity monitoring in PAs managed by the DWLC.
- The CRMP coastal habitat survey (January – June 2002).
- The Wetland Conservation Project (WCP) surveys of wetlands (species and habitats) to prioritize them for conservation and management, and preparation of site reports for 26 wetlands.

There has also been a perceptible increase in taxonomic research on the faunal groups of Sri Lanka during the past decade, which has lead to the discovery and scientific description of many new species of invertebrate and vertebrate taxa (see chapter 1). The angiosperm flora of Sri Lanka has also been revised during the past two and a half decades to reflect the new species/taxonomic nomenclature (Dassanayake and Fosberg, 1980–2004).

Accordingly there is fair understanding of threatened species and their needs at the national level, and the preparation of species profiles and species conservation actions plans are underway. However, a fair number of species of plants and animals have been subjected to local extinctions over the past three decades, due to habitat loss; pocketing in degraded and fragmented forest patches; extensive clearance and degradation of montane forests and conversion to timber plantations and agriculture (IUCN SL & MOENR, 2007); reclamation of lowland marshes and swamps-- especially in the Western Province; and fragmentation of home gardens in the western wet lowlands. While Sri Lanka has adequate legislation (see chapter 1 and 3 for details) for protecting terrestrial biodiversity and threatened species, their enforcement is inadequate due to insufficient staff and facilities for effective monitoring and complicated legal procedures.

- **Programmes for *in-situ* conservation of threatened species.**

Targeted projects for *in-situ* conservation of threatened species and populations have been less addressed than conservation of ecosystems. However, as a response to the national Red List of 2007, two recovery plans have been prepared, namely: a single species plan for *Puntius bandula* and a multi-species plan for the Morning Side Amphibian hotspot at the Sinharaja World Heritage Site (Gamage, G. personal communication, 2009). Other projects that focus on conservation of groups of threatened taxa have targeted halting the slaughter of small cetaceans and turtles (and poaching of turtle eggs) in Sri Lankan waters and addressing the human-elephant conflict.

Capacity building for *in-situ* conservation of threatened fauna and flora is also required within the Forest Department and the Department of Wildlife Conservation to meet the demands of species specific conservation action, especially with regard to wild fauna. While in-country high level technical capacity exists among individual species specialists in the country, this expertise is not fully utilised to support the state institutions mandated with *in-situ* and *ex-situ* conservation of wild biodiversity.

- **Programmes for *ex-situ* conservation and propagation/breeding of wild species of commercial importance**

Initiatives for *ex-situ* conservation of indigenous threatened fauna for introduction/re-introduction are few, exceptions being a programme for elephants by the DWLC (MoENR, 2007) and the breeding and reintroduction of a threatened endemic species of freshwater fish – *Puntius bandula* by the National Zoological Gardens. The National Botanic Gardens is also currently involved in propagation of indigenous orchids, many of which are threatened. It is expected that more captive breeding efforts will be established with the establishment of the Sri Lanka zone of the National Zoological Gardens to be located at Pinnawela in the Wet Zone.

The National Aquatic Resources Research and Development Agency (NARA) carried out research on captive breeding of threatened species of brackish water food fish, developed technologies to breed about 12 endemic ornamental fish species, and propagated many aquatic plant species. Even so, much of this is on a project basis and are not sustained in the long –term. While NARA has capacity to provide training on breeding ornamental fish and ornamental aquatic plants for exporters, they require better infrastructure facilities to extend the relevant technology to more species. Several private aquaria also breed both freshwater ornamental fish as well as Indian ocean marine fish. While this is not for conservation purposes, it serves to reduces the need to collect from the depleted wild stocks.

- **Trends in indigenous species important for agriculture and livestock breeding**

Overall, biodiversity in agricultural ecosystems has suffered due to conservation of agricultural lands (paddy) to other uses, fragmentation of home gardens in the Wet Zone, and a shift to new high yielding varieties of crops that have high nutritional requirements. However, some positive steps have been taken for *ex-situ* conservation of traditional crop varieties through various projects and institutional programmes of the Department of Agriculture and to promote organic farming. Among them are conservation of genetic material in the Plant Genetic Resources Centre (PGRC); provision of seeds of traditional varieties to farmers for on-field propagation; and setting up demonstration plots and extension to promote organic farming. A burgeoning market that is limited but lucrative has helped to popularise traditional varieties of rice among a specific group of farmers and NGOs[18]. Conservation of indigenous livestock biodiversity has not been adequately addressed as yet - largely due to low capacity for *ex-situ* conservation of livestock germplasm and lack of integration of this aspect into the plans and programmes in the livestock sector. However, cross-breeding programmes in this sector have used indigenous varieties to improve adaptability for local conditions.

Local breeds such as the Zebu cattle have been crossed with high yielding Indian Zebu cattle and *Bos taurus*. Breeding studies have also been carried out to cross them with Indian breeds such as Sindhi, Sahiwal, and Tharpakar, and European breeds such as Jersey and Friesian. Similarly the indigenous buffalo is being crossed with the Indian *Murrah* and *Surti*, and the Pakistani breed *Nili-Ravi*. There have been long-term studies to cross the local '*Kottukachchiya*' breed of goats with the Indian breed *Jamnapari*, and more recently with the Boer breed to increase meat production. Among the poultry there are local breeds, but here too the emphasis is on hybrids such as 'Rhowhite'.

Source: MoENR, 2002

FOCAL AREA 1: PROTECT THE COMPONENTS OF BIODIVERSITY continued

Goal 3. Promote the conservation of genetic diversity

Global Target

3.1: Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.

National targets:

- *In-situ* programmes for conservation of genetic diversity of wild species of endemic plants and animals and crop wild relatives with potential economic, food or medicinal use.
- Well formulated *ex-situ* biodiversity conservation programmes, including animal germplasm conservation, and captive breeding or cltication/propegation.
- Uptodate and adequate facilities for preservation and storage of useful germplasm including microorganisms.
- Strengthened "field gene banks" of selected crops.

[18] From Discussions with officials in the DOA

- The widespread application of biotechnology (including tissue culture) for conservation (and propagation) of traditional varieties of crops and livestock.
- Use of traditional varieties of crops and livestock for crop and livestock enhancement.

Focal Area	Global Indicators	Additional national indicator
Status and trends of the components of biological diversity	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socio-economic importance.	• Trends in genetic diversity of wild species of plants and animals and wild relatives of crop plants.[1] • Programmes for conservation of crop and livestock genetic diversity.[2] • Programmes for *in-situ* conservation of genetic diversity among critically affected threatened species.[3]

Progress:

There are several programmes for *ex-situ* conservation of genetic diversity of crops and their wild relatives with potential economic, food or medicinal use. In contrast, there have been no similar programmes for conservation of the genetic diversity of wild species and live stock.

- **Trends in genetic diversity among crops and livestock**

Overall, genetic diversity in agricultural ecosystems has suffered due to conservation of agricultural lands (paddy) to other uses, fragmentation of home gardens in the Wet Zone and a shift to higher yielding crop varieties and livestock breeds (see section above for more details).

The area devoted to traditional varieties of rice and other crops has declined perceptibly over the years, from 44,268 ha in 1986 to 2430 in 1998 (MoENR, 2007). Whilst loss of this genetic diversity is being addressed by the Department of Agriculture through *ex-situ* conservation, regular use of germplasm for crop improvement and dissemination of seeds to farmers, there is considerable danger of loosing the indigenous strains of livestock due to a move towards high yielding varieties.

Sri Lanka has high genetic diversity among horticultural species, particularly fruits. For instance there is a wide range of cultivars of banana (*Musa* spp.), including the parent species (*Musa acuminata* and *M. balbisiana)* of the cultivated banana. There is also considerable genetic variation among fruit crops such as citrus, mango, avacado, jak, durian, pomegranate, *rambutan,* guava and papaw that have been in cultivation for a long time in this country. However, the existence of this biodiversity can be lost, with the fragmentation and degradation of home gardens that are the main repositories of horticultural crops.

- **Trends in genetic diversity among wild relatives of crops**

The maintenance of genetic diversity among wild relatives of crops has received considerable attention through institutional programmes of the Department of Agriculture as well as special projects.

The Plant Genetic Resource Centre (PGRC) which functions under the DOA is well equipped to conserve indigenous plant germplasm of crops and their wild relatives (see chapter 1 for details).

The Agriculture Department with the PGRC and the National Institute of Agrobiological Science (NIAS), Japan, carried out a three year collaborative project for the conservation and analysis of wild relatives of crops, which particularly focused on the genus *Oryza* and *Vigna*. Over 12,000 accessions (PGRC data, 2009) of more than 125 food plant species is presently conserved in the PGRC seed gene bank (MoENR, 2007).

The crop wild relatives project

The objectives of the project are to identify the status of crop wild relatives conservation in Sri Lanka in respect of *in-situ* and *ex-situ* activities. The expected outputs of the project are:

- Development of an information management and access system.
- Capacity to undertake *in-situ* conservation with local communities.
- Ability to review and share current experiences on conservation of crop wild relatives at the global level.
- A framework for an information management system with national and international features that will support improved conservation and use of wild crop relatives.

This project is initially concentrating on wild crops but is expected to cover the herbarium data available at the Royal Botanic Gardens (RBG).

The Crop Wild Relatives project currently implemented by the Ministry of Environment and Natural Resources in collaboration with the DOA has documented 672 species of wild relatives (122 endemic species) of 238 food crops, under 54 families (MoENR, 2009). With regard to fish germplasm, NARA has established a fish gene bank.

- **Trends in genetic diversity among wild species**

Conservation of genetic diversity of wild species has received little attention, as the focus has been on conservation of threatened species and maintenance of species diversity. Even so, there are indications of loss of genetic diversity among species of ornamental plants and animals due to selective collection of individuals with attractive colours and other commercially important attributes. For example, the populations of colourful varieties of the threatened endemic fish species *Rasbora vaterifloris*, *Puntius titteya*, *Puntius nigrofasciatus*, *P. cumingii*, *Acanthocobitis uropthalmus*, *Aplocheilus werneri* and *Schismatogobius deraniyagali* have been subjected to drastic declines due to over-exploitation for the ornamental fish trade (Gunasekara, 1996). Among the endemic primates, two critically threatened sub-species (i.e. the Horton Plains slender loris and the western purple-faced langur) have been listed among the most threatened 25 primate taxa in the world. There is an ongoing joint collaborative project between individual researchers and the Forest Department (Dela *et al.*, 2008) for a survey of the range, identification of conservation requirements and preparation of conservation action plans for the western purple-faced leaf monkey (*Semnopithecus vetulus nestor*). A similar project for the red slender loris (*Loris tardigradus*) is being initiated to identify and document the genetic diversity of this species for preparation of conservation action plans and programmes for conservation of species as well as genetic diversity of these threatened primates.

FOCAL AREA FOR ASSESSMENT 2: PROMOTE SUSTAINABLE USE

Goal 4. Promote sustainable use and consumption.

Global Targets

4.1: Biodiversity-based products derived from sources that are sustainably managed, and production areas managed consistent with the conservation of biodiversity.

4.2: Unsustainable consumption, of biological resources, or the impacts upon biodiversity, reduced.

4.3: No species of wild flora or fauna endangered by international trade.

National Targets

- Well formulated forest management plans being implemented with the active participation of stakeholder groups and communities.
- Marine and coastal conservation areas are managed sustainably with the participation of local communities.
- Well organized research programmes promote conservation and sustainable use of biodiversity.
- Research for a better understanding of the status of selected forest and marine bioresources that would enable the development of more sustainable harvesting strategies.
- Programmes to manage bio-resources so as to conserve biodiversity while enabling the use of resources within sustainable limits.
- Enabling legislation in place for land alienation for home gardens and conservation farming.
- A higher level of multi-cropping in the perennial plantation sector, particularly under coconut
- Well developed education and eco-tourism enterprises such as wetland and coastal and marine parks; arboreta; forest gardens; biodiversity conservation centres; and crop, horticultural and flower gardens that would strengthen biodiversity conservation efforts.

- A private sector playing an active role in conservation and rehabilitation efforts and in the use of biodiversity in a sustainable manner.
- Programmes with application of biotechnology for the conservation and sustainable use of biodiversity
- Well formulated effective legislation for Implementing articles of CITES.
- A downward trend in the incidence of illegal international trade of bio-resources in Sri Lanka.

Focal Area	Global Indicators	Propose additional National indicators
Sustainable use	• Area of forest, agricultural and aquaculture ecosystems under sustainable management. • Proportion of products derived from sustainable sources. • Ecological footprint and related concepts (NA).	• Trends in economically important services from sustainable use of biodiversity.[1] • Trends in detection of illegal international trade of bio-resources.[2] • Trends in species research to support sustainable use.[2]

Progress:

- **Area of forest, agricultural and aquaculture ecosystems under sustainable management**

Forests

Preparation of management plans for all forests managed by the FD and the DWLC are underway, and will be soon a mandatory requirement. Overall 16 Management Plans have been prepared for several forests managed by the FD and plans are being prepared for the others. Management Plans were prepared for nine cluster PAs managed by the DWLC; subsequently some were revised and management plans with operational plans have been prepared for eight PAs; management plans are being prepared for three other national parks. They include plans for tourism development and participatory management involving local people. Institutional capacity has been built for preparation of managements plans for PAs managed by the DWLC under the PAM&WC project (see Appendix III).

Marine and coastal areas

The concept of Special Area Management (SAM), which involves a collaborative, adaptive and flexible approach to resource management within a defined geographic area is now an integral component of national coastal zone management policy. The Coastal Resources Management Project of 2000-2005 has proposed extending the SAM process to 59 sites, 36 of which are listed as potential SAM sites and 23 sites were identified as potential Areas of Particular Concern (APC). Examples of SAM sites are the Bar Reef Santuary, Negombo Estuary/Muthurajawela marsh, Lunawa Lagoon, Madu Ganga Estuary (now a Ransar site), Hikkaduwa National Park and environs, Unawatuna Bay including Koggala Estuary, the Mawella and Kalametiya Lagoons, and the coastal stretch in Hambantota. However, implementation of the SAM concept has not achieved the desired targets.

Special Area Management (SAM) Planning

"Special Area Management (SAM) is a locally based, geographically specific planning process that in theory is a highly participatory practice and allows for the comprehensive management of natural resources with the active involvement of the local community as the main stakeholder group (De Cosse, P.J., and Jayawickrama, S.S. 1996; CCD. 1997). It involves co-management of resources through which decision-making, responsibility and authority in respect of natural resource use and management are shared between the government and the local resource users or community (Jayatilake, et al 1998).The government institutions and other planning agencies assume the role of facilitator by providing technical and financial assistance to the local community management effort. The local community groups are considered the custodians of the resources being managed under the SAM process through which sustainable livelihood practices allow for sustainable natural resource use and management within the designated site (Lowry, et al, 1997, 1999). One of the major objectives of SAM is to resolve competing demands of natural resource use - within a specific geographical boundary - by planning optimal sustainable use of resources (Wickramaratne, and White, 1992) In a broad sense the SAM approach seeks to ensure both economic well-being of the local communities as well as the ecological well-being of the natural ecosystems by the practise of sound natural resource management. The SAM concept is now considered a key component of Sri Lanka's coastal zone management policy
Source Senaratna, 2003.

Wetlands

Under the Wetland Conservation Project (1991-1998), 26 site reports, of which ten are management plans, were prepared for prioritised wetlands These plans envisaged a sustained yield of multiple benefits with minimum resource use conflicts with local people within a framework of preserving the ecological, cultural and social values of the wetlands.

- **Research for a better understanding of the status of forest and marine bioresources for development of sustainable harvesting strategies**

The National Science Foundation has established a Committee for Sustainable Utilisation of Natural Resources, which funds a limited numbed of research projects in this regard. Individual scientists have also carried out research on sustainable use of various species, particularly at the Sinharaja Man and Biosphere Reserve (Dela, 2003). Further, a central database on genetic resources for food and agriculture, including medicinal plants, is due to be established at the Plant Genetic Resources Centre (PGRC).

- **Sustainable agricultural systems**

Traditional home gardens and rice field agro-ecosystems:

Traditional home garden that cover 367,800 ha (MoFE, 1999), and rice field that amount to about 525,000 ha (CB, 2008) are sustainable agro-ecosystems. They have occurred throughout Sri Lanka from time immemorial in terrain ranging from slopes of 5-30% (MoENR, 2009). Rice fields, both irrigated and rainfed, range from terraced fields in hilly areas to open fields in lowland areas (ibid). These sustainable ecosystems harbour a wide range of useful plants, including timber, fruits, yams, medicinal plants, flowers, spices and vegetables for the owners, and form a dynamic ecosystem that harbours a vast array of animal life (Bambaradeniya, 2007). Forest gardens or the typical 'Kandyan home gardens' located on sloping land in small plots of about 0.4-2.0 ha, are excellent models of a traditional system of sustainable agriculture and perennial cropping that yields a range of economically valuable tree species such as jak (*A. heterophyllus*), arecanut (*Areca catechu*) and coconut (*Cocos nucifera*) (MoFE, 1999).

Kandyan Forest Gardens

Sri Lanka's Kandyan home-gardens have evolved through generations, and are a strategy to restore the depleting resources and ecosystem functions that forests once provided. They are located on sloping terrain that has undergone severe depletion of forests during the colonial era, and consequently are vulnerable to land degradation through soil erosion. Kandyan home-gardens emulate natural forests of the region, and are found to be ecologically superior to all other forms of land-use systems outside forests. Structurally they have five layers: the emergents, the main canopy, the mid-canopy, the shrub layer, and the ground layer. All strata have distinctly dominant species. As in forests, these gardens have a predominance of woody perennials over herbs and climbers. Endemic and naturalised species make-up nearly 40 per cent of species. The average species richness per garden is around 100-280, and is influenced by garden size. Species with single stems, straight boles and narrow canopies are found at the edges of hedges or demarcation areas. The more dense food-producing species are located closer to the houses. The non-food producing species are more abundant towards the outer edges of the gardens. These gardens are a source of multiple products, and exhibit the manner in which multiple functions of forests can be integrated into a non-forest systems. The main resources obtained from these systems include food species (e.g. spices, fruits and beverage crops), raw material for domestic energy, medicinal products, fodder for domesticated animals, non-timber products, timber for construction, mulch, fencing material and a pleasant environment for the dwellers. The ecological superiority of the system is related to the contribution they make toward the conservation of soil, water, nutrients and biodiversity in the environment.
Source: Wickremasinghe, in Halliday and Gilmour (eds) 1995

TABLE 4.3: **Key non-forest sources of timber and fuelwood**

Key sources of non-forest trees	Area covered in 1992 (ha)	Area covered in 1995 (ha)
Home gardens	858,5000*	NA
Rubber plantations	198,452	193,500
Coconut plantations	300,737	NA

Sustainable sources of timber

With the shift in emphasis of forest policy from production to protection, forest plantations have become particularly important for the supply of timber and other small wood requirements. The total area of forest plantations maintained by the Forest Department in 1999 was around 135,623 ha, but records indicate about 72,350 ha of viable forest plantations in 2000 (MoENR, 2002). **Table 4.3** indicates the area covered by key non-forest sources of timber and fuelwood in 1992. Home gardens,

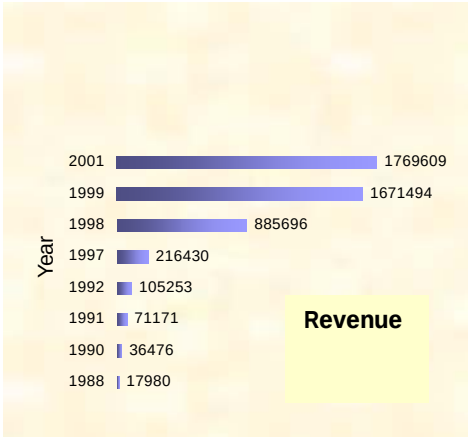
rubber and coconut plantations yield timber or fuelwood, as do shade trees planted in tea plantations and wind breaks, along roadsides and farm boundaries. Trees from such non-forest areas reduce the pressure on natural forests as sources of timber, fuelwood and other small wood requirements.

