5 State of the environment, environmental challenges and governance in Sri Lanka

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Introduction

Sri Lanka is a tropical island in the Indian subcontinent. It covers an area of about 65,610 square km and lies between 6° and 10°N latitude and 80° and 81°E longitude. A central mountainous massif with an altitude of more than 2,500 m