- **Biodiversity and sustainable tourism**

> Ecotourism has been defined as "responsible travel to natural areas, that conserves the environment and sustains the well-being of local people, developed on the lines of sustained tourism which contributes to sustained development." Ceballos-Lascurain, H. (1996).

Currently tourism is the 4th largest foreign exchange earner, with earnings of US $ 400 million in 2007. The tourism related policy adopted by the government promotes sustainable development of tourism as a key sector of the economy to increase tourist arrivals and earnings. To do so, the current strategy adopted by the government is to diversify the market mix to include both "sun and sand" and "nature, culture and adventure". In this regard ecotourism is being given special emphasis because of the increased interest among foreign and domestic tourists for enjoying nature through activities such as hiking, wildlife viewing and bird watching.

There has been an increasing trend of visitors to wildlife parks, botanical and zoological gardens, and the cultural triangle. For instance the earnings from tourists visiting the botanic gardens doubled from 1980 to 1990, and showed a more then six fold increase from 1990 to 1995 (CB, 1998), while earnings from tourists visiting the wildlife parks grew more than 19 fold from 1985 to 1995 (CB, 1998). **Figure 4.1** shows the growth of tourism in the Sinharaja World Heritage Site from 1998 - 2001.



Figures 4.1: Revenue from visitors to the Sinharaja Biosphere Reserve in selected years (both domestic and foreign)

Source: Dela, 2003

- **Implementing articles of CITES**

Sri Lanka is a party to CITES and adhere to its regulations. Any wild species that is exported is given a permit by the DWLC, which is the focal point for this Convention. Any export of wild plants or animals require a certificate from the Department of Wildlife Conservation, particularly if the species is listed as Protected under the Fauna and Flora Protection Ordinance. This covers specimens sent overseas for identification or other research purposes. Even so, there are illegal exports that are clearly unsustainable. The Customs Department has a biodiversity unit which has been

active in detecting such illegal exports. Examples are detections of attempts to export medicinal plants such as *Salacia reticulata*, the threatened *Cryptocoryne* spp., *Terminalia chebula*, and *Acorus calamus* (MoENR, 2009)

FOCAL AREA FOR ASSESSMENT 3: ADDRESS THREATS TO BIODIVERSITY		
Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced.		
Global targets: 5.1. Rate of loss and degradation of natural habitats decreased.		
National targets • A significant reduction in illegal activities such as unauthorized logging, gemming, coral and sand mining, destructive *chena* cultivation and encroachment for cash crops in forests. • A significant reduction of forest encroachments and deforestation • Reduction of the human-elephant conflict.		
Focal Area	**Global Indicators**	**Additional National indicators**
Threats to biodiversity	• Nitrogen deposition • Connectivity/fragmentation of ecosystems	• Trends in unauthorised destructive practices such as illegal removal of timber, coral and sand mining.[1] • Trends in measures to reduce *chena* cultivation and encroachments for cash crops.[2] • Trends in human-elephant conflicts.[1] • Trends in human population density .[1]

Progress/ Status

- **Nitrogen deposition**

Sri Lanka has the highest fertiliser consumption in the SAARC region at 101.5 kg/ha (Mubarak, 2000), resulting from the 'green revolution' to reach self sufficiently in rice and other food products and the resultant shift to high yielding new varieties. As the new high yielding varieties are susceptible to various pests and diseases and have increased nutrition requirements (MoFE, 1999), agriculture is now entrenched in the high use of fertilizers and pesticides, with a marked reduction in the use of traditional fertilizer such as organic manur. Further, a majority of farmers over-use these substances, and the excess ends up in rivers and streams causing pollution and contamination of ground and surface waters (ibid).

The artificial fertilizer use in Sri Lanka has increased from 20,000 t of N, P, K during 1950-51, and 195,000 t in 1974-1975 to 525,651 t in 1995 (MOFE, ND). This trend has continued and total fertiliser use increased to 605,000 t in 2007, of which urea accounted for 366,000 t. Extremely high values of nitrates are found in areas subject to intensive cultivation. For example, Irrigation wells within the extensively cultivated areas of the Kalpitiya peninsula have a nitrate concentrations in excess of the WHO guideline of 10 mg/1, whereas the domestic wells located outside of these areas have nitrate levels less than 2 mg/1 (Mobarak, 2000). Likewise, widespread and significant ground water contamination in the Jaffna peninsula is attributed to agricultural run-off and the extensive use of pit latrines (Manchanayake and Madduma Bandara 1999).

The Department of Agriculture (DOA) is now promoting organic farming (Chapter 3) and has drafted measures to promoted organic certification among agricultural crops to address the problem of over use of pesticides.

TABLE 4.4: **Trends in deforestation and reforestation**

Year	Number of forest offences recoded	Volume of illegal timber Detected (cu m)
1998	4193	2589
1999	3928	2912
2000	4626	5662
2001	4344	4201
2002	4157	4527
2003	3093	2789
2004	2842	4466
2005	2758	3334
2006	2797	2602
2007	1097	884

Source: Central Bank Annual Report for 2007 (2008)

- **Trends in deforestation and reforestation**

With regard to illegal activities in forests, there has been a decrease in forest offences and illegal timber detections **(Table 4.4)** despite increased monitoring. This has been facilitated by boundary demarcation of forest reserves and a move towards participatory forest management in selected areas (**see Appendix III)**.

Coral is the principal source of quicklime for Sri Lanka's construction industry, supplying approximately 90% of the lime in use. Part of this is supplied by sea coral mining. Most records of sea coral mining are from the west and south coastal areas.

Sea coral removal has declined in the coastal stretch between Ambalangoda and Dickwella from 7,660 tons in 1984 to 4,020 and 2,200 tons respectively in 1994 and 1998, due to better law enforcement (CZMP, 2004). The Coast Conservation Department also records a decrease in beach sand mining in coastal areas from 137,800 m^3 in 1991 to 32000 m^3 in 2001 due to better surveillance in the coastal zone, although river sand mining in the major rivers where this occurs increased from 25,00,000 m^3 in 1991 to 40,00,000 m^3 in 2001 (CZMP, 2004)

- **Trends in reduction of chena cultivation and encroachment for cash crops**

Over the years there have been several projects in the forest and wildlife sub-sectors to wean local people away from destructive practices such as chena cultivation in the Dry Zone and encroachment for tea cultivation in the Wet Zone. Examples are the Protected Area Management and Wildlife Conservation Project carried out by the DWLC (2001-2008); the GEF funded Southwest Rainforest Project; The GEF/UNDP funded Southwest Rainforest Conservation Project of the Forest Department (2000-2006); and The Aus-Aid funded Sri Lanka Australia Natural Resources Management Project (SLANRMP) of the Forest Department (2003-2008). These projects have been successful in pilot testing approaches to wean people away from destructive agricultural practices through community participation, and the establishment of micro-credit schemes for improved livelihoods and training. However, these approaches need to be more widely implemented to benefit all forested areas in the country.

- **Trends in the human elephant conflict**

Forest clearing in the Dry Zone for agriculture and settlements have caused disruption of elephant migration routes leading to severe human–elephant conflict. This has increased over the years with at least about 50 human deaths and 150-195 elephant deaths per year over the past 15 years (MoENR, 2009), in addition to large scale damage to crops and human habitations (National Environmental Outlook, 2006).

- **Trends in population density**

While population density in Sri Lanka's Dry Zone is 170/km^2, density in the biodiversity-rich south-western Wet Zone is 650/ km^2 (MoENR, 2009). A burgeoning human population in the island has compounded the loss of biodiversity,

because of anthropogenic factors such as habitat degradation/modification, over-exploitation of species, spread of invasive alien species and pollution.

FOCAL AREA FOR ASSESSMENT 3: ADDRESS THREATS TO BIODIVERSITY		
Goal 6. Control threats from invasive alien species		
Global Target 6.1. Pathways for major potential alien invasive species controlled. 6. 2. Management plans in place for major alien species that threaten ecosystems, habitats or species.		
National targets • A national database on alien invasive species established.[2] • Enhance capacity for entry, establishment, eradication and management of invasive species in general and formulate management strategies for specific alien invasive species that threaten key ecosystems.[2] • Reduction of accidental and intentional introduction of AIS.[1]		
Focal Area	**Global Indicators**	**Additional national indicators**
Threats to biodiversity	• Trends in invasive alien species.	• Mechanism in place for prevention of entry, establishment and eradication of IAS.[2]

- **Trends related to spread of invasive alien species**

The introduction and spread of invasive alien species (IAS) is a growing concern in Sri Lanka, with several species of exotic fauna and flora well established in wild habitats over the past two decades, and threatening native biodiversity (Bambaradeniya, 2002). About 20 species of invasive alien fauna and 39 species of invasive alien flora are documented from natural and semi-natural ecosystems in the different bioclimatic zones of Sri Lanka (Bambaradeniya, 2002), and other new species of alien invasive species have been discovered over the past 6 years (Mordan *et al*., 2003).

- **Mechanisms in place for prevention of entry, establishment and eradication of IAS.**

The agricultural sector is responsible for quarantine activities and the prevention of alien invasive species entering the country as per legal provisions at the national level. The Plant Protection Act No. 35 of 1999 makes provision for preventing the introduction of weeds, insects, pests and diseases that would pose a threat to plants in Sri Lanka, particularly the crops. All imported plants and animals, or their parts, are thus required to be declared at the point of entry to the country and should be subject to quarantine regulations.

The Plant Protection and Quarantine Division of the Agriculture Department, through the Plant Quarantine Service can, in accordance with the Plant Protection Act No 35 of 1999:

- restrict or prohibit the importation into Sri Lanka of any plants, plants products and organisms.
- restrict or prohibit the landing in Sri Lanka of plants, plant products and organisms, either absolutely or conditionally.

All imported seed should be certified by the National Plant Quarantine Service and the Seed Certification and Plant Protection Centre of the Department of Agriculture prior to release or use within the country. Species (or parts of species) that are perceived as probable sources of pathogens, or potential invasives have been listed in relation to any adverse impact on plants, although this list is by no means comprehensive, and is still under revision.

Although Sri Lanka as an island is highly vulnerable to alien species invasions and the severe repercussions they could have on the fishery, agriculture, wild biodiversity and hence the national economy, control measures for prevention of entry and establishment of invasive species are perceived as inadequate. The problem is compounded due to the magnitude of checking all imports that may carry invasive species, given the limited customs and quarantine staff available for this activity and the lack of skills for identification of potential invasive species at the points of arrival.

Control of IAS has also been initiated in PAs under the DWLC where considerable areas has been affected. Here too, the capacity for identification and control are not optimal, but there has been special consideration of IAS management in six PAs managed by the DWLC on a pilot scale under the recently concluded PAM&WC Project. This involved removal of IAS from an area totalling 8,166.8 ha for habitat enrichment, and all areas affected by invasive

species in these PAs have been identified and mapped. However, this programme will only be successful if monitoring and management of the cleared areas is continued as the project was completed in December 2008.

The MoENR has also embarked on a project to formulate a major project for 'Strengthening Capacity to Control the Introduction and Spread of Invasive Alien Species (IAS) in Sri Lanka, with funds from the Global Environmental Facility. The project proposal will focus on building capacity for all aspects pertaining to the prevention of entry, establishment and control of alien invasive species in the country.

FOCAL AREA FOR ASSESSMENT 3: ADDRESS THREATS TO BIODIVERSITY		
Goal 7. Address challenges to biodiversity from climate change and pollution		
Global targets: 7.1:Maintain and enhance resilience of the components of biodiversity to adapt to climate change. 7.2: Reduce pollution and its impacts on biodiversity.		
National target: • Research on impacts of climate change on selected major ecosystems and indicator species. • Reduce pollution of air, water and land.		
Focal Area	**Global Indicators**	**Additional national indicators**
Threats to biodiversity	• Water quality in aquatic ecosystems.[1]	• Trends in air pollution.[1] • Progress made for addressing climate change[2] • Ecosystem vulnerability to natural disasters due to environmental degradation.[1] • Possible impacts of climate change on biodiversity identified.[2]

- **Mechanisms to meet the challenges of climate change**

Sri Lanka, as a signatory to the United Nations Framework Convention on Climate Change of 1992, has commenced several important initiatives to address climate change. Since ratification of the UNFCCC and acceding to the Kyoto Protocol, most of the requirements of the UNFCCC have been addressed by Sri Lanka to some extent. Currently, Sri Lanka's Minister of Environment and Natural Resources has been elected as the President of the 8th Conference of parties to the Vienna Convention for the next three years.

Actions taken by Sri Lanka to meet the demands of climate change

- Establishment of a Climate Change Secretariat (CCS) within the MOE to facilitate, formulate and implement projects and programmes at national level with regard to climate change.
- Establishment of a Climate Change Division within the Ministry of Environment and Natural Resources.
- Establishment of a National Co-ordination Committee on Climate Change convened by the Environmental Division of the Ministry dealing with Environment, which led to the formation of a Steering Committee and the preparation of a National Action Plan on Climate Change and an updated national green house gas inventory.
- Establishment of a Centre for Climate Change Studies (CCCS) in 2000, under the Department of Meteorology, to conduct research, monitor climate change, and provide the general public with current information on climate change and allied issues.
- Preparation of the initial National Communication on Climate Change under the UNFCCC in 2000 by the MOE, which indicates the sectors most vulnerable to climate change and subsequent impacts, the sectors that most contribute to climate change, and the required mitigation options and adaptation responses.

- Systematic gathering of atmospheric data by a large number of state departments, although networking to share this data is deficient.
- Projects to improve the quality of the environment through air quality management, use of renewable energy (solar and wind) and solid waste management with support from USAID.
- Introduction of new technologies for adaptation by the Departments of Agriculture, Department of Wildlife Conservation and the Tea Research Institute, and several other institutions and universities that are developing new technologies for mitigation measures.
- National strategies for carbon trading under the CDM.
- Promoting technologies for renewable energy through wind, solar and dendrothermal power.
- Addressing national capacity needs to implement the UNFCCC through the National Capacity Needs Self Assessment Project for preparation of the NCSA Action plan based on a thematic assessment of existing capacity to address climate change.

The following policies also address areas relevant to climate change:

- A National Policy on Air Quality Management of 2002.
- The National Energy policy of 1997.
- National Transport Policy.

- **Identification of threats to forests and wildlife from climate change**

The impact of climate change on tropical humid tropics is in general not well understood, but major changes in biomass and species composition have been identified as possible impacts (Costa, 2006). Even so, there is very limited research on potential impacts of global climate change on biodiversity. Among these are studies on forest distribution and quality in Sri Lanka (e.g. Somaratne and Dhanapala, 1996; Costa, 2006) and elephant mortality (Zubair, *et al*, 2006). However, experience in other parts of the world shows that local climate change and acidification of rainwater could pose a major threat to the survival of threatened endemic herpetofauna and land snails, which have a very restricted distribution. It is suspected that recent climatic changes may underlie the reduction of several endemic shrub-frog populations in the island, and the extinction of some species (Meegaskumbura *et al*., 2007). Other studies have shown the critical humidity dependence of *Philautus* eggs, rendering them extremely vulnerable to global warming (Bahir *et al*., 2005). Forest die-back in the montane region is also felt to be a possible result of air pollution and acid rain (MoENR,2009), while the same problem is a potential threat to threatened reptiles and land snails that are restricted to this region. In contrast, the CZMP has identified the potential impacts of climate change on coastal and marine systems, and this has been taken into consideration when setting coastal set back standards for development in the coastal zone. The coastal sector agencies are also initiating the preparation of an Action Plan to address the impacts of climate change on coastal areas.

Changing weather patterns due to climate change during the past few years is threatening Sri Lanka's hard achieved self sufficiency in rice as out of the 525,000 ha used for paddy cultivation, 30% of the rice fields are rainfed. Over the years the Rice Research and Development Institute (RRDI) of Sri Lanka has worked on varietal improvement to produce rice that is resistant to salinity, drought, pests, and bacterial leaf blight. The traditional rice variety *pokkali* has natural resistance to high salinity, through a characteristic water absorption system and ability to oust sodium, but is low yielding .This variety is used as a foundation to produce many new varieties to meet the impacts of climate change by introducing these characteristics to high yielding rice varieties.
Source: Waterless rice? The Nation. March 8th 2009 and CB, 2007

While sectors such as the coastal and agriculture sectors believed to be most vulnerable to climate change have already initiated adaptation and mitigation measures, the biodiversity related sectors that are also vulnerable to climate change have been slower in assessing vulnerability of ecosystems and species to climate change and responding accordingly. This is mainly due to the constraints of funds and capacity, and inadequate awareness about the consequences of climate change on the island's biodiversity.

- **Connectivity/fragmentation – indicators of resilience to climate change**

The tropical wet forests of Sri Lanka that are exceptionally rich in biodiversity, occur as small blocks that are often less than 10,000 ha in extent IUCN (1997a). Today their value has been recognised and boundary marking of most of these forest patches has been carried out. This has significantly halted further erosion of these forests and illegal tree, and no official logging is permitted in them. However, the question of connectivity remains, as most of these forests are isolated from each other and surrounded by human modified areas with a high population density. The NCR revealed, however, that eight units of contiguous forests (IUCN, 1997), six of which fall entirely within the Wet Zone, harbour 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). These forests have been provided with high conservation priority. Even so, there is little knowledge about the impacts of climate change on the sustainability of the wet zone

forest fragments.

Possible impacts of climate change on biodiversity in Sri Lanka.

- As a tropical island Sri Lanka is vulnerable to sea level rise from global warming. The resultant intrusion of the sea into the land will invariably impact on Sri Lanka's rich coastal ecosystems.
- The use of global climate change models and analysis of climatic trends in Sri Lanka to assess global warming have already shown: (a) that minimum and maximum temperatures have clearly risen around the island, and (b) the presence of a significant trend for increased rainfall variability in most parts of the island.
- Prolonged droughts could result and changes in rainfall patterns and drought periods. As Sri Lanka's high biodiversity as well as much of the endemic species are found In the Wet Zone, changes in rainfall patters can be expected to severely affect the high biodiversity in the island.
- The impacts of climate change on terrestrial ecosystems such as forests and species they harbour are not known, but adverse impacts can be expected due to the changes in weather patterns and climate which govern the bioclimatic zones of the island.
- The impact of GHGs and changes in ambient temperature and rainfall regimes on forests and the fauna and flora of Sri Lanka have hardly been investigated, but it is known that tropical species are extremely sensitive to global warming, Given the importance of Sri Lanka's rich and globally significant biodiversity, there is need for greater emphasis on laboratory and field studies in this regard.
- The varied impacts of global warming is expected to have major impacts on Sri Lanka's agriculture, fisheries, tourism, transport, industry and energy sectors as well as on human health and well being, with severe ramifications on national development.
- Climate change can increase the frequency of extreme climatic events such as tropical cyclones etc. which in turn will have adverse impacts on forests and wildlife, wetlands, coastal and marine systems and agricultural systems.
- Sri Lanka's C3 plants, including rice and wild relatives of rice are operating at an optimum temperature range, and are extremely vulnerable to temperature rise in the future.*

*Source: The National GEF Strategy of Sri Lanka, 2006 and *workshop on preparation of CWR Atlas for rice,* Vigna*, and banana species in Sri Lanka, 2009*

- **Ecosystem degradation and vulnerability to natural disasters and climate change**

There are several impacts of environmental degradation and changes in natural habitats that have rendered ecosystems vulnerable to natural disasters such as floods, landslides, impacts of the tsunami, and coastal erosion and climate change.

Landslides

The frequency of landslides has increased in Sri Lanka since the early eighties (MOFE, 2000), due to clearing of forests in watershed areas, obstruction of natural waterways and drainage paths, construction of infrastructure in vulnerable locations, cultivation of seasonal crops on steep slopes, the construction of large reservoirs throughout the accelerated Mahaweli Project, and the impact of land clearing in the hills during colonial times (Madduma Bandara, 2000). The wet zone districts of Kegalle, Ratnapura and Nuwara Eliya that contain forests with high endemism are among the regions most prone to landslides in the country. Changes in rainfall regimes due to climate change is expected to compound this problem.

Floods

Almost all river basins in Sri Lanka are flood prone and serious flooding frequently occur in the *Kelani, Kalu* and *Mahweli* river basins. Floods are prevalent mainly in the biodiversity rich Wet Zone (MoENR, 2003), and also in the Dry Zone due to the sudden breeching of silted up tanks and reservoirs (NARESA,1991). The increased frequency and damage from floods in recent years is attributed to human activity such as deforestation - especially in the Wet Zone catchment forests, and due to increased sediment run-off caused by soil erosion in cultivated lands. The exposed soil mined from gem pits (Dissanayake C B., 2002) can add to the siltation of rivers and streams, and increase the possibility of flash floods (MoENR, 2003).

Since 1968, considerable areas of low lying lands that served as storm water basins have been filled up by the Colombo District Low Lying Areas Reclamation Board, and its successor the Sri Lanka Reclamation and Development Corporation. The rate of reclamation was accelerated since 1978, with the formation of the Urban Development Authority and the National Housing Development Authority. The government policy on this issue was to seek a solution to the problem of land scarcity in urban areas while paying less attention to the importance of these lands for flood protection (MEPA, 1991; Mahanama, *et al*., 1998). The unprecedented floods in the Colombo Urban Area, almost paralysing work in this

region for over a week (Arulpragrasam, 1998) are considered a direct consequence of the inadequacy of both the drainage system in the area and the state policy on filling up low-lying areas and marshy lands that served as a flood retention network (Mahanama, *et al*., 1998).

Coastal ecosystem degradation and impacts of 2004 tsunami

The tsunami in the Indian Ocean in December 2004 devastated a large area along Sri Lanka's south-eastern coast including many ecosystems such as coral reefs, mangroves, sand dunes, shore vegetation, etc. While there is no definite substantive data, there is widespread belief that areas with intact sand dunes (such as the Bundala National Park) were relatively less affected by the tsunami than areas where the sand dunes had been breached. Likewise, there was a view that areas where sea coral mining had caused the loss of living reefs that acted as natural barriers against wave action, had been more vulnerable to the impacts of the tsunami.

Water quality in aquatic ecosystems

The water quality of most inland wetland ecosystems in Sri Lanka has deteriorated over the last three decades, as a result of reclamation, deforestation, hydrological alterations, over extraction of fresh water, improper land use practices, mining of mineral resources, agro-chemical run-off and industrial effluents (Kotagama and Bambaradeniya, 2006), haphazard waste disposal, sewage, sediment run-off, salt intrusions and urban run-off (MoENR, 2002). Industries are a major source of water pollution in Sri Lanka. Deforestation in catchment areas, poor practices in gem mining and unsustainable agricultural practices near water bodies also compound the problem of reduced water quality due to siltation of Wet Zone streams and reservoirs. This is exemplified by the fact that the reservoirs built under the Mahaweli Development Project silted up much faster than expected (NARESA ,1991; IUCN, 1997a). Ground water has also been polluted by leaching of agro-chemicals, municipal wastes and sewage, leading to high levels of nitrate, pesticide and faecal contamination. In urban areas, ground water is also affected by indiscriminate disposal of heavy metals, synthetic chemicals and other hazardous wastes, oil from petrol and service stations, due to seepage from leaking underground storage tanks, and the discharge of untreated waste water with a high oil content (Mubarak, 2000). Agricultural areas are prone to high contamination of ground and surface water, as seen in the high nitrate concentrations in the irrigation wells of the Kalpitiya peninsula (ibid).

With regard to coastal waters, the main shipping lanes across the Indian Ocean lie eight km off Sri Lanka's coast, so that the release of waste oil from ships and fishing craft have direct consequences on coastal water pollution. There is also the ever present risk of a major accidental oil spill and contamination of coastal waters with alien invasive species from ships' ballast water.

Meeting the challenges of water pollution

The *Pavithra Ganga* (i.e. clean river) Programme

This programme was developed by the MoENR to deal with the wide spread problem of river pollution. Accordingly a pilot project was developed to rid the *Kelani Ganga* (river) of pollutants from industries and sewage from domestic sources. The stretch targeted by the project involved *50* industries, 13 Local Authorities, and the Western Provincial Council.
Source: MoENR, (2003)[8]

In terms of industrial pollution of water, the MoENR has responded by enforcing Environmental Impact Assessment (EIA) procedures and an Environmental Pollution Licensing (EPL) scheme. Both are mandatory under the National Environmental Act of 1988. An EPL can be obtained from the CEA, BOI or a Local Authority. The CEA prepares guidelines and the Sri Lanka Standards Institute (SLSI) sets standards for industrial effluents, vehicle emissions, ambient air and water quality (for both inland and coastal waters. Pollution occurs due to lapses in enforcement of pollution control, and poor technology for pollution abatement in many industries. Due to the widespread nature of the problem, however, addressing the pollution of inland and coastal waters has been difficult Addressing agricultural pollution from non-point sources has been particularly complicated, and there are no strict policies and implementation mechanisms to address this problem as yet. Notably, the MoENR initiated a programme, termed the *Pavithra Ganga* programme, to deal with the wide spread problem of river pollution.

The provision of safe drinking water and sanitary facilities is given high priority by the state with the aim of providing safe drinking water to all. There was also a move to control pollution in the city canal system under the Colombo Environment Improvement Project (CEIP) implemented by The National Water Supply & Drainage Board (NWS&DB).

The Legal responsibilities for water quality monitoring and modelling studies required for analysing water pollution conditions and trends in major water bodies lie with a large number of agencies, operating at local or regional levels. These include the Mahaweli Authority, the Board of Investment (BOI), the CEA, CCD (i.e. with authority to monitor water quality in the coastal zone and regulate discharge within it), NARA (which has the broadest national responsibility for research on aquatic resources and the authority to prepare the Aquatic Resources Management Development and Research Plans), Irrigation Department, Water Resources Board and the National Water Supply & Drainage Board. Many other institutions also carry out independent water quality studies from time to time. For instance, the Industrial Technology Institute (ITI) undertakes a wide range of analytical studies in water, soil and environment, as do the National Building Research Organization (NBRO), universities, and the Institute of Fundamental Studies (IFS). Even so, the analysis of water quality trends has been impeded because the data are often scattered, unpublished or unprocessed (UNDP. Sri Lanka Development Corporation Report 1996/1997).

The Coast Conservation Department (CCD) has continued to deal with coastal zone management, including pollution, in the coastal zone under the provisions of the Coast Conservation Act of 1981 (CZMP, 2004). The CCD has a major role in establishing suitable coastal water quality standards and is expected to develop a continuous coastal water quality monitoring programme that is supported by GIS application. The issue of coastal and marine pollution is dealt with in detail in the Coastal Zone Management Plan of 2004. The Marine Environment Protection Authority (MEPA) is mandated to deal with marine pollution under the Marine Pollution Prevention Amendment Act No.35 of 2008 and to develop guidelines for different uses of coastal waters to be gazetted by the MoENR.

The MEPA is responsible for warning and promoting prompt remedial action in the event of a major oil spill in Sri Lankan waters, or in adjacent waters that may affect the country's marine environment. It therefore has an important role to play in fulfilling obligations under **Article 14** of the CBD, and for conservation of marine biodiversity.

Air pollution

Air pollution in Sri Lanka has mainly resulted in the loss of ambient air quality in the Colombo Metropolitan Area, other highly populated cities such as Kandy, and the vicinity of major industrial sources that emit air pollutants. However research now suggests that these pollutants may affect natural ecosystems a considerable distance away from the source, resulting in adverse impacts such as forest die back in the biodiversity rich montane forests.

The major source of air pollution is vehicular traffic, which is aggravated by the current fuel pricing policy that promotes the use of diesel over petrol. Some action to meet this problem has been taken by the introduction on unleaded petrol, traffic management to address the inadequacy of the road network for vehicular traffic that results in heavy traffic congestion. Other options to ease traffic congestion through road development are continuing.

- **Addressing build up of Persistent Organic Pollutants (POPS)**

Sri Lanka has ratified the Stockholm Convention, despite a history of low production of Persistent Organic Pollutants (POPs), and has not manufactured any of the POPs chemicals decades before the Convention came into force. There have also been several measures in the past to phase out POPs. For instance DDT was phased out from agricultural application by 1970 and from all forms of vector control by 1976. Of the 12 chemicals known as POPs, eight are banned from use as pesticides in Sri Lanka. However, poly-chlorinated biphenyls (PCBs) are still used in open and closed applications, and Dioxins and Furans result as unintended by-products of industrial, domestic and other uses and combustion processes. However, Sri Lanka has taken positive action with regard to addressing the problems of POPs. Among these are:

- A preliminary inventory of all PCB containing equipment in the country, to be followed up with labeling and monitoring all such equipment until the 2028 deadline for phasing out of all PCB containing equipment.
- Three separate national inventories prepared for POPs pesticides, polychlorinated biphenyls (PCBs) and unintentionally produced Dioxins and Furans.
- Awareness on POPs, capacity building by training on handling PCB containing /contaminated transformers and capacitors, testing oils for presence of PCBs ; carried out a awareness campaigns using news papers, TV programmes, leaflets and brochures to build awareness of POPs issues among the general public.
- Ratification of the Basel Convention on the Transboundary Movement of Hazardous Waste and their Disposal on 28.08.1992.
- Preperation of a National Implementation Plan (NIP) for the control of persistent organic pollutants by the MOE with aid from UNDP/GEF.

FOCAL AREA: MAINTAIN GOODS AND SERVICES FROM BIODIVERSITY TO SUPPORT HUMAN WELL-BEING

Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods

Global targets

8.1. Capacity of ecosystems to deliver goods and services maintained.

8.2. Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained.

National targets:

- Ecotourism activities that strengthen the conservation of forests, wetlands and coastal and marine resources
- A better understanding of the status of marine bio-resources that would enable the development of more sustainable harvesting strategies.
- Well maintained biodiverse home gardens having a multitude of indigenous plant species.
- A private sector playing an active role in conservation and rehabilitation efforts and in the use of bio-resources in a sustainable manner.
- Alternative sources of coral lime that could mitigate the destruction of this bio resource.
- Significant replacement of chena cultivation by eco-frienfly farming practices.

Focal Area	Global Indicators	Additional national indicators
Ecosystem integrity and ecosystem goods and services	• Biodiversity for food and medicine • Marine Trophic Index. • Water quality of freshwater ecosystems • Trophic integrity of other ecosystems (not clear) • Connectivity/fragmentation of ecosystems. • Incidence of human-induced ecosystem failure. • Health and well-being of communities who depend directly on local ecosystem goods and services.	• Ecosystem degradation and vulnerability to natural disasters.[1] • Major Impact of resource depletion on livelihoods.[1] • Biodiversity used for livelihoods[1]

- **Use of bioresources for food and medicine and other products derived from components of biodiversity**

Food

Agriculture

The contribution of the agricultural sector to the country's export earnings has declined from 38 per cent in 1950 to about 23 per cent in 1998 (CB, 1998). In 2007 the entire agricultural sector (Agriculture, livestock and forestry) contributed only 11.9 per cent to foreign exchange earnings (CB, 2008) However, over 70 per cent of the population still live in rural areas, about 1.8 million families are engaged in paddy cultivation and in the plantation sector--comprising tea, rubber and coconut (MoENR, 2002); and 31 per cent of the labour force continue to work in the agricultural sector (CB, 2008).

Paddy cultivation, which provides the staple diet of the population, is even now the backbone of Sri Lanka's agriculture, and forms a way of life which links the present with the country's ancient agrarian civilisation. As a result of development of this sector, the average annual extent under paddy cultivation has increased from 479,000 ha in 1952 (CB, 1998) to 525,000 ha by 2007 (CB, 2008). Sri Lanka is largely self sufficient in rice. Improvement of paddy productivity has been attributed to more intensive cultivation practices, use of new high yielding varieties (using indigenous traditional varieties), new recommended inorganic fertilizers and new methods of crop husbandry.

Crops such as onion, potato and vegetables that are a small farmer activity, chilli and cashew that are grown on a semi-commercial scale, and other field crops that include over 100 species used as food such as cereals, grain legumes, condiments and oilseeds play a vital role in national food security and income generation (ibid). Horticultural crops such as fruits, vegetables, root and tuber crops and ornamental plants also form an important component of the agricultural scene. The importance of the horticultural sector is considerable economically, reflected by its contribution of SLRs 28 billion (from 0.2 million hectares) in 1998 (DOA/DEA/CARP, ND.; Draft Agriculture Research Plan of the Ministry of Agriculture and Lands 2000-2008).

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classification based on categories used in the Draft Agriculture Research Plan

Fisheries

The national marine fishery contributes 90% to the island's total fish catch, and provides 65% of animal protein and 13% of all protein consumed in Sri Lanka. The marine fish captured and marketed as food fish in Sri Lanka include 146 species of bony fish of high or medium level importance to the commercial food fishery (MoENR, 2001), about 12 species of cartilaginous fish (sharks, skates and rays), about 10 species of crustaceans (prawns, crabs, lobsters), about 5 species of molluscs (cuttlefish, squid, octopus) and several species of sea cucumbers (NARA, 2006 cited in MoENR, 2009).

Overall the marine fishery production in Sri Lanka has shown a gradual increase over the past three decades, from 167,412 t in 1980 to 257,670 t in 2007 (Source: Fisheries Department Statistics - www.fisheries.gov.lk). The export quantity of marine fish and fishery products (including fin-fish and shell-fish) has also increased considerably over the past two decades, from 2,393 t in 1983 to 18,647 t in 2006 (NARA, 2006 cited in MoENR, 2009). The percentage contribution of edible fisheries exports to the overall national export earnings in year 2007 was 1.1% (CB, 2007).

Trends in annual fish production related to inland and aquaculture fisheries indicate a considerable increase over the past three decades; from 20,266 t in 1980 to 38,380 t in 2007 (Source: Fisheries Department Statistics - www.fisheries.gov.lk cited in MoENR, 2009). The Fisheries Department has actively promoted inland fisheries in ancient irrigation tanks, enabling local communities to engage in fisheries related livelihoods. However, this is mainly by using exotic freshwater fish species such as Tilapia (*Oreochromnis* spp.) and Carp (*Cyprinus carpio*). The National Aquatic Development Agency (NAQDA) has also established aquaculture development centers in Udawalalwe, Dambulla, Inginiyagala, Rambodagalla, and Nuwara Eliya where exotic fish such as Tilapia, Common Carp, Chinese Carp and Indian Carp are bred and stocked in tanks, ponds, and reservoirs, to promote inland fishery. The NAQDA also maintains a facility in Pambala to breed freshwater prawns. Overall, the fisheries sector policies and plans and programmes of recent years have sought to increase the sustainability of fish production, and has built capacity through projects such as the CRMP (see Appendix III).

Livestock

Livestock is an important component of the agricultural sector in Sri Lanka. (MoENR, 2002). Most of the livestock comprise imported high yielding breeds although Sri Lanka has several local breeds that are well adapted to the local environment and harsh conditions but show low growth rates and milk production. Hence, indigenous varieties have been crossed with high yielding imported breeds to increase the productivity in the livestock sector. Such efforts resulted in a moderate growth in the sector (CB, 2001).

Medicinal Plants

The national demand for medicinal plants in Sri Lanka in year 2000 was 3,864,760 kg, of which 68% was supplied locally, while 32% was imported (MoENR, 2009). About 80% of locally supplied medicinal plants in Sri Lanka are collected from wild habitats. In view of its importance to rural populations, medicinal plants are collected in large quantities from forests for both human and veterinary needs; for both domestic consumption and for sale (IUCN 1994).Unlike in ancient times, when collection of medicinal plants from the natural environment was essentially need based, today most people who seek traditional medication are located away from forests or other areas from which the ingredients are collected. As they have to purchase the required plant items, the collection of medicinal plants has become a commercial enterprise.

- **Biodiversity for livelihoods and subsistence**

Cut flowers

Table 4.5 Export of Floriculture Products from Sri Lanka (1990-1995)

Product	Value (Million Rupees)					
	1990	1991	1992	1993	1994	1995
Bulbs, Corms, Tubers	0.5	0.71	21.2	21.6	10.03	6.1
Live Plants	99.5	123.1	132.4	120.3	162.4	179.0
Cut Flowers	31.0	29.7	21.7	34.5	45.3	54.8
Cut Foliage	60.3	77.74	106.9	111.0	189.1	190.2
Total Rs. Million	191.3	231.25	282.2	287.4	406.83	430.1

Source: cutflowers.htm

This industry has developed substantially during the last few years (**Table 4.5)** to become one of Sri Lanka's major foreign exchange generating ventures, showing export earnings of SLRs 573 million from foliage and cut flowers in 1999 (CB, 2000). The new policy framework prepared by the Ministry of Agriculture has clearly identified the need to initiate a Floriculture Research and Development Programme to support the industry. While at present the existing market share is less than 0.2% of the world market, floriculture has high potential in Sri Lanka due to the island's stable but geographically varied tropical climatic conditions and the rich native flora with many potential ornamental plants.

Indigenous ornamental species

About 40 indigenous freshwater fish species from 14 families, including 15 endemic species, are exported from Sri Lanka to nearly 50 countries in the world, as Sri Lanka provides about 4% of the world's ornamental fish trade (Gunasekara, 2007). These exports contribute significantly to the economy, with earnings of SLRs 593 million from the export of ornamental aquarium fish from Sri Lanka in 2000 (CB, 2001). Unfortunately, the latter trade is almost entirely dependant on wild collections, which has driven many high demand freshwater fish species towards extinction. Several species of endemic aquatic plants are also subjected to high exploitation in the export ornamental trade. Examples are threatened endemic aquatic plants such as *Cryptocoryne* spp. and *Lagenandra* spp. that are over-exploited from wild habitats. Recognising the importance this industry, the government has set up a tissue culture laboratory at Rambadagalla for production of aquatic plants.

- **Incidence of human-induced ecosystem failure**

There have been a few incidence of human induced ecosystem failure, mainly associated with wetlands. A good example is the Lunawa lagoon which became severely affected by industrial effluents. Consequently, the fishing in the laggon collapsed leading to l;oss of livelihood for the fishers in the area. The estimated annual loss of income from fish sales in the Lunawa lagoon due to pollution was estimated as SLRs 1,963 million and the total annual land value decline in the area was estimated at SLRs 712 million (CZMP, 2004). This lgoon has now been dredged and the fishery is expected to pick up. The flow of excess fresh water into estuaries and lagoons from upstream irrigation projects has also adversely affected some lagoon fisheries. A case in point is the Malala lagoon, which receives excess fresh water from the Lunugamwehera tank. This has lead to a decline of the traditional shrimp fishery. The inflows of excess fresh water from the Kirama Tank into the Rekawa lagoon too has caused a change in the ecosystem, with loss of aquatic fauna and a subsequent deprivation of many fishermen of their livelihood (CZMP, 2004).

Up to the early nineties, *Salvinia molesta* was a major problem in Sri Lanka's waterways and paddy lands, even threatening the efficient functioning of irrigation reservoirs of the Mahaweli Development Programme. This has now been controlled successfully through biological control, but most of the cleared water bodies have been taken over by another exotic aquatic weed, *Eichhornia crassipes* (water hyacinth), for which biological control measures are being tested.

- **Health and well being of rural communicates**

Rural health

Sri Lanka is an example of a low income country that has achieved remarkable progress in health and social development (MDG, 2005) The Government's emphasis on social development has given priority to health and schooling for both males and females, which in turn this has increased individual demand for health care services. The extensive network of health facilities throughout the country have also contributed towards low maternal and infant mortality (chapter 1), with the exception of the North and East where there was civil strife. In most rural areas health care of some sort is available within 1.4 kilometers from most homes and, on average, free state provided allopathic health care is available within 4.8 kilometers. Medical officers are available in rural hospitals, while services of specialist pediatricians are available at the level of base hospitals and above.

The indigenous system of medicine termed *Ayurveda* is practised by a large number (18651) of licensed private practitioners (CB, 2007) who sometimes have a degree from an Ayurvedic university. All practise healing through the use of herbal medicines. Rural communities also practise a parallel curative system based on supernatural beliefs and superstitions. These cures include traditional exorcising ceremonies and rituals to appease demons, gods and lesser spirits. There are also simple village practices to ward off the "evil eye" and "evil mouth" that are attributed to be the cause of many ailments. Charms (*mantara*) and simple curative practices (*kem*) are also popular among village people to ward off various illnesses, many of which require plant material from forests and home gardens (IUCN, 1995).

Rural sanitation

Although most rural areas in Sri Lanka have a relatively unpolluted environment, the shallow unprotected wells, irrigation tanks and other water bodies that are used for drinking and bathing in rural areas are polluted with excess chemical fertiliser and pesticides runoff from cultivated lands and faecal matter due to poor sanitation (MoENR, 2002).The National Water Supply and Drainage Board has targeted the supply of safe water to the entire population at 85% for 2010 and 100% achievement by 2025.

FOCAL AREA: PROTECT TRADITIONAL KNOWLEDGE, INNOVATIONS AND PRACTICES

Goal 9 Maintain socio-cultural diversity of indigenous and local communities

Global target

9.1. Protect traditional knowledge, innovations and practices.

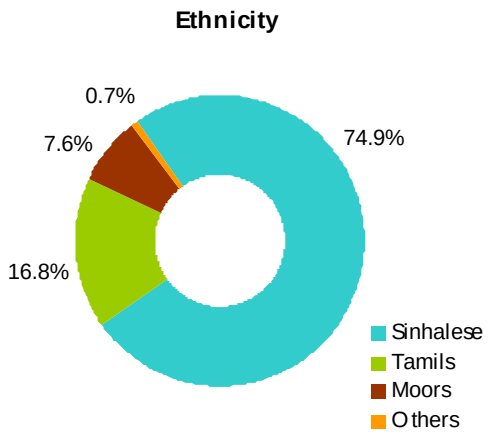
9.2. Protect the rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit-sharing.

National targets (source: Derived from NCSA biodiversity thematic report, 2007:

- Establishment of a metadatabase of holders of traditional knowledge (i.e. genuine knowledge holders). associated with medicinal, curative and other purposes such as agriculture and livestock improvement.
- Traditional knowledge holders are apprised of their rights within an ABS regimes and about IPR issues.
- Explore and use alternative methods for protecting traditional knowledge rather than archiving them in databases (i.e. assisting traditional knowledge holders to pass down their knowledge through the oral tradition to a pupil of their choice).
- Well formulated effective legislation for archiving and safeguarding indigenous knowledge.

Focal Area	Global Indicators	Additional National indicators
Status of traditional knowledge, innovations and Practices	Status and trends of linguistic diversity and numbers of speakers of indigenous languages.	• Meta database of traditional knowledge holders relevant to the use of components of biodiversity.[1] • Mechanisms for archiving traditional knowledge relating to biodiversity in the public domain.[2] • Alternative to archiving traditional knowledge not in the public domain developed.[2]

- Status and trends of linguistic diversity and numbers of speakers of indigenous languages



Sri Lanka has a population exceeding 20 million, of which 74% are Sinhalese who speak Sinhala as their mother tongue. The Tamil and Moor population comprising 24.4 % speak Tamil as their mother tongue. Sinhala and Tamil are both recognised as national languages. Learning Tamil is now compulsory for Sinhalese students following the state curriculum. There were various dialects of the Sinhala language in different regions of the country (e.g. in the south, central province, etc.) that are not in use now due to wide reach of the audio-visual media even in rural areas. The small population of the indigenous 'veddhas in Sri Lanka have a dialect that is akin to Sinhala but is very distinct and characteristic of this ethnic group. However, they too are now conversant in Sinhala for daily use.

Figure 4.2 Ethnic and Religious Composition in Sri Lanka
Data Source: Dept of Census & Statistics cited in Abeykoon (2001)

- **Addressing preservation of preserving traditional knowledge**

Traditional knowledge on biodiversity and its use in farming, ayurvedic medicine, home remedies, etc. is important for Sri Lanka. Some of the information on medicine and crops is documented in *ola* leaves, but much of it is in the memory of old medical practitioners, farmers, priests, and village elders who pass down information through the oral tradition from one generation to the next. It is vitally important that there are mechanisms to prevent this knowledge from dying out with the original knowledge holder. While information in the public domain should be compiled, documented and archived, it is equally important to see that such knowledge is adequately safeguarded, and made accessible with measures in place to ensure that any benefits derived from its uses are equitably shared with the knowledge holders. Further, as in Article 8(j) the use of traditional knowledge and innovations should be used with the approval and involvement of the holders of such knowledge.

One of the most important uses of traditional knowledge is associated with the practise of Ayurvedic medicine for both humans and veterinary purpose. Cconsultations during the National Capacity Self-needs Assessment (NCSA) Project with traditional knowledge holders and other interested members of the public showed that practitioners do not impart their full knowledge for storage in modern data-bases. Some medications are secret recipes that are believed to loose potency if publicly disclosed, and they have age old customs and practices to pass down such knowledge to a special disciple who is chosen with great care based on astrological and other considerations. There is also apprehension that their knowledge will be exploited, with little gains to them, their families or communities and also may be misused. The miss match between wants of traditional knowledge holders among Ayurvedic medical practitioners and the scientific community who promote archiving information has created a situation whereby the knowledge is lost with the decease of the knowledge holder. Furthermore, the popularity of western medication has also made it difficult for the traditional medical practitioners to find interested and appropriate disciples to pass on their knowledge.
MoENR, 2007 and 2009

Overall there is a general failure to recognize the value of traditional knowledge for the pharmaceutical industry, agriculture, livestock and crop improvement and other measure for sustainable use of biological diversity.

However, this issue has been addressed in several ways:

- The MoENR has formulated a national Policy on Traditional Knowledge. While past initiatives on traditional knowledge and strategies had little participation of indigenous and local holders of such knowledge, this is addressed in the policy.
- There are some activities for development of rural industries based on indigenous knowledge.
- A few NGOs have conducted field studies on indigenous knowledge and its conservation. These include programmes with special emphasis on women (traditional cultivation systems, traditional food preparation systems, weaving etc). The GEF/Small Grants Programme has focused on these aspects.
- Collection of information on traditional knowledge and documentation by the BDS.
- Preparation of two volumes of traditional knowledge holder's registers, which is in progress.
- 1st Annual symposium of Traditional Knowledge conducted in 2007
- National IPR law has strengthened the position of Traditional Knowledge and indigenous people's considerations.

FOCAL AREA OF ASSESSMENT: ENSURE THE FAIR AND EQUITABLE SHARING OF BENEFITS ARISING OUT OF THE USE OF GENETIC RESOURCES

Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources

Global Targets:
10.1. All access to genetic resources is in line with the Convention on Biological Diversity and its relevant provisions.
10.2. Benefits arising from the commercial and other utilization of genetic resources shared in a fair and equitable way with the countries providing such resources in line with the Convention on Biological Diversity and its relevant provisions

National targets
- Provide for the fair and equitable sharing of benefits by resource owners and users arising from the utilization of genetic resources and related indigenous specialised knowledge.

Focal Area	Global Indicators	National indicators
Status of access and benefit-sharing	• Indicator of access and benefit-sharing	• Status and trends of national policies, plans and institutional mechanisms that govern ABS and related indigenous knowledge.[1] • A system in place that precludes provision of the country's genetic resources to external parties without PIC and MAT.[1]

- *Status and trends in policies and regulations that govern ABS*

Sri Lanka's present legal framework adequately covers the granting or denial of a legitimate application made to the Government of Sri Lanka for Transfer/Access of Genetic Resources by another Country Party to the CBD, as well as by natural and legal persons from these countries and from "non-CBD Party" countries. The existing laws governing wild biodiversity is a control based regime rather than an open access regime which precludes access sans PIC and MAT. The main laws governing wild biodiversity are the FFPO, FO, and the Fisheries Act (See chapter 3). They govern the export of biodiversity, and both import and export of biodiversity requires permits. Hence any benefit sharing requirements with regard to biodiversity including genetic resources may be linked to granting such permits. These laws have provision for regulations to be gazetted where required to facilitate an ABS regime.

However, illegal access to indigenous genetic resources does occur at various levels and institutions due to poor enforcement of existing laws. There is also legitimate access occurring through: the DOA for research and taxonomic purposes, commercial products that have value in its unmodified form [under a permit system], specimens sent out legally by various institutions (e.g. universities, research institutions and the national herbarium) for taxonomic identification, and during collaborative biotechnology projects with foreign collaborators.

Action taken

- Detailed guidelines for ABS regime were prepared through the National Capacity Needs Self Assessment Project by the MoENR. This called for Access Determining Agencies (ADAs); namely the Department of Wildlife Conservation, supported by the Forest Department (for forest products), the Department of Agriculture (for crops) and the Department of Animal Production and Health (for livestock) that would act on behalf of the state by providing permits for export of local biological resources. This is occurring at present and can be continued under an ABS regime (MoENR, 2007) . However, technical knowledge within these ADAs about legal and IPR issues (entrenched in Articles 15, 16 and 19) and the formulation of MTAs to promote benefit sharing should be strengthened; and there should be a focal point (within the MoENR) to facilitate the ABS regime (ibid).
- The need to ensure fair and equitable benefit-sharing and secure farmers'/breeders' rights are currently being discussed.
- Material Transfer Agreements and standard institutional mechanism to regulate access to indigenous genetic resources by external parties has being initiated by the Ministry of Environment and Natural Resources following the recommendations of NCSA project.
- A National Policy on Access to Genetic Resources and Benefit Sharing is proposed,
- An Act on Plant Breeders' Right to cover fair and equitable benefit-sharing and will secure farmers'/breeders' rights is also proposed.

Proposed assistance from the CBD/COP

- A major multi-institutional capacity building initiative for establishing an ABS regime in source country Parties to be assisted with GEF or other funds.

FOCAL AREA: ENSURE PROVISION OF ADEQUATE RESOURCES		
Goal 11: Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention		
Global Target *11.1. New and additional financial resources are transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with Article 20.*		
National target: A government that is aware of the true value of the country's biodiversity, which would therefore allocate a proportional quantum of funding for the conservation of this valuable resource.		
Focal Area	**Global Indicators**	**National indicators**
Status of resource transfers	• Official development assistance provided in support of the Convention • Indicator of technology transfer	• Increased budget for biodiversity conservation, management and promotion of sustainable use.

Sri Lanka is a small open economy with a per capita income that exceeded US Dollars 1,000 in 2004. This is higher than that of most of its South Asian neighbors despite the country facing a 20 year civil conflict in the Northern and Eastern provinces. Sri Lanka's economy is predominantly a Small and Medium Enterprise (SME) economy where over 50% of our GDP is produced by the SME sector.

Over the years Sri Lanka has committed considerable funds for biodiversity conservation, either through the national budget, loans, or grant funds (see chapter 3). Even so, funds have not been adequate to comply with all of the CBD articles, especially Article 15.

4.3 Impact of NBSAPs and related sectoral and cross-sectoral plans on achieving goals and objectives of the Strategic Plan

The preparation of the BCAP and Addendum helped to highlight biodiversity conservation among sectoral organisations considerably. Despite the lack of a special mechanism to implement these recommendations, their presence has influenced much of sectoral, and some cross-sectoral plans and programmes and achieving goals and objectives of the strategic plan at the in-country level.

The major systemic and broad institutional capacity needs for biodiversity conservation are identified in the FSMP. the NEAP and the CZMP were incorporated into the BCAP of 1999; thereby underlining their importance.

- The National Environmental Action Plan is updated periodically, The current NEAP (Termed Caring for the Environment 2003-2007, Path to Sustainable Development) identifies biodiversity conservation as a cross-sectoral action on natural resource management. It also reiterates the importance of implementing the BCAP in toto.
- The relevant BCAP recommendations have been incorporated into the current CZMP of 2004 which is updated periodically according to the Coast conservation Act.
- The Forestry Sector Mater Plan of 1995 has a chapter on biodiversity conservation in the forestry sector (i.e. including the geographic areas under the Department of Wildlife Conservation).
- The National Agricultural Research Plan (2002-2008 incorporated BCAP recommendations.
- The policies, plans and programmes in the forestry and wildlife sub-sectors have considered biodiversity conservation requirements.

In contrast, officials of development agencies (i.e. those in non-conservation oriented agencies such as irrigation and mining engineers, BOI officials, tourism planners, etc.) have inadequate knowledge of the technical aspects governing biodiversity issues and environmental laws and policies. Hence they cannot contribute positively for implementation of biodiversity plans and policies. Likewise the involvement of the private sector in the various aspects of biodiversity conservation and sustainable use is poor. An institutional coordination mechanism to incorporate biodiversity recommendations in the BCAP and addendum into the plans of other sectors (e.g. CZMP) should be established on a formal basis.

Suggested recommendation to the COP

Parities should be assisted to implement the NCSA recommendations and to establish mechanisms for implementing the national BAPs holistically with adequate emphasis on coordination and implementation of a CEPA strategy and monitoring.

4.4 Assessment of achieving goals/objectives of the Strategic Plan

TABLE 4.63 **Goals and objectives of the strategic plan and major obstacles in meeting major obstacles**

The scale of agreement with regard to achievement of global goals has been rated from 1-4, with a score if 1 for achieved totally; 2 for somewhat achieved, 3 for not achieved and 4 for Difficult to evaluate due to lack of information.

Strategic goals	Scale of agreement	Sri Lanka status and comments on global achievements
Goal 1: The Convention is fulfilling its leadership role in international biodiversity issues.		
1.1 The Convention is setting the global biodiversity agenda.	2	The convention has to work more on promoting in-country capacity to address Articles 14, 15, 16 and 17, and benefit sharing with regard to traditional knowledge. The following

Strategic goals	Scale of agreement	Sri Lanka status and comments on global achievements
		aspects in relation to the latter should be addressed at the global level: • The COP should clarify concept of public domain information to help Parties identify mechanisms for fair and equitable sharing of benefits from traditional knowledge in the public domain and practical solutions for establishing ownership of traditional knowledge among particular communities or individuals for an ABS regime. • There is need to assist source country Parties to investigate and identify a system, such as *sui generis*, that is appropriate for benefit sharing from traditional knowledge by knowledge holders, preparation of a metal data base on traditional knowledge holders, apprising traditional knowledge holders of their rights within an ABS regime and IPR issues and training personnel in institutions dealing with traditional knowledge and the ABS regime. • Countries should be assisted to build capacity to negotiate benefit sharing on traditional knowledge, especially as patents on genetic resources or other bioproducts may cite the original source of the information, but there is no legal requirement for benefits to be shared with the original traditional knowledge holder/s. • The Convention should assist source country Parties to set up mechanisms for ABS through the GEF or other means. Legislation for an ABS regime should not required of countries such as Sri Lanka that have an adequate legal framework to prevent illegal access, while there should be assistance to build capacity for PIC and MAT--via agreements-- at the national level.. • The Bonn guidelines should be expanded built upon to give more detailed guidance on: (a) issues to be addressed when providing access to indigenous genetic resources for commercial use or other use by external country parties, and (b) negotiating benefit sharing when collaborating with other countries for research or commercial products. Such guidelines should help country parities to clarify IPR issues over the following during MAT: a. The gene constructs made during the course of research and the ultimate genetic constructs. b. The end products (e.g. plants, animals, primers, microbes, biomolecules). c. Technologies and associated technologies (divisional applications). d. The rights of use. e. The assignment of genetic constructs and technologies to 3rd parties, and f. The rights of inventors and assignees. • The legal status with regard to regulating export of biological resources in trade is not well known. The legal details about the WTO are not well understood, and the impacts of WTO on implementing Article 15 of the CBD are known only to a few legal experts.

Strategic goals	Scale of agreement	Sri Lanka status and comments on global achievements
		The GOSL has given high priority to Articles 6a, 7, 8, 10, 13 (to biodiversity related education, not CEPA), 20 and 21 and medium priority to articles 6b, 12 and 17, and 18, and low priority to 9, 11, 14, 15, 16 and 19. The programmes dealing with Agricultural biodiversity, Forest biodiversity, Inland wetland biodiversity, Coastal and marine biodiversity have been identified as high priority areas. The capacity gaps precluding implementation of the CBD in full have been identified in detail through the GEF funded NCSA project.
1.2 The Convention is promoting cooperation between all relevant international instruments and processes to enhance policy coherence.	2	The capacity to undertake cross-sectroral action between the three Rio Conventions was part of the NCSA project and this is incorporated in the Action plan prepared through this project.
1.3 Other international processes are actively supporting implementation of the Convention, in a manner consistent with their respective frameworks.	2	Sri Lanka has been assisted by way of funding and technical expertise by the GEF, ADB and World Bank as well as bilateral sources. There are considerable bilateral links for research on components of biodiversity.
1.4 The Cartagena Protocol on Biosafety is widely implemented.	2	This is being acted upon in Sri Lanka. See details in section 4.5
1.5 Biodiversity concerns are being integrated into relevant sectoral or cross-sectoral plans, programmes and policies at the regional and global levels.	2	Sri Lanka prepared a National Biodiversity Action plan in 1999 and has updated this with an Addendum and has prepared provincial level plans. The strategy to implement the plan holistically has been prepared, but there are no funds to create the coordination mechanism to make the strategy operational.
1.6 Parties are collaborating at the regional and subregional levels to implement the Convention.	3	This is not happening to the extent required. There is need for greater focus on Article 14.
Goal 2: Parties have improved financial, human, scientific, technical, and technological capacity to implement the Convention.		
2.1 All Parties have adequate capacity for implementation of priority actions in national biodiversity strategy and action plans.	2 ++	There is adequate technical capacity at national level to implement the national biodiversity action plan. However, the GOSL is severely handicapped in implementing the BCAP due to lack of adequate financial resources and provisions for skilled staff in senior positions for work on the convention. Overall the commitment of the scientific community towards the convention is weak, and the capacity for implementing the BCAP (which requires a coordination mechanism) should be strengthened. Despite several measures and activities in line with the CBD is

Strategic goals	Scale of agreement	Sri Lanka status and comments on global achievements
		being carried out but they lack direction and focus and need to put in to a proper perspective. Among the recommendations technical and scientific cooperation and information exchange and regional cooperation is of higher priority.
2.2 Developing country Parties, in particular the least developed and the small island developing States amongst them, and other Parties with economies in transition, have sufficient resources available to implement the three objectives of the Convention.	4	The in-country resources to implement the CBD and reach the 2010 targets are not sufficient.
2.3 Developing country Parties, in particular the least developed and the small island developing States amongst them, and other Parties with economies in transition, have increased resources and technology transfer available to implement the Cartagena Protocol on Biosafety.	3	Technical capacity is lacking to fully implement the Cartagena Protocol on Biosafety. Sri Lanka is developing the Biosafey CHM and Risk Assessment Protocols to facilitate implementation of the Cartagena Protocol on Biosafety and the National Biosafety Framework.
2.4 All Parties have adequate capacity to implement the Cartagena Protocol on Biosafety.	2	There is adequate technical capacity at national level to implement the Cartagena Protocol on Biosafety, national Policy on Biotecnology and Biosafety. However, the GOSL is severely handicapped in implementing the related strategies and action plans due to lack of adequate financial resources and provisions for skilled staff in senior positions for work on this aspect of the Convention and the Protocol.
2.5 Technical and scientific cooperation is making a significant contribution to building capacity.	2	There is inadequate financial resources and provisions for skilled staff in senior positions for work on the convention, and to mplement the information systems and sharing mechanisms
Goal 3: National biodiversity strategies and action plans and the integration of biodiversity concerns into relevant sectors serve as an effective framework for the implementation of the objectives of the Convention.		
3.1 Every Party has effective national strategies, plans and programmes in place to provide a national framework for implementing the three objectives of the Convention and to set clear national priorities.	3	Please see the Third National Report 2010 Target pages 21-39/

Strategic goals	Scale of agreement	Sri Lanka status and comments on global achievements
3.2 Every Party to the Cartagena Protocol on Biosafety has a regulatory framework in place and functioning to implement the Protocol.	2	The National Biosafety Framework and the National Biosafety Policy have been developed.
3.3 Biodiversity concerns are being integrated into relevant national sectoral and cross-sectoral plans, programmes and policies.	2	Sri Lanka prepared a National Biodiversity Action plan in 1999 and has updated this with an Addendum and has prepared provincial level plans. The strategy to implement the plan holistically has been mapped out, but there are no funds to create the coordination mechanism to make the strategy operational. Please see Third National Report as well.
3.4 The priorities in national biodiversity strategies and action plans are being actively implemented, as a means to achieve national implementation of the Convention, and as a significant contribution towards the global biodiversity agenda.	2	Most of the priority recommendations in the BCAP and some in the Addendum are implemented under various programmes of individual agencies, especially with regard to Articles 8 and 9.
Goal 4: There is a better understanding of the importance of biodiversity and of the Convention, and this has led to broader engagement across society in implementation.		
4.1 All Parties are implementing a communication, education, and public awareness strategy and promoting public participation in support of the Convention.	3	The Sri Lankan public is well aware of the current environmental issues due to the awareness programmes carried out through the mass media by the sectoral state agencies. However, only very a few are really keen to change their lifestyles and reduce the anthropogenic impacts on the environment and the natural resource base. As such, there is clearly a need to implement a CEPA strategy in Sri Lanka. This has been identified through the UNDP-GEF funded National Capacity Needs Self Assessment Project. An initiative by the Convention is required to build capacity for CEPA as identified in the IUCN/CEC/CBD initiative to prepare a CEPA toolkit for National focal Points and NBSAP coordinators.
4.2 Every Party to the Cartagena Protocol on Biosafety is promoting and facilitating public awareness, education and participation in support of the Protocol.	3	Considerable work has bee done with regard to this aspect in Sri Lanka.
4.3 Indigenous and local communities are effectively involved in implementation and in the processes of the Convention, at national, regional and international levels.	2	This aspect is lacking with regard to the situation in Sri Lanka, although efforts have been made to involve local people in PA conservation and management by the FD and DWLC that manage these areas. Public participation in managing wetlands and coastal areas are lacking, although integrated Coastal Area Management has been practiced in Sri Lanka since the early 1990s.

Strategic goals	Scale of agreement	Sri Lanka status and comments on global achievements
4.4 Key actors and stakeholders, including the private sector, are engaged in partnership to implement the Convention and are integrating biodiversity concerns into their relevant sectoral and cross-sectoral plans, programmes and policies.	2	There is poor participation of the development sector and business sector in biodiversity conservation, but integration of biodiversity concerns into sectoral plans and programmes are well established. Biodiversity concerns are also considerably integrated into other sectors such as agriculture and fisheries that are mandated to deal with bio-resources.

4.5 Impact of Strategic Plan on implementing the Cartagena Protocol on Biosafety

Sri Lanka has prepared a comprehensive National Biosafety framework (NBF), which includes a regulatory regime, but has not yet passed any laws to specifically deal with GMOs. The NBF includes country specific guidelines for importation of GMOs and products, guidelines for internal transport and release of GMOs and products (information on consignee, shipper, written permit number authorizing importation, etc. required). It states that handling and packaging guidelines should be developed and contact points for further information should be obtained; no organism or products other than approved ones should be permitted for transport and release.

The NBF has identified that labeling all GMOs, products and products made by process involving the use of a GMO or LMO should be mandatory and that all relevant information should be made available for all the Parties. Through the Framework project, the provisions in existing laws that could be used to control, check and even ban introduction of certain GMOs have been identified. The recommendations cover that all LMOs, GMOs and their products should be covered by an Act, Regulations, etc. At present Sri Lanka is drafting laws to ensure Biosafety. Regulations have been made by the Ministry of Healthcare and Nutrition for food (control of Import, labeling and sale of GM Foods), with 'Regulations 2006' coming into effect from January 2007 regarding criteria for appropriate labeling of products and released to the market. The draft Biosafety Act will confer authority to a Competent Authority to make rules in respect of handling, transportation, packaging and identification of LMOs that are subject to international transboundary movement.

The National Science Foundation of Sri Lanka has formulated guidelines for the safe use of Recombinant 10 DNA technology under contained conditions. According to the Food (Control of Import, Labelling and sale of Genetically Modified Foods)

At present Sri Lanka is implementing the "UNEP-GEF project on building capacity for effective participation in the Biosafety Clearing House" and will be establishing the national Biosafety Clearing House mechanism to provide information to the central portal in a timely manner.

National target BCAP (1999):

Well formulated effective legislation for regulating the import and export of GMOs, LMOs, and their products.

[i] (National Conservation Strategy, 1988

Appendix I - Information concerning reporting Party and preparation of national report

A. Reporting Party

Contracting Party	
NATIONAL FOCAL POINT	
Full name of the institution	Ministry of Environment & Natural Resources
Name and title of contact officer	Mr.M.A.R.D. Jayatilleke, Secretary, Ministry of Environment & Natural Resources
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CONTACT OFFICER FOR NATIONAL REPORT (IF DIFFERENT FROM ABOVE)	
Full name of the institution	Ministry of Environment & Natural Resources
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SUBMISSION	
Signature of officer responsible for submitting national report	
Date of submission	

B. Process of preparation of national report

Please provide information on the process used to prepare this report, including information on stakeholders involved and material used as a basis for the report.

Appendix 1 (B) Process of Preparation of National Report.

During the period 2004-2007 there were several wide ranging consultative processes in Sri Lanka with regard to preparation of documents pertaining to the biodiversity sector, with which the national consultant preparing the 4th National Report was closely associated with. This included the extensive stakeholder consultations held during 2005 and 2006 to identify national capacity needs to implement the Convention on Biological Diversity under the National Capacity Self-needs Assessment Project. These consultations together with desk work, questionnaire surveys and individuals interviews were used for preparation of the baseline survey and final biodiversity thematic report.[1] This report included a stakeholder survey of institutions having a major role to play in biodiversity conservation. The consultations were limited to sectoral institutions so that development sectors were also consulted as well as the business sector and the media. Eleven prioritised areas identified through the NCSA process were scrutinized at several workshops. Among those were: Reaching sectoral and cross-sectoral support for effective national planning and coordination to mainstream biodiversity conservation and sustainable use in accordance with the ecosystem approach (including capacity of the CBD focal point); reaching effective enforcement of laws and regulations to promote biodiversity conservation and sustainable use; establishing an effective inter-institutional coordination mechanism for identification and monitoring of critical components of biodiversity and threats to biodiversity; implementing a multi-institutional coordinated effort to identify, design and establish a rational network of areas needing protection in accordance with the ecosystem approach; developing and introducing measures and mechanisms for a national Access (to genetic resources) and Benefit Sharing (ABS) regime that ensures fair and equitable benefit-sharing from such use and ensures fair and equitable benefits from traditional knowledge associated with genetic resources. Cross cutting issues relevant to all three Rio-conventions were also examined.

Similar consultations were held for preparation of a National GEF Strategy in 2006 which covered climate change, and other GEF focal areas. Furthermore, wide stakeholder consultations had been held during the preparation of an Addendum to the BCAP published in 2007 The NCSA also used a detailed questionnaire survey to obtain information on biodiversity related activities of stakeholders, institutional capacity assessment, and effectiveness of projects pertaining to biodiversity conservation. As such it was decided to prepare this report based on the information already gathered rather than re-consult on the same issues. However, some interviews were held where it was perceived that considerable changes had occurred in sectors since 2006. Accordingly meetings were held with the officers of the Plant Quarantine Division, Director General HoRDI (Dr J de Soysa), Director PGRC (Dr Mallika Samarasinghe), Mr Siril Wijesundara, Director of the National Botanic Gardens and Ms Amitha Bentota, plant breeder at the Rice Research and Development Institute, Bathalagoda. Interviews during field visits made by the national consultant on parallel projects to wildlife reserves and the National Zoological Gardens for preparation of the project completion report of the Protected Area Management and Wildlife Conservation Project have also been incorporated into this report. Discussions were also held with Mr Gamini Gamage, Director Biodiversity Division of the MoENR and Mr Sujith Ratnayake during formulation of this report.

[1] The meetings and stakeholders represented have been sent under separate cover as supplementary material.

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Appendix III

Progress towards Targets of the Global Strategy for Plant Conservation and the Programme of Work on Protected Areas

A. Progress towards Targets of the Global Strategy for Plant Conservation

Sri Lanka has prepared a working List of Known Plant Species in 2008.

Further, The Ministry of Environment and Natural Resources and IUCN Sri Lanka prepared a report for formulation of a project on identifying and protecting important plant areas in Sri Lanka. The wide participatory process involved:

- Collation of available baseline data on plants and pertinent socio-economic dimensions, and previous work on Important Plant Areas and Habitats relevant for the project's needs.

- Identification of institutional mechanisms and partners to develop and implement conservation strategies for the full project.

B. B: Progress towards Targets of the Programme of Work on Protected Areas

B.1 Introduction

This Appendix provides an overview of status of the Protected Area Management in Sri Lanka and the progress made by Sri Lanka towards selected targets contained in the Programme of Work on Protected Areas, adopted by decision VII/28.

B.2 Background to the PoWPA in Sri Lanka

This section provides an overview of the status of Protected Areas in Sri Lanka and the background to Protected Area Management in Sri Lanka.

B.2.1 The Protected Area System in Sri Lanka

As much of Sri Lanka's indigenous species exist only in the wild, preserving/conserving habitats that contain unique biological communities, species and landscapes and important gene banks become the most efficient and cost effective way of conserving them. Consequently, one of the most critical steps in protecting Sri Lanka's

forest biodiversity is the establishment of legally designated Protected Areas (PAs) representative of important components of biodiversity.

Currently, the national system of protected areas is estimated to cover over 18% of total land area of Sri Lanka. Two institutions bear principal responsibility for managing the country's Protected Areas (**Table B.1**).

TABLE B.1: **Extent of Protected Areas Administered by the Forest Department and the Department of Wildlife Conservation**

National Designation	No. of reserves	Area under each category (ha)
Forest Department		
National Heritage Wilderness Area*	1	11,187
International Biosphere Reserves*	2	9,376
National Biosphere Reserves *	31	7,323
Conservation Forests ()	33	76,227
Mangroves	20	2,163
Sub total (corrected for overlap)	**55**	**102, 73**
Wildlife Department		
Jungle Corridors	1 (?)	10,360
National Parks	14	495,984
Nature Reserves	4	32,581
Sanctuaries	63	262,156
Strict Natural Reserves	3	31,573
Sub total	**73**	**832,654**

Source: IUCN, 1997; DWLC, 2000; Bandaratilleke, 2000.

*areas located within the other PA categories; numbers and area corrected to exclude reserves that fall into other categories. The total number of CFs is 33 covering an area of 16,575 ha. Some are pending gazetting, but all are currently managed as Conservation Forests

Over 28% of the total land area of Sri Lanka is reserved and administered by either the Forest Department (estimated at 15.1% - 16.1 %) or the Department of Wildlife Conservation (12.4%); and more then 60% of closed canopy natural forest, or 55% of all natural forests, lie within the reserves of these two departments (IUCN/FAO/FD 1997(i); MALF, 1995).

While about 9,462 km ^{2} of natural forest and scrubland amounting to around 15% of the island lie within the PAs system, a major gap is that only about 18% of this system falls within the biologically rich (MoFE, 1999). Further, whilst the Forest and Wildlife Departments are responsible for managing the island's PAs, identifying areas for protection is not carried out jointly through a coordinated exercise.

Protected Areas under the DWLC

Table B.1 gives the extent of Protected Areas administered by the Departments of Forest and Wildlife Conservation respectively. The Department of Wildlife Conservation (DWLC) is responsible for the management of protected wildlife parks and reserves termed Strict Natural Reserves, National Parks, Nature Reserves, Jungle Corridors and Sanctuaries. All of them are on state land, except Sanctuaries that may contain privately owned land, and they are recognised and governed by the Fauna and Flora Protection Ordinance of 1937 and its subsequent amendments. Several new protected areas have been added to the PA network under the DWLC, or upgraded with regard to conservation category, over the past decade. They include the Kaudulla National Park, Rekawa Turtle Sanctuary, Godawaya Turtle Sanctuary, Elahera-Girithale Sanctuary, Galways National Park and Horagolla National Park.

Protected Areas under the FD

The Forest Department (FD) deals with the conservation and management of almost all the balance land under natural forest, which is estimated at 16.1 of natural habitats (10,670 km^2 of the land area). This includes much of the climax rainforests, grasslands, wetlands, secondary forests, and mangroves and forest plantations managed for production. The Designated Areas under the Forest Department up to 1995 were Forest Reserves, Proposed Forest Reserves and one National Heritage and Wilderness Area (NHWA) – the Sinharaja forest - declared under the National Heritage Wilderness Areas Act No. 3 of 1988.

Since then, a category termed Conservation Forests has been introduced by an amendment to the Forest Ordinance (Act No 23 of 1995). While Forest Reserves and Proposed Forest Reserves cannot be termed Protected Areas in the strict sense as they were declared and managed originally for production purposes, the category termed 'Conservation Forests' will be entirely preserved for posterity.

> "Conservation forests are established in forest areas of outstanding natural value and are managed primarily for the conservation of biodiversity (i.e. genes, species and ecosystems), the maintenance of ecological processes and services, and the preservation of cultural traditions. Conservation Forests are distinguished from Production Forests in that they are to be maintained in perpetuity free from the commercial exploitation of their timber resources, though, where appropriate, the sustainable and regulated use of renewable natural forest products by local people will be sanctioned"

The KDN and Knuckles Forests and 14 mangrove areas have been legally declared as Conservation Forests up to now. There are 31 other forests (from among the FRs and PFRs) and six mangrove areas to be designated as Conservation Forests pending legal declaration and gazetting. While formerly, all forests under the Forest Department were for production, the Department currently manages all natural forests under its jurisdiction for conservation. The protected area categories under the Forest Department are listed in **Table B.1**. In addition to the protected areas listed here, there are about 42,000 ha of forest above 1500 m that are managed exclusively for conservation purposes by the Forest Department.

Apart from the legally defined PAs, there are currently 33 National Man and Biosphere Reserves under the Forest Department and four under the Department of Wildlife Conservation, to ensure that representatives of varied forest ecosystems are conserved. Many of these are located within existing legally defined categories of protected areas established under the two departments.

Four forests (the Sinharaja, Hurulu, Kanneliya-Dediyagala-Nakiyadeniya Forest Reserve Complex and the Bundala National Park) have now been recognised as International Biosphere Reserves. MAB reserves have no specific legal status as Protected Areas, but assume the status of the national Protected Area Category in which they are located. The criteria for selection of national MAB reserves are: human use values due to religious, cultural and traditional activities; historical values, and biodiversity values. The Sinharaja forest was also declared as a Natural World Heritage Site by UNESCO in 1990. Sri Lanka has also recently proposed the Peak Wilderness Nature Reserve, the Horton Plains National Park and the Knuckles Conservation Forest to be recognised as a Mixed World Heritage Site by UNESCO. The Wilpattu National Park (131,661 ha) is the largest single block of protected area in the country while the largest complex of protected areas is the Ruhuna National Park (144,938 ha). Both are located in the Dry Zone and managed by the Department of Wildlife Conservation. Some of the largest species rich Wet Zone forests are the Peak Wilderness Sanctuary (22,379 ha) and the contiguous Horton Plains National Park (3,159 ha), the Kanneliya-Dediyagala-Nakiyadeniya (KDN) Reserve (10,139 ha), the Sinharaja Forest (11,280 ha) and the Knuckles Range of Forests (21,650 ha).

B.3 National Targets Relevant for Programme of Work on Protected Areas

This section lists appropriate national targets relevant to achieve global goals and targets adopted under the PoWPA in Sri Lanka and the context of these targets at the national level.

TABLE B.2: **PoWPA goals and targets and corresponding national targets**

PROGRAMME ELEMENT 1
PoWPA Goal[1] 1.1 - To establish and strengthen national and regional systems of protected areas integrated into a global network as a contribution to globally agreed goals
PoWPA target: By 2010, terrestrially/and 2012 in the marine area, a global network of comprehensive, representative and effectively managed national and regional protected area system is established as a contribution to (i) the goal of the Strategic Plan of the Convention and the World Summit on Sustainable Development of achieving a significant reduction in the rate of biodiversity loss by 2010; (ii) the Millennium Development Goals - particularly goal 7 on ensuring environmental sustainability; and (iii) the Global Strategy for Plant Conservation.
National Target (BCAP[2], 1999) 10 years after the BCAP Sri Lanka should have a well established protected area network system, having adequate representation of the diverse range of biodiversity found in the country. (meets PoWPA actions 1.1.1).
Recommended national action relevant to reach National Target • Define, demarcate and establish an optimal Protected Area Network using data available from biodiversity assessments (e.g. NCR), with special attention given to the conservation of endemic species (BCAP 6.1. recommendation 8). • Ensure that the wide range of habitats of animal and plant life in Sri Lanka is adequately represented in the Protected Areas of the country (under DWLC and FD), and that habitat bridges are established where necessary (CFE 2003-2007 recommended strategy, 5.1-3). • Carry out scientific biodiversity assessment of coral reefs and other important marine systems to identify a minimum network of marine reserves to conserve the totality of marine biodiversity based on principles similar to the National Conservation Review of forests. (BCAP 6.13 recommendation 9) • Ensure that the forests identified as important hydrologically through the National Conservation Review are brought within the protected area system and given strict protection (BCAP 6.2 recommendation 11). • Strengthen and enhance current efforts to identify critically important wetlands in terms of biodiversity, *give priority attention for their conservation* and prepare site reports and management plans where necessary (BCAP 6.2 recommendation 2). • Identify critically important biodiversity hot spots in the country, including those outside forests, and bring under an appropriate protected area category (Addendum to the BCAP, 2007, 2-2 (i)). • Study the status/trends in wildlife areas, and identify the needs for wildlife corridors and linkages as an option for species conservation. (Addendum to the BCAP, 2007 2.2 (ii)).
PoWPA Goal 1.2 - To integrate protected areas into broader land- and seascapes and sectors so as to maintain ecological structure and function
PoWPA Target: By 2015, all protected areas and protected area systems are integrated into the wider land and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity/ and the concept, where appropriate, of ecological networks.

[1] Goal of PROGRAMME OF WORK ON PROTECTED AREAS (PoWPA)
[2] National Biodiversity Conservation Action Plan (BCAP)

National Target (NCSA[3] 5.7, 2007)
Identify, design and establish a rational network of areas**needing protection, in accordance with the ecosystem approach through a multi-institutional coordinated effort.
*(** these areas include those outside legally defined PAs that need some sort of protection for biodiversity conservation).*

Recommended Action relevant to reach National Target

- Formulation of a policy to identify and select areas for protection of biodiversity through a multi-institutional basis at local, regional and national levels in accordance with the ecosystem approach (NCSA 5.7).
- Establishment of a strong coordination mechanism to drive the above policy formulation and implementation with wide stakeholder participation at all levels with representation from grassroots to scientists and top level decision makers (NCSA 5.7).
- Identification of existing data sets that can be used for identification of areas for protection using the ecosystem approach (NCSA 5.7).
- Study the status/trends in wildlife areas and identify the needs for wildlife corridors and linkages as an option for species conservation (Addendum to the BCAP, 2007, 2.2 (ii))).
- Ensure that activities in forests outside protected areas are governed by management plans that pay adequate attention to the conservation of biodiversity (BCAP 6.1 recommendation 9).
- Establish a strong and effective co-ordinating mechanism to secure the collaboration of all the concerned institutions in the effective management of the coastal zone (BCAP 6.3 recommendation 22).
- Initiate action in collaboration with agricultural and irrigation authorities and provincial/regional bodies to prevent siltation of lagoons, estuaries and marine ecosystems due to soil erosion inland (BCAP 6.3 recommendation 23).
- Prepare suitable maps and implement the management plans for wetlands, taking into account the need for collaboration between the several state institutions concerned, including the provincial administration, and based on participatory management principles. (BCAP 6.2 Recommendation 3).

The above recommendations also support the overall PoWPA target of *"By 2015, all protected areas and protected area systems are integrated into the wider land-and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity/ and the concept, where appropriate, of ecological networks."*

PoWPA Goal 1.3 - To establish and strengthen regional networks, transboundary protected areas (TBPAs) and collaboration between neighbouring protected areas across national boundaries.

PoWPA Target: Establish and strengthen by 2010/2012 / transboundary protected areas, other forms of collaboration between neighbouring protected areas across national boundaries and regional networks, to enhance the conservation and sustainable use of biological diversity, implementing the ecosystem approach, and improving international cooperation.

National Target
None as this was not a priority for conservation of Sri Lanka's biodiversity during preparation of Sri Lanka's BCAP (1999) and Addendum to the BCAP (2007) as Sri Lanka is an island.
Recommended Action to reach National Target

- Not applicable

PoWPA Goal 1.4: To substantially improve site-based protected area planning and management.

PoWPA Target: All protected areas to have effective management in existence by 2012, using participatory and science-based site planning processes that incorporate clear biodiversity objectives, targets, management strategies and monitoring programmes, drawing upon existing methodologies and a long-term management plan with active stakeholder involvement.

National Target (BCAP, 1999)

- Within five years of the BCAP (1999): Well formulated, forest management plans for PAs being on of

[3] National Capacity Needs Self Assessment (NCSA) Project

stakeholder groups and communities.

- Within ten years of the BCAP, 1999: Well-managed and rehabilitated wetlands, protected from urban development activities, and free of industrial pollution and urban solid waste.
- Within ten years of the BCAP, 1999: Marine and coastal conservation areas managed with the participation of local communities.

Recommended Action to reach National Targets

- Complete the preparation of management plans (including surveying and boundary marking) for all protected areas; ensure that such plans continue to recognize the participatory role of communities living in proximity to the areas under protection and adequately address the conservation and sustainable use of biodiversity. (BCAP 6.1 Recommendation 4)
- Ensure that activities in forests outside Protected Areas are governed by management plans that pay adequate attention to the conservation of endemic plants and animals. (BCAP 6.1 Recommendation 9).
- Continue to develop strategies and plans for the management of wetlands. (BCAP 6.2 Recommendation 1).
- In collaboration with relevant state agencies, user groups and communities, prepare management plans for identified marine protected areas to conserve biodiversity, and strengthen capabilities for management. (BCAP 6.3 Recommendation 10)
- Strengthen and expedite the preparation and implementation of the special area management programmes identified in "Coastal 2000" and the CZM Plan of 1996, and extend the programmes to other coastal sites as necessary. (BCAP 6.3 Recommendation 28).
- Prepare and implement management plans and strengthen capability among stakeholders for conservation and management of mangrove areas using a participatory approach (BCAP 6.3 Recommendation 11)
- Actively implement the conservation-management plans of protected areas, giving due attention to buffer zone activities involving the peripheral communities (BCAP 6.1 Recommendation 5)
- Prepare suitable maps and implement the management plans for wetlands, taking into account the need for collaboration between the several state institutions concerned, including the provincial administration, and based on participatory management principles. (BCAP 6.2 Recommendation 3).
- Establish a suitable mechanism for ensuring co-ordination in the management of protected areas and the conservation of biodiversity between the Forest Department and the Department of Wildlife Conservation (BCAP 6.1Recommendation 17).
- Enhance field staff capability in pest management, protection against unlawful activities, and fire protection (BCAP 6.1 Recommendation 7)
- The Forest Department and Department of Wildlife Conservation to collaborate to strengthen their capabilities in protected area management. (BCAP 6.1 Recommendation 6).

PoWPA Goal 1.5: To prevent and mitigate the negative impacts of key threats to protected areas.

PoWPA Target: By 2008, effective mechanisms for identifying and preventing, and/or mitigating the negative impacts of key threats to protected areas are in place.

National Targets

- Establish a system for monitoring forest, wetland and coastal and marine biodiversity and taking corrective action when necessary (MoFE, 1999).
- Identify adverse impacts (including potential impacts) on the different components of biodiversity; to take action to mitigate such impacts and to avert potential adverse impacts (BCAP 5.3 (2)).
- Capacity enhancement for monitoring as a priority action to implement the CBD (NCSA thematic Assessment Report on biodiversity, MoENR, 2007).

Recommended Action to reach National Target

- Develop a system for the regular monitoring of forest biodiversity, and take remedial action to rectify any negative trends as and when necessary, including threats from invasive species (BCAP 6.1 Recommendation 1).
- Monitor Protected Areas continuously to ensure that uses are sustainable, especially pollution and

disturbance by over-visitation and vehicles (Addendum to BCAP 7.3 xii).

- Establish biodiversity monitoring indicators within a common flexible and transparent framework and periodically review indicators (Addendum to BCAP 11.3 i).
- Establish an effective inter-institutional coordination mechanism for identification and monitoring of critical components of biodiversity and threats to biodiversity (NCSA 5.5.)
- Strengthen the capability of relevant state institutions for regular monitoring of freshwater aquatic biodiversity, in collaboration with universities and NGOs, and provide guidelines where necessary. (BCAP 6.2 recommendation 8)
- Both within and outside Protected Areas promote *in-situ* conservation activities that specially target threatened species (BCAP 6.1 Recommendation 10).
- Take effective action to stop further encroachments on the forests (bioregions 4,5 and 6). (BCAP 6.1 Recommendation 2).
- Take action to prevent the use of high-forest areas and fragile ecosystems for chena cultivation (BCAP 6.1 Recommendation 3).
- Carry out studies on the impact of introduced exotic species of fish, and measures for their control if found to be harmful to indigenous wetland biodiversity (BCAP 6.2 recommendation 9)
- Monitor the extent and sustainability of harvesting coastal resources such as ornamental fish, sea-cucumber, molluscs, sponges, beche-de-mer, and other species with a market demand (BCAP 6.3 recommendation 4).
- Examine and monitor effects of fishing methods that may have adverse effects on biodiversity, and take appropriate action (BCAP 6.3 recommendation 12, and Coastal Zone management plan, 2004, 3.4 – under policy 1.2)
- Control and regulate the export of all organisms, particularly threatened organisms (BCAP 6.11 Recommendation 6)
- Provide a legal framework to enable the implementation of the CITES Convention with regard to the protection of endangered species (BCAP 6.11 Recommendation 8).

PROGRAMME ELEMENT 2: GOVERNANCE, PARTICIPATION, EQUITY AND BENEFIT SHARING

PoWPA Goal 2.1 - To promote equity and benefit-sharing

PoWPA Target: Establish by 2008 mechanisms for the equitable sharing of both costs and benefits arising from the establishment and management of protected areas.

Sri Lanka's National Wildlife Policy:

- . . . "encourage sustainable development of communities living around protected areas, by consulting them in decision making, enabling their active participate in PA management and providing direct benefits from the management of protected areas"
- The national Forest Policy of 1995 also promotes a reorientation of the traditional approach to forest conservation through protection only, and recommends enabling greater involvement of local people in managing PAs.

National Targets that influence ABS with regard to genetic resources within PAs (NCSA, 2007)

- Establish a national access (to genetic resources) and benefit sharing (ABS) regime as consonant with Sri Lanka's role as a potential provider of genetic resources.
- Ensure fair and equitable benefits from traditional knowledge associated with genetic resources

(As Protected areas and the genetic resources they contain are state owned, a national ABS regime to be set up will address such resources within Protected Areas. Furthermore, an ABS regime that ensures benefits to traditional knowledge holders will cover benefit sharing with local communities living outside Protected Areas and possessing traditional knowledge of value for the use of such genetic resources).

Recommended Action to reach above National Targets (NCSA, 2007)

- Initiate a major multi-institutional capacity building initiative for establishing an ABS regime in Sri Lanka.
- In the absence of a policy on benefit sharing with traditional knowledge holders, this should be addressed in a policy on ABS under a national ABS regime
- Initiate a study to investigate (using expert networks): the issue of benefit sharing from traditional

knowledge with the relevant knowledge holders, whether a *sui generis* system can be adopted, and whether benefits could be channelled to local communities through the normal regional administrative systems (e.g. Divisional Secretaries).

- Establish a Training of Trainers activity to apprise traditional Knowledge holders of their rights within an ABS regime and IPR issues. This could be through empowering civil society organizations and environmental NGOs to play a prominent watch dog function and to apprise traditional knowledge holders about their rights within an ABS regime and about IPR issues.

PoWPA Goal 2.2 - To enhance and secure involvement of indigenous and local communities and relevant stakeholders.

PoWPA Target: Full and effective participation by 2008, of indigenous and local communities, in full respect of their rights and recognition of their responsibilities, consistent with national law and applicable international obligations, and the participation of relevant stakeholders, in the management of existing, and the establishment and management of new, protected areas.

Corresponding National Target (BCAP, 1999)

- Within Five years of the BCAP (1999): Well formulated, forest management plans for PAs being on of stakeholder groups and communities.
- Within ten years of the BCAP, 1999: Marine and coastal conservation areas managed with the participation of local communities.

Recommended Action to reach National Target

- Complete the preparation of management plans (including surveying and boundary marking) for all protected areas; ensure that such plans continue to recognize the participatory role of communities living in proximity to the areas under protection and adequately address the conservation and sustainable use of biodiversity. (BCAP 6.1 Recommendation 4)
- Actively implement the conservation-management plans of protected areas, giving due attention to buffer zone activities involving the peripheral communities (BCAP 6.1 Recommendation 5).

PROGRAMME ELEMENT 3: ENABLING ACTIVITIES

PoWPA Goal 3.1: To provide an enabling policy, institutional and socio-economic environment for protected areas.

PoWPA Target: By 2008 review and revise policies as appropriate, including use of social and economic valuation and incentives, to provide a supportive enabling environment for more effective establishment and management of protected areas and protected areas systems.

N**ational Target**:

There are no stated national targets in this regard, but there are adequate policies governing both the Forest and wildlife Departments and their activities that address provision of a supportive enabling environment for more effective establishment and management of protected areas and protected areas systems.

PoWPA Goal 3.2: To build capacity for the planning, establishment and management of protected areas.

PoWPA Target: By 2010, comprehensive capacity building programmers and initiatives are implemented to develop knowledge and skills at individual, community and institutional levels, and raise professional standards.

National target:

- The Forest Department and Department of Wildlife Conservation to collaborate to strengthen their capabilities in protected area management (BCAP 6.1 Recommendation 6).

PoWPA Goal 3.4 - To ensure financial sustainability of protected areas and national and regional systems of protected areas.

PoWPA Target: By 2008, sufficient financial, technical and other resources to meet the costs to effectively implement and manage national and regional systems of protected areas are secured, including both from national and international sources, particularly to support the needs of developing countries, countries with economies in transition, and small island developing States.

National target:

- Within 5 years of the BCAP there is a proper basis for the government to make budgetary provision of funds for biodiversity conservation and related activities.
- Within ten years after the BCAP the government is aware of the true value of the country's biodiversity, and would therefore allocate a proportional quantum of funding for the conservation of these valuable resource.

PoWPA Goal 3.5: To strengthen communication, education and public awareness.

PoWPA Target: By 2008 public awareness, understanding and appreciation of the importance and benefits of protected areas is significantly increased.

National target:
There are no specific targets for public awareness with regards PAs, although many PAs have developed educational material and visitor centres. However there are national targets to promote biodiversity conservation. They are:

- Ten years after the BCAP:
  - a high percentage of the population are aware of the value and importance of biodiversity and are concerned about its conservation for the benefit of future generations.
  - biodiversity is included in the primary and secondary school curricula and taught in university undergraduate courses in agriculture, veterinary science, architecture, engineering, management studies and social sciences.
  - postgraduate courses are oriented towards specialized training in ecology and environmental management, including conservation of biodiversity.

PROGRAMME ELEMENT 4: Standards, assessment, and monitoring

PoWPA Goal 4.1 - To develop and adopt minimum standards and best practices for national and regional protected area systems

PoWPA Target: By 2008, standards, criteria, and best practices for planning, selecting, establishing, managing and governance of national and regional systems of protected areas are developed and adopted.

National target:

- There are no stated national targets with regard to best practices, but pilot testing of best practices in PA management has been addressed through various projects that are given below.

PoWPA Goal 4.2 - To evaluate and improve the effectiveness of protected areas management

PoWPA Target: By 2010, frameworks for monitoring, evaluating and reporting protected areas management effectiveness at sites, national and regional systems, and transboundary protected area levels adopted and implemented by Parties.

PoWPA Goal 4.3 - To assess and monitor protected area status and trends

PoWPA Target: By 2010, national and regional systems are established to enable effective monitoring of protected-area coverage, status and trends at national, regional and global scales, and to assist in evaluating progress in meeting global biodiversity targets.

National Targets for Goals 4.2 and 4.3:

See national targets and recommended action to reach National Targets above.

PoWPA Goal 4.4 - To ensure that scientific knowledge contributes to the establishment and effectiveness of protected areas and protected area systems
PoWPA Target: Scientific knowledge relevant to protected areas is further developed as a contribution to their establishment, effectiveness, and management.
No specific National Targets have been formulated corresponding to goal 4.4, although action has been initiated to broaden scientific knowledge for reaching this goal (see below for details of the PAM&WC project and the NCR.

B.3 Policies, plans and strategies

This section provides an overview of relevant sectoral policies, strategies, plans and programmes for promoting the PoWPA in Sri Lanka.

B.3.1 Policy and strategy tools that support the Protected Area work programme in Sri Lanka

TABLE B.3.3 Policies, plans, projects and laws to support the PoWPA in Sri Lanka

Policies	Plans and strategies	Projects	Laws
National Forest Policy of 1995 National Policy on Wildlife Conservation of 2000	Forestry Sector Master Plan (FSMP) of 1995 The Strategy for preparation of a Biodiversity Action Plan for Sri Lanka,1994 The Biodiversity Conservation Action Plan of 1999 Addendum to the Biodiversity Conservation Action Plan of 2007 The recent National Capcity Self-needs assessment Biodiversity Thematic Report.	The Forestry Sector Development Project (FSDP) has built capacity for environmental management in the FD *(relevant for Article 18)*. Community Participation Project (1982-1990) and the Participatory Forestry Project initiated in 1993. The ADB funded Forest Resources Management Project (FRMP) The GEF/UNDP funded Southwest Rainforest Conservation Project of the Forest Department (2000-2006). The Aus-Aid funded Sri Lanka Australia Natural Resources Management Project (SLANRMP) 2003-2008 The Global Environmental Facility Project to strengthen the wildlife sector (1992-1998) The Protected Area Management and Wildlife Conservation (PAM&WLC)	The Fauna and Flora Protection Ordinance Act No. 2 of 1937, and its amendments including the 2009 revision. The Forest Ordinance Act No. 16 of 1907, and its 12 subsequent amendments, The National Heritage Wilderness Area Act No. 3 of 1988.

		Project (2001-2008)	
Other Policies, plans and projects that have an indirect but important impact on PAs			
National Environmental Policy of 2003 The National Wetlands Policy of 2006 The National Ecotourism Policy National Industrial Pollution Management Policy statement of 1996	National Conservation Strategy in 1988; The National Environmental Action Plan in 1991, and its systematic revision periodically. The Coast Conservation Management Plan in 1994 and its periodic revisions. The initial National Communication on Climate Change under the UNFCCC in 2000.	The CCD/GTZ funded Coast Conservation Project (1988-1996) The USAID funded Coastal Resources Management Programme - Phases I and II (1985 – 1991, 1991-1997) The Coastal Resources Management Project (CRMP) from 2000-2006 The Wetland Conservation Project (1991 -1998)	National Environmental Act No. 47 of 1980 and its amendment Act No. 56 of 1988* The Coast Conservation Act No.57 of 1981 and the amendment No.64 of 1988.

**Introduction of Environmental Impact Assessments to all development projects and an Environmental Pollution Licensing Scheme came into effect under the NEA Amendment ACT of 1988.*

The National Forest Policy

The current National Forest Policy of 1995 and the Forestry Sector Master Plan (FSMP) of 1995 (for the period 1995 to 2020) identify biodiversity conservation as a key objective of forest and wildlife conservation. They both advocate reorientation of the traditional approach to forest PA management by enabling greater involvement of local people in planning and managing Protected Areas. The main objective of the current Forest Policy of 1995 is to conserve forests for posterity "with particular regard to policy on biodiversity, soil, water, and historical, cultural, religious and aesthetic values", and promotes the adoption of the Protected Area work Programme in Sri Lanka. This policy decrees that all state forests will be brought under suitable management for continued existence of important ecosystems and the flow of forest products and services, while recognising traditional rights of local people and their beliefs; management and protection of forests will adopt partnerships with local people, rural communities and other relevant stakeholders with the use of appropriate tenural arrangements; and nature based tourism will be promoted in so far as it does not damage ecosystems and will benefit local people. The policy also reiterates that the State will observe international forest-related conventions and principles that have been agreed upon by Sri Lanka. In pursuance of this policy, the functions of the Forest Department have become 'greener' and shifted from one of production to conservation of the nation's forest biodiversity.

National Wildlife Policy

The National Wildlife Policy of 1990 was prepared in response to the National Conservation Strategy of 1988. The overall translation of the previous Wildlife Policy into action was weak. The current National Policy on Wildlife Conservation (of 2000) has been expanded to include policy needs that respond to the evolving needs of Sri Lankan society and the mandate conferred as obligations under the Convention on Biological Diversity. The National Wildlife Policy of 2000 recognized the need for appropriate and effective management of PAs, taking into consideration the needs of local communities and for providing support to wildlife resource managers by way of reorientation, strengthening and decentralization of their institutions. This policy renews state commitment to conserve wildlife resources for the benefit of present and future generations. It also recognises the need to link activities, interests and perspectives of the people who use and benefit from wildlife resources with those of professional wildlife managers and scientists. The policy concurs with the targets of the PoWPA by its decree to:

- identify, classify manage and monitor all protected areas based on appropriate scientific studies and agreed criteria;
- zone and manage all protected areas according to approved management plans, taking into account the context of their surrounding landscapes, and the ecological, social and economics links between natural and human systems;
- adopt ecosystem-based management, including the eradication of alien and invasive species where possible after consideration of the environmental impacts of these interventions; and to encourage sustainable development of communities living around protected areas, by consulting them in decision making, enabling their active participate in PA management and providing direct benefits from the management of protected areas; and
- facilitate eco-tourism in protected areas, to the extent that it provides benefits to local people and does not damage the ecosystem concerned.

The section on Protected Area management of this policy specifically recognises the importance of protecting representative samples of all terrestrial, coastal and marine ecosystems and sites of special scientific interest such as Wet Zone forests, and obtaining the support of local people in protected area management. The policy also articulates the need for a decentralised administration that enhances the flow of benefits from protected areas to those living in their vicinity.

The National Forestry Sector Master Plan

The Forestry Sector Master Plan (FSMP) of 1995 was prepared to take forward the National Forest Policy of 1995 during the period 1995 to 2020. This plan was developed with special emphasis on the conservation of biodiversity in the forest and wildlife sub-sectors, and has direct relevance for implementation of the PoWPA. While the management of PAs under the Department of Wildlife Conservation has not followed the FSMP, the Forest Department follows the strategy outlined in the FSMP for management of its reserves. Accordingly, forests under the jurisdiction of the Forest Department will be reclassified, rehabilitated and placed under four management systems for: (a) strict conservation; (b) non-extractive use such as research and tourism with controlled collection of non-wood resources; (c) management of multiple use forests for sustainable production of wood, and (d) management of forests with community participation to meet the needs of local people (MALF, 1995). A significant feature of the FSMP is that it advocates a re-orientation of the traditional approach of both Forest and Wildlife Conservation Departments promoting the involvement of local communities in Protected Area Management.

The National Environmental Action Plan 0f 2003

The current NEAP is termed “Caring for The Environment: National Agenda for Sustainable Development 2003 - 2007” (CFE). This contains the National Environmental Policy of 2003, development linked environmental strategies for implementing the policy, and a comprehensive set of actions for managing the environment so as to make the development process sustainable. Development is perceived with the active involvement of NGOs and business sector to work with the government sector at both national and provincial levels. The CFE takes into consideration that individual ministries have their own development strategies and action plans, although they have various environmental dimensions according to their mandates.

There is no overall policy to guide the declaration of areas on a coordinated basis that is in accordance with the ecosystem approach, nor are Protected Areas currently declared with the concurrence of local people. This may jeopardize their subsequent management in accordance with the ecosystem approach, particularly in the coastal areas. It has been stated that the absence of a bottom-up approach to the identification of protected areas and their management, with due consideration of needs at the grass-root level at the time declaration impedes the management of Protected Areas. The need for capacity building in this regard is recognized in the National Capacity Self-needs Assessment (NCSA) of 2007.

The major laws relevant to promote the PoWPA in Sri Lanka are given in Chapter 3.

B. 4 Overview of major action to achieve the PoWPA, problems, needs and future priorities

This section provides an overview of major actions that enable achieving the targets of the Work Programme of Work on Protected Areas (PoWPA).

B.4.1 PoWPA **Goal**[4] **1.1 -** *To establish and strengthen national and regional systems of protected areas integrated into a global network as a contribution to globally agreed goals.*

Status of actions taken/in progress
The Forest Department has expanded the PA system under its management based on the results of the biodiversity and hydrology (i.e. soil erosion, flood hazard, headwater protection, fog interception) assessments under the Accelerated Conservation Review (ACR) of 13 forests and the more widespread National Conservation Review (NCR), and considering forest size; type (forest, mangrove, etc); uniqueness of the ecosystem represented; location in respect of other Protected Areas, and socio-cultural significance. The 33 forests identified for conservation are in the and aim at securing the most threatened species and endemics in the context of national priorities. Three forests have now been legally declared as Conservation Forest (CFs, and boundary demarcation and mapping of another 30 CFs for strict conservation have been carried out under the Forest Resource Management Project (FRMP) to enable their legal declaration and gazetting as Pas. However, all 33 are even now managed as conservation forests. The Department of Wildlife Conservation has already declared a large numbed of PAs under their management (**Table B.1**), including marine, wetland and forest sites. Boundary demarcation of these were carried out under the Protected Area Management and Wildlife Conservation Project (PAM&WC) to enable effective PA management. Most of areas managed by the DWLC have not been established based on biodiversity values as they were declared prior to such considerations. However these PAs include very important wildlife habitats that habour the charismatic large mammals of Sri Lanka and are distributed in all bioclimatic zones in the country. The Ministry of Environment and Natural Resource is now taking steps to facilitate the use of the NCR carried out by the Forest Department, and a GAP analysis of the national Protected Area system carried out by the DWLC (under the PAM&WC) to examine the present PA system and declare other key areas that need protection.

[4] Goal of PROGRAMME OF WORK ON PROTECTED AREAS (PoWPA)

Status of actions taken/in progress
Twenty Mangrove areas (ten mangrove habitats south of Colombo and ten northwest of Colombo that are located outside forests have been set aside for conservation and management by the FD with the aid of management plans within the PA system. Two marine protected areas containing coral reefs have been established (at Hikkaduwa National Park and the Bar Reef Marine Sanctuary) by the DWLC. Both are among the potential SAM sites identified for Special Area Management (SAM) by the Coast Conservation Department (CCD). The Ministry dealing with fisheries has declared several Fisheries Management Areas,[5] but no fisheries reserves that equal the status to wildlife sanctuaries have been declared yet. The Central Environmental Authority (CEA) has identified 84 wetland sites of importance for conservation and management through the Wetland Conservation Project. Site reports have been prepared for 26, of which 10 have management plans. Under the National Environmental Act (NEA) the CEA has declared a further 8 Environmental Protection Areas (EPAs) which do not have total protection, but in which the CEA allows only identified activities. This enables the protection of environmentally sensitive or biodiversity rich areas that lie outside the PA system.

The National Conservation Review of Sri Lanka

This constituted a systematic assessment of biodiversity by the Forest Department and IUCN-The World Conservation Union in all the natural forests over 200 ha in the country, except in the north and east were there was political unrest. The survey was conduced from April 1991 to September 1996, with the main objective of defining a national system of protected areas in which forest biodiversity was fully represented and watersheds important for soil conservation and hydrology were protected, while meeting the cultural, economic and social needs of the country. This survey covered a total of 204 forests and covered biodiversity assessments that were restricted to woody plants, vertebrates, molluscs and butterflies. Today, the NCR is hailed as one of the most detailed, comprehensive and innovative evaluations of its kind carried out on a countrywide scale to date.

The NCR identified the forests as the most important for protection due to their value in terms of soil and water conservation and rich biodiversity, including much of the island's endemics. According to the findings, 133 forests are required to conserve woody plant and vertebrate species that were recorded. The comprehensive picture of natural terrestrial biodiversity that emerged through this survey provides valuable information for planning an optimal network of protected areas for the country ***(Articles 8(a) and Article12).*** Even so, of the 204 designated forests inventoried through the NCR only 54, including the 33 conservation forests of the, lie within the country's Protected Area Network yet.

Source MoFE, 1999

The GAP Analysis

The GAP analysis carried out by the Department of Wildlife Conservation, under the Protected Area Management and Wildlife Conservation Project (PAM&WC), has served to assemble a portfolio of strategic conservation sites for Sri Lanka that adequately represent the biological diversity and ecological systems of the country. This involved comparison of the existing PA system with this portfolio to indentify gaps and describe areas of conservation importance that are not in the existing PA system (gaps). All existing PAs by definition have been included in the final portfolio, while other sites falling outside the existing PA system have been included because they contained conservation targets that are currently not well represented or replicated, or were required to be added to the existing PA system to provide landscape functional integrity to connect existing PAs, or form buffer zones to the PAs.

Although this study was essentially a desk exercise using existing information, some information that was not commonly available has been generated anew. The process actively involved a wide range of stakeholders and expert review teams. Recommendations are provided for a conceptual shift from a system of PAs to a network of PAs and the means to achieve it ***(Articles 8(a)***). The gap analysis produced base maps, a condition index for vegetative type conservation targets, maps of selected threatened endemic species (e.g. amphibians, agamid lizards, marine turtles, bird eating spiders, and snails), flora and rock outcrops.

Source: Portfolio of Strategic Conservation Sites / Protected Area Gap Analysis In Sri Lanka, MoENR, 2006

[5] The area encompassing the Great and Little Basses reefs, the Kumbukkan Oya estuary and the Buttuwa Rock, off Yala, declared in July 2001, for protection of their undisturbed reefs, unique setting and archaeological importance; the Madiha-Polhena coral reef ecosystem, declared in July 2001; The Negombo Lagoon declared in July 1998; The Rekawa Lagoon declared in February 1999;The Bolgoda Lake Lagoon declared in July 2001;The Batticoloa Lagoon declared in January 2001.

The ADB funded Forest Resources Management Project (FRMP)

Under this project, capacity building of the Forest Department (FD) (as the main beneficiary), targeted awareness and extension ***(Article 13),*** agroforestry ***(Article 10(b)),*** rehabilitation of degraded forests ***(Article 8(f)),*** buffer zone development through participatory community programmes ***(Article 8(e)),*** boundary demarcation of natural forests and forest plantations (relevant for ***Articles 8(b) and 8(c))*** and capacity building for forest management (relevant for ***Articles 8 as a whole).*** Skills training was via technical assistance (TA) provided to the FD in the form of expatriate and local senior level expertise in the fields of forestry education, forest management and the revision and improvement of the curricula at the Sri Lanka Forestry Training Institute (SLFI). Assistance was specifically provided for integrated management planning and biometrics, planning and project implementation, data collection and collation, database development and management via technology development (for GIS databases); public awareness and extension, developing technology for research, ecosystem and biodiversity management, participatory forestry and institutional capacity building, and for improving the database established through the NCR. Overall. about 500 FD staff have received special training and skills development through this project in this regard. The project also had a training programme for capacity building on an annual basis, through both local and overseas training.

The FRMP also provided equipment and other facilities in-kind, including computers and equipment for field survey, inventory and communication. Financial assistance has been provided to the FD to enhance nature based tourism at Sinharaja, Knuckles and Kanneliya forest reserves with the involvement of local people.

Source: Thematic Assessment Report on Biodiversity, MoENR, 2007

Asian Development Bank (ADB,) the Global Environmental Facility (GEF) and the Netherlands Government funded Protected Area Management and Wildlife Conservation (PAM&WLC) Project

The main beneficiary from this project was the Department of Wildlife Conservation (DWLC). The key objectives of the project were: (a) enhancing institutional capacity in the DWLC 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 has been achieved at the DWLC by updating staff knowledge, providing staff training, building technical and managerial competence in the DWLC, and development of institutional potential. Adaptive management has been pilot tested at several pilot PAs (PPAs), namely the Peak Wilderness Nature Reserve, Horton Plains National Park, Ritigala Strict Nature Reserve, Bundala National Park, Wasgamuwa National Park, Minneriya - Kaudulla National Park complex, and the Udawalawe National Park ***(relevant for Article 8, mainly 8(b)) for*** habitat enrichment, including management of alien invasive species and pilot research on invasive species eradication ***(Article 8(h)) ,*** grassland establishment and enhancing water and fodder for animals. The project enhanced community participation in PA conservation, and facilitated buffer zone community development (relevant ***for Article 8(e)).*** The project also developed visitor service plans for the PPAs, and enhanced visitor facilities by establishing visitor centres with interpretive material at seven PPAs (***relevant for Article 13***). Under the project, the DWLC has been assisted to carry out detailed biodiversity assessments and habitat mapping in seven PPAs to pilot test systematic monitoring of biodiversity and to enable PA zoning **(*relevant for Article 7*).** The gap analysis carried out under this project also helped to assemble a strategic portfolio of conservation sites for Sri Lanka ***(relevant for Article 7(a)).***

Source: Borrower's Project Completion Report on the ADB funded PAM&WC Project..

B.4.2 PoWPA Goal 1.2 - To integrate protected areas into broader land-and seascapes and sectors so as to maintain ecological structure and function.

Status of actions taken/in progress
The landscape approach had been considered during the establishment of National Parks in the Mahaweli Region by the DWLC in the 1980s. However, management has not adopted this approach here or elsewhere in the country, although ecological connectivity for a network of PAs is now being looked into (see GAP Analysis above). Areas in Buffer Zones of protected areas have also been covered by management plans prepared for PAs. There has also been an attempt to adopt the landscape approach to conservation at the Horton Plains National Park by getting the participation of landowners around the national park and the involvement of other state departments managing lands in the landscape. Getting the required cross-sectoral and multi-stakeholder participation has proved an impediment in adopting

the landscape approach through the ecosystem approach.

The importance of capacity building for adopting the ecosystem approach to identifying and managing a network of PAs has, however, prioritised under the National Capacity Self-needs Assessment (NCSA) Project.

Aforestation and reforestation are occurring under institutional programmes of the FD on a regular annual basis.

B.4.3 PoWPA Goal 1.4: To substantially improve site-based protected area planning and management

Status of actions taken/in progress

The FD has followed the concepts of the Forestry Sector Master Plan (FSMP) of 1995 and taken them forward by preparing management plans for 16 forests considered to be of outstanding value in terms of biodiversity and watershed protection. These Management Plans have been prepared after consultation with local communities, and to identify site-specific issues and recommend remedial measures including a prescription for a participatory management approach to be adopted by CBOs, NGOs, local state authorities and the Forest Department. The plans also address linking the management of conservation forests with development activities in the buffer zone.

Forests

Preparation of management plans for all forests under the FD is will soon be mandatory under proposed amendment to the Forest Ordinance of 1996, and management plans for all forests are being prepared by the FD field staff, taking into consideration buffer zone management and participatory conservation with the involvement of local communities. Management Plans have also been prepared for 20 mangrove areas within the PA network. *(Supports Article 8(e)).*

With regard to PAs under the DWLC, Management Plans have been prepared by the Departmental staff for nine cluster PAs. More recently, management plans, including tourism development plans and participatory management plans involving local people, were revised for eight PAs through the PAM&WC project for which technical assistance was provided via this project. Three other plans are in progress. Capacity has been built within the DWLC to prepare management plans for other PAs under its jurisdiction.

Implementation of some management plans by the FD is ongoing through institutional programmes and special projects. Management plans for all forests, now being prepared will be implemented. Capacity for management has been built under a range of projects. Staff training for forest management is also carried out through in-service training at the Forestry Training institute.

Implementation of existing management plans by the DWLC is ongoing through institutional programmes and special projects for some protected areas. Extensive **c**apacity building has been done through the PAM&WC project for adaptive management and participatory management of PAs with local communities. Staff training for Wildlife management is also carried out through in-service training at the National Wildlife Training Institute at Giritale.

Wetlands

Conservation Management Plans have been prepared for 10 wetland sites by the CEA of which several are PAs managed by the DWLC. (Minneriya Reservoir, Wirawila Sanctuary and Yoda Wewa, Bundala Wetlands, Lunama and Kalametiya Kalapuwa, Bellanwila Attidiya Marsh, Mundel Lake and Corridor Channel. Koggala Lake, Annaiwilundawa Tank, Colombo Flood Retention Area, Muthurajawela–Colombo Lagoon.

The FD will be preparing management plans for critically important forests in terms of hydrological value where ever they are included under the category of Conservation Forests. The Urban Development Authority has prepared Wetland Regulations and Western Province Wetland Zoning for application in urban development programmes.

Coastal and marine areas

A management plan has been developed for the Hikkaduwa National Park (then a Marine Sanctuary in 1996) and some activities have been implemented. The CCD has prepared and implemented Special Area

Status of actions taken/in progress
Management (SAM) in the area that is now the Hikkaduwa National Park. Management of the Bar Reef Marine Sanctuary is underway, though action has been slow in this area. While all coastal SAM sites identified by the CCD for management are not PAs, they include areas that should be included within the national PA network. The CERM component of the CRMP project has provided assistance to revamp coastal special area management at SAM sites with community assistance. This process has not achieved success as desired.

B.4.4 PoWPA Goal 1.5: To prevent and mitigate the negative impacts of key threats to protected areas

Status of actions taken/in progress
It has been recognised that both FD and DWLC should take lead roles in institutionalising a simple system of reporting of perceived threats to biodiversity by the field staff of FD, DWLC to regional offices and Head Quarters. No regular reporting system to the central office exists yet within the FD. Reporting from the field has been addressed recently by the DWLC by the establishment of an online information management system (IMS) through which such reporting can be carried out from the field to regional and Head offices. A mechanism for reporting in areas outside the jurisdiction of the FD and DWLC that are patrolled by FD and DWLC staff also has to be established. The possibility of assistance from the CEA Divisional Environmental Officers, the Coastguard division of the CCD (in coastal areas), etc. to report threats to FD/DWLC as relevant has been suggested. During the management planning process for PAs by the FD and DWLC, key threats to protected areas are identified and strategies to prevent and/or mitigate such threats are routinely implemented. This has been carried out successfully at several sites where participatory management of PAs have been carried out (e.g. Sinharaja, Kanneliya and Knuckles forests managed by the FD and in 8 PAs managed by DWLC under the PAM&WC project). Removal of alien invasive species and habitat enrichment were key aspects of the PAM&WC project in eight Protected Areas where adaptive management was piloted. Boundary marking in forests via the FRMP by the FD has partly helped stem encroachments into Wet Zone forests. A similar halt to chena cultivation of forests managed by the DWLC is envisaged through boundary marking of PAs carried out through the PAM&WC project along with participatory management. The National Environmental Act No. 56 of 1988 lists 52 prescribed projects. Anyone or organisation that submits a "Prescribed Project" for approval has to submit an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) to the relevant Project Approving Agency (PAA). Among the prescribed projects are : the conversion of forest cover of more than one hectare to non-forest use, extraction of timber covering land exceeding 5 ha, clearing of land exceeding 50 ha; conversion of wetlands of more than four hectares, timber extraction from land over five hectares, and any prescribed project in the NEA located within 100 m of an area declared under the National Heritage Wilderness Area Act or the Forest Ordinance. In addition, the Coast Conservation Act No. 57 of 1981 empowers the relevant state departments to request an IEE or EIA for developmental activities in the Coastal region. Under the Fauna and Flora Protection Ordinance (amended Act No. 49 of 1993) development activity within one mile of a National Reserve is subject to EIA regulations. Goal 1.5 The FFPO and the FO also provide stringent laws to halt the removal of forest resources from PAs and to eliminate illegal trade in such resources. Sri Lanka is also a party to CITES, and permits are required for export of components of wild biodiversity from the Department of Wildlife Conservation to ensure adherence to the CITES Convention as well as National laws.

The Coastal Resources Management Project (CRMP) from 2000-2006 with funds from the ADB and the Government of the Netherlands

The Coastal Resource Management Project (CRMP) was a major initiative of the then Ministry of Fisheries and Ocean Resources, Component B of the CRMP for Institutional Strengthening covered several aspects that are relevant for Managing PAs. This component has dealt with enhancing institutional arrangements within key agencies of the Ministry of Fisheries and Aquatic Resources (MFAR) , which 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 to assist the department's functions and to enhance capacity for Integrated Special Area Management Planning in the coastal areas (***relevant for Article 6(a)***); 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 (***relevant for Article 7(d)).***

Through the CRMP, coastal community members (from Coastal Coordinating Committees at six SAM sites) were sent on overseas study tours. The training covered staff skills development for resource management, project management, GIS use, monitoring and evaluation. About 76 persons have been trained overseas, and 642 have been trained locally in the Ministry dealing with fisheries, institutions under its purview (see Chapter 3 for institutions), as well as community members and Divisional Secretaries in the provincial administration.

This project also instituted a programme of Information, Education and Communication (IEC) to improve awareness of the issues in the fisheries sector and a better understanding of sectoral management issues that will lead to the formulation of viable and durable interventions by sector institutions (***relevant for Article 13***). This project also set up a basic management information system/framework whereby the main line agencies in the fisheries sector and their outlying offices could be connected electronically, to enable exchange of information and data with the MFAR (**relevant for Article 7**). Under this an IT programme and a data gathering network has been developed within the ministry, and was piloted for 18 months to gather catch and effort data as a first step towards interpreting and managing the biological state of the fishery.

Source: Thematic Assessment Report on Biodiversity, MoENR, 2007

B.4.5 PoWPA Goal 2.1 - To promote equity and benefit-sharing

Status of actions taken/in progress
The National Forest Policy of 1995, the Forestry Sector Master Plan (FSMP) of 1995 (for the period 1995 to 2020) and the Wildlife Policy (2000) identify biodiversity conservation as a key objective of forest and wildlife conservation. They all advocate reorientation of the traditional approach to forest management by enabling greater involvement of local people in planning and managing Protected Areas. Coal 1.2 While some actions have been done to reach this target, initiating the required action to achieve the above target is deficient in Sri Lanka, mainly due to resource constraints to initiate work on reaching the above mentioned national targets. While a national ABS regime has not yet been formerly established in Sri Lanka, the requirements for such a regime as consonant with Sri Lanka's role as a potential provider of genetic resources, have been identified, and the systemic, institutional and individual capacity building requirements for such a regime have been identified in detail under the NCSA project. The existing legal framework is sufficient to enable an ABS regime. The capacity requirements to ensure fair and equitable benefits from traditional knowledge associated with genetic resources have also been identified through the NCSA project, but have not been addressed adequately yet. As Protected areas and the genetic resources they contain are state owned, a national ABS regime that ensures benefits to traditional knowledge holders will cover benefit sharing with local communities living outside Protected Areas and possessing traditional knowledge of value for the use of such genetic resources.

B.4.6 Goal 2.2 - To enhance and secure involvement of indigenous and local communities and relevant stakeholders

There have been considerable re-orientation of policy decisions regarding management of Protected Areas to involve participation of local people and to facilitate the gaining of benefits to local people through from Protected Areas, for example through development of ecotourism. It should be noted that Sri Lanka's Protected Areas do not in general contain settlements, and where such settlements do occur in forests managed by the Forest Department, they are by legal definition excluded from the surrounding protected area. However, there is wide recognition of the participatory role of communities living in proximity to the areas under protection by both the Forest and Wildlife departments, and their participation to address the conservation and sustainable use of biodiversity in PAs are well accepted by both departments.

The **Community Participation Project (1982-1990) and the Participatory Forestry Project initiated in 1993 were** milestones in developing understanding of the role of local people in forest conservation in Sri Lanka and for initiating capacity building for participatory forest management *(supports Article 8(j), Article 10 (b)).*

Subsequently, a large number of projects have dealt with building capacity for PA managers to work with local communities and to provide benefits for local people from PAs. Foremost among these are the Sri Lanka Australia Natural Resources Management Project (SLANRMP) for poverty reduction through improved natural resource management, the GEF/UNDP funded Southwest Rainforest Conservation Project of the Forest Department at two PAs; and Component D of the Protected Area Management and Wildlife Conservation Project of the Department of Wildlife conservation in nine PAs.

Considerable economic and social benefits have been conferred at these sites to local communities in the buffer zones as part of PA management. For example, communities that are actively involved in providing visitor services at the Knuckles Conservation Forest (Illukumbura area) managed by the FD. Consequently there is considerably increased participation by local communities with protected area management in the PAs where participatory management is being practised when compared with the situation in the 1980s.

The management plans prepared for forest and wildlife areas so far recognize the participatory role of communities living in proximity to the areas under protection. Attention is given to buffer zone development activities involving the peripheral communities when implementing conservation-management plans of protected areas where such plans are being actively implemented.

The GEF/UNDP funded Southwest Rainforest Conservation Project of the Forest Department (2000-2006

This project pilot tested the development of a viable participatory management model for 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—two forests within Sri Lanka's PA system. The project built capacity in the Forest Department for community mobilisation and formal registration of existing CBOs involved with the project in the villages where its was in operation. The model took into account the conservation status of the relevant forests, the level and type of forest dependency among local people, and the national forest policy ***(supports Article 8(j) and 10(b)).*** As such, the model is one in which the overall control of forest resources remains vested in the Forest Department, with the communities having a recognisable role in planning and managing the two forest reserves so that they remain committed stakeholders in the process. The CBOs assisted the Forest Department to work out appropriate systems for delivery of assistance (for each village) as deemed required for social upliftment and to reduce forest dependency (including encroachment) by improving local livelihoods. The CBOs were helped to become self-reliant in the long-term after the project ended through establishment of Community Trust Funds (CTFs) for which seed money were initially provided via the Forest Department. The CBOs were registered so that they can operate the CTFs and a bank account. The CTFs provided soft loans at very low interest rates for CBO members to engage in activities that would enhance cash incomes and reduce forest dependency – mainly to alleviating the need to expand tea small holdings into the reserves and some damaging forest extractions. The CBO members were trained through the project to write proposals for seeking funds, and office bearers were trained to keep accounts and carry out the CBO activities.

The CBO members were also assisted in developing technical and entrepreneurial skills by the Forest Department for enhance their cash incomes, thereby reducing the need to encroach into the reserve to expand tea holdings. The required training programmes and the members to receive training were selected by the CBOs. 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 reserves. The project also provides tangible benefits for CBO members, thereby promoting continued support for forest conservation. The Forest Department which initially facilitated the formation of these voluntary CBOs has now moved into an advisory and monitoring role; the CBOs are run entirely by community members.

Source: Thematic Assessment Report on Biodiversity, MoENR, 2007

The Aus-Aid funded Sri Lanka Australia Natural Resources Management Project (SLANRMP) for poverty reduction through improved natural resource management SLANRMP: Sri Lanka – Australia Natural Resources Management Project.

This project was active in two Dry Zone areas in the Kurunegala and Matale districts since February 2003 - 2008 to support

communities improve the management of natural resources through a participatory and holistic approach. The project aimed to build institutional capacity enhancement and human resources development in this sphere in the forestry sub-sector. The project also aimed to pilot the handing over of the management of degraded forest patches to communities in adjacent villagers who would benefit from enhanced household income due to improved land use and integration of forestry and agriculture. The project specially targeted communities that are dependant to varying degrees on the adjacent forests for their livelihood, and are thus willing to accept responsibility for community management of forests in exchange for forest user rights. Women and disadvantaged members were given special attention.

This project acted as a pilot research project to test an appropriate development processes that the Forest Department could implement through its institutional programmes on a routine basis. A Training of Trainers course was developed to disseminate the results nationally. The ultimate goal of the project is to contribute to poverty reduction through improved natural resource management in Sri Lanka.

Source: Thematic Assessment Report on Biodiversity, MoENR, 2007

Asian Development Bank (ADB,) the Global Environmental Facility (GEF) and the Netherlands Government funded Protected Area Management and Wildlife Conservation (PAM&WC) Project – Component D

Component D of the (PAM&WC) project implemented participatory adaptive management in eight PAs. This served to institutionalizing a process for community participation in protected area management through dialogue, partnership building and benefit sharing and financing of community sub-projects. Overall the project dealt with 168 Community Based organizations in 171 *Grama Niladhari* Divisions around the eight PAs, namely the Ritigala Strict Nature Reserve, Wasgamuwa National Part, Uda Walawe National Part, Kaudulla National Part, Minneriya National Park, Bundala National Park and Peak Wilderness Nature Reserve. While new were CBOs formed, existing CBOs were also used to carry out community outreach activities.

A total of 168 micro-plans (i.e. village action plans) were prepared through which village needs were identified, and based on these, proposals for buffer zone development were submitted for each PA to the relevant Regional Grant Review Committees (RGRCs). These were forwarded to approval to the National Grant Review Committee (NGRC). Of these 204 proposals were approved and funded. The project funds were given as soft loans to the CBO members (selected by the CBOs) and the monies from loan repayment form a fund for each CBO once the project ends.

This component has led to a positive change in DWC and community relationships in almost all PAs where this scheme has been piloted, resulted in considerable weaning away of buffer zone communities from adverse activities they were engaged in the PAs. These PAs also employ volunteer guides and cleaners from among these communities, and award contract work for adaptive management (e.g. removal of invasive species) to these CBOs based on competitive bidding. Several CBOs also carry out voluntary services such as manual removal of invasive species. An important activity also has been community based establishment and maintenance of electric fencing to reduce the human- elephant conflict.

As outreach was a new concept to the DWLC, intense training of several categories of staff in the PPAs were trained on community outreach, to inculcate the attitudinal changes to accept communities as stakeholders in PA management. Extensive awareness proegrammes were also carried out among external stakeholders that were central to implementing component D.

As the long-term aim of this component, this pilot tested participatory management is expected to be applied on a wider scale to other PAs managed by the DWLC.

Source: Borrower's Project Completion Report on the PAM&WC Project

B.4.7 PoWPA Goal 3.1: To provide an enabling policy, institutional and socio-economic environment for protected areas

Status of actions taken/in progress
The BCAP and Addendum, the National Wildlife and Forest policies as well as the National Environmental Action Plan create an enabling environment for establishment and management of PAs, for participation of local people in PA management, and to facilitate the provision of benefits to local people from Protected Areas through development of ecotourism.

B.4.8 PoWPA Goal 3.2 - To build capacity for the planning, establishment and management of protected areas

Status of actions taken/in progress
Both Forest and Wildlife Conservation Departments carry out in-service staff training through their respective institutions. The National Wildlife Training Centre (NWTC) at Giritale was established with USAID funds in 1992 and is now well equipped with provisions for Special Diploma Courses for Range officers and Junior Certificate Course for Wildlife Guards. Under the PAM&WC project there has been comprehensive revision of curricula and preparation of course materials with expatriate and local expertise for the NWTC. Additionally, nearly 300 DWCC staff members have been exposed to short-term overseas study tours, 32 have received specific foreign training, five have received overseas diplomas and 2 have received postgraduate training in the UK. The training has covered wildlife conservation and management, ecotourism, community outreach and buffer zone management, adaptive management and habitat enrichment (e.g. fire management invasive species management), wildlife conflict management (e.g. human-elephant conflict), GIS use, data collection and collation, database development and management through technology development, team building, change management and leadership training. Over 100 DWLC officers have been trained on use of GPS. Local training has been facilitated through in-service staff training at Giritale; skills transfer through working with Project Consultants and training workshops. The Sri Lanka Forestry Institute (SLFI) was set up in 1987 with USAID funds to provide in-service training for Forest Department staff. The Sri Lanka Forestry Institute (SLFI) established at Moon Plains in Nuwara Eliya in 1987 with USAID funds offers a two year full-time residential course for Range Forest Officers of the Forest Department a; a one year full time Forestry Certificate Course; and short term training courses in many aspects of forestry, and subject specific training for forestry personnel in technical and sub-technical grades *(relevant for Article 12(a)).* Training on participatory forest management is inbuilt into the FD training curricula. A special short course in forest survey is carried out at the Sri Lanka Forestry Institute for DWLC staff. Tailor made courses are also offered to other institutions on request *(relevant for Article 12(a)* In-service postgraduate training is also provided overseas for those at the Assistant Conservator of Forests (ACF) level. The FRMP provided a revision and improvement of the curricula at for staff training at this Institute. A comprehensive capacity needs assessment for implementing the CBD in Sri Lanka was carried out from 2005- 2006 by the MoENR included assessment of capacity for PA management and recommendations have been provided for the required capacity building.

B.4.9 Goal 3.5 - To strengthen communication, education and public awareness

Status of actions taken/in progress
Through the PAM&WC project, the DWLC laid a foundation for enhanced visitor services and nature tourism within the DWLC. This includes establishment of visitor centres in 7 PAs with interpretive material for visitors prepared with expatriate expertise. Some of this material were prepared by internal staff following staff training. The project has also promoted understanding of importance of PAs among the public by the production of many radio and video programs and other awareness programs. Among these are 20 X 25 minute video documentaries. Workshops on ecotourism and PAs have been held for the private sector. Similarly there have been many initiates under the Forest Department for awareness creation among local communities to promote participatory forest conservation. There are also large number of sector specific recommendations listed under the cross-cutting area of Education and Awareness (BCAP Section 6.8) as well as under forests, wetlands and coastal and marine systems. However, the emphasis so far has been on education for awareness creation, so that there is a considerable need to develop effective and customized Communication, Education and Public Awareness (CEPA) Initiatives that are promoted under the Convention on Biological Diversity to target all stakeholders connected with PAs.

B.4.10 Goals 4.1 – 4.4

Goal 4.1 - To develop and adopt minimum standards and best practices for national and regional protected area systems
Goal 4.2 - To evaluate and improve the effectiveness of protected areas management.
Goal 4.3 - To assess and monitor protected area status and trends
Goal 4.4 - To ensure that scientific knowledge contributes to the establishment and effectiveness of protected areas and protected area systems

Status of actions taken/in progress
Habitat mapping using GIS tools and remote sensing tools has been done for seven PAs managed by the DWLC, and this data are being used for monitoring the condition of protected areas. The DWLC has also built capacity for monitoring PAs through the Baseline Biodiversity Surveys (BBS) carried out in seven PPAs[6] to assess status of biodiversity as represented among mammals, birds, herpetofauna (mainly reptiles), freshwater fishes and vascular plants. The data are entered into a Biodiversity Information Management system and database (using GIS) to be used as a tool to base future management planning and zoning of the PPAs. These surveys pilot tested a scientifically sound and practical method for continual systematic monitoring of biodiversity that can be replicated and applied to other PAs. A similar socio-economic survey has been carried out in the buffer zones of the above PPAs, and this can serve as a baseline for monitoring the socio-economic status of buffer zone communities. A comprehensive database (with GIS) has been set up through the NCR for woody plants, and though less comprehensive, data on some vertebrate and invertebrate groups. This database has been updated by the FD through the FRMP project and made more user-friendly. Forest maps using GIS have been prepared though various projects, all of which is available in the FD database. GPS and computers have been supplied through the FRMP to all range offices of the FD. A Management Information System (MIS) has been installed at DWLC through the PAM&WC Project to track inventory and financial management, ecological monitoring and human resources management with the necessary hardware and software. Most PAs under the DWLC have been provided with internet access to enable information exchange. Databases in the fisheries sector can be of use for management of coastal and marine PAs. The Marine Environment Protection Authority has established a database on environmentally sensitive marine areas (mapped using GIS) via the Institutional Strengthening of Oil Spill Contingency Management Project – Phase 1. However, critical areas such as coral reefs, sea grass beds have not been mapped, and this is perceived as a major deficiency by the MEPA. The National Aquatic Research Agency (NARA) has a meta database for coral reefs, developed by GCRMN and NARA in CD form. The CCD has set up a GIS unit with a database on coastal habitats (with GIS/GPS facilities/equipment, established in 2002) to help the department's functions and decision making for integrated coastal Special Area Management Planning, including conservation and mapping of coastal habitats and identification of coastal land use patterns and sites for future development. This information was used when updating the Coastal Zone Management Plan prepared in 2004.
Research needs of the DWLC have been identified through the PAM&WC project, and research that is vital for PA management have been outsourced through contracts to local research groups, that include university academics and other experts. Examples of such research are (a) the development of low cost electric fencing to address the human elephant conflict and (b) a resource inventory of the Hikkaduwa National Park. The DWLC has also commenced awarding grants from its internal budget to promote field research among DWLC staff through a competitive process. The proposals are evaluated by an expert panel for funding. The partnerships built between PA staff and researchers in local universities and research institutions through the biodiversity surveys have also helped promote a research ethic within the DWLC.

[6] BNP, HPNP, MNP, PWNR, RSNR, UWNP and WNP

B.5 Overview of obstacles for implementing the PoWPA and future needs

This section provides an overview of obstacles to reach the targets of the PoWPA and future priorities to reach the targets successfully.

1.5.1 Obstacles and gaps to be addressed

The BCAP, the Forestry Sector Master Plan and the National Environmental Action Plan recognise the importance of establishing a network of Protected Areas that will comprehensively protect national biodiversity. The Addendum for the BCAP has also prioritised identification of areas that may now be outside the protected area system, due to small size, etc., but nevertheless support important and threatened components of biodiversity.

Currently, estimates for the national system of PAs has reached 15-18% of the land area, but gaps in the coverage of the PA system have been identified by the NCR and the more recent Gap Analysis of PAs in the country for comprehensively conserving national biodiversity and important hydrological features.

The background work needed for establishment of a rational network of PAs has been done through the NCR study, the GAP analysis of the PAM&WC project and institutional programmes of the Coast Conservation Department, the Department of Fisheries and Aquatic Resources, and the Central Environmental Authority. The Department of Agriculture has also identified areas that require protection or special measures to conserve wild and agricultural biodiversity. The ongoing Crop Wild Relatives project (see chapter 3) addresses the need for *in-situ* conservation of wild relatives of crop plants and identification of such areas.

Areas to be considered for protection in Sri Lanka identified through the NCSA process in 2006

Areas high in biodiversity (at ecosystems, species and sub-species levels); biologically important areas with a high level of threats to biodiversity; hydrologically important areas; modified areas (e.g. home gardens, plantations, paddy fields and urban habitats) with very rare, unique and/or endangered small populations of plants and animals -especially endemic species; coastal hot spots with multiple issues (SAM sites) and considerable biodiversity loss; areas under the existing PA system; critically important wetland habitats (including tanks and mangroves); areas rich in crop wild relatives; fisheries management areas declared under the Fisheries Act of 1996; environmental protection areas declared under the NEA; flood protection areas (under the Flood Protection Ordinance); important Soil Conservation Areas declared under the Soil Conservation Act, sensitive areas declared under the Pasture Lands Ordinance, important bird habitats, and areas with unique physical features such as river basins and isolated hills that can support high or unique biodiversity; archaeological and historical sites, culturally significant sites; biologically important landscapes and seascapes; and important animal migration routes and viable patches of vegetation between protected areas.

The NCR carried out by the FD has identified the forests that should be protected to conserve a full complement of indigenous species and endemics, by sampling flowering plants, vertebrates and some invertebrate groups. The Gap Analysis under the PAM &WC project has added more information to select the areas for a PA network.

(Source: NCSA workshop on in-situ conservation using the ecosystem approach)

Many institutions have established PAs under the laws applicable to each institution, but the absence of a coordinated inter-institutional approach for identification and declaration of protected areas is greatly felt, although inter-institutional consultative processes are operational. This has resulted in:

The Gap Analysis of protected areas under the PAM&WC project shows that a large number of land use categories including villages and lands under various state organization are important corridors for wildlife migration. This underscores the need for an integrated approach for declaration of protected areas and for their management.

- Confusing overlaps in jurisdiction of Protected Areas.
- Some areas that are critically important in terms of biodiversity and watershed conservation have not received any form of protection.
- The lack of a nationally accepted approach for pragmatic zoning of areas with conservation value for controlled resource use management, development and strict

conservation.

Among the problems in declaring and managing PAs are:

- Difficulties of maintaining forest connectivity by the use of corridors and other linkages due to private lands lying between PAs.
- Insufficient contact and exchange of knowledge and experiences with appropriate peers among individuals managing PAs due to intangible barriers to communication within and across relevant institutions.
- Individuals at provincial, regional, and local levels (including communities) do not have adequate skills to adopt the ecosystem approach for identifying and managing areas of high biodiversity conservation and sustainable use.
- Most individuals in state institutions managing PAs do not have adequate skills to effectively mobilise provincial, regional and local level support for identification of areas for protection and for adopting the ecosystem approach.

B.5.2 Future national priorities for the Work Programme on PAs at the national level

Priority 1: Implement a multi-institutional coordinated effort to identify, design, establish and manage a rational network of areas needing protection in accordance with the ecosystem approach.

- The current protected area network must be reviewed and revised to eliminate anomalies, to prevent establishing PAs merely increase the percentage of protected area of the country, and promote conserving biodiversity-rich habitats, while permitting a greater degree of sustainable use in others. This requires:
    - considering ecological requirements of species and communities rather than political boundaries.
    - a coordinated approach to establishment and management of PAs among the many institutions that are stakeholders in establishing and managing PAs, as well as local level administration and buffer zone communities.
    - An overarching policy to govern the declaration of PAs by different institutions under various ministries.
    - Use of all available data for prioritising areas for PA establishment.

- The ecosystem approach should be applied for selection of areas for protection, and an integrated approach consonant with this should be adopted for management of the various sites at the landscape level.
- The selected areas should be zoned for different management regimes by different institutions and communities.
- PAs should be identified through wide stakeholder participation that spans scientists, top level administrators and regional and grassroots level representation to base the selection on a sound scientific footing as well as gain local and national support for subsequent management of the PAs.

Priority 2: Build capacity among stakeholders to gain their support for identification and management of PAs

- Capacity should be built among local and provincial level officials, NGOs and CBO representatives (communities) through awareness programmes on the criteria for selection and identification PAs before the participation of regional and grassroots level agencies and communities in the section process.

Priority 3: Ensure continued coordination and monitoring to help resolve recurrent problems between various state institutions that have common jurisdiction over PAs.

Priority 4: Use Communication, Education and Public Awareness Initiative (CEPA) as promoted under the Convention on Biological Diversity for more effective targeting of stakeholders for identification, establishment and management of PAs.

Priority 5: Establish a mechanism to evaluate the impacts of participatory PA management and communication, education and public awareness programmes as relevant for effective management of PAs.

(Source: The NCSA Thematic Assessment Report on Biodiversity, MoENR, 2007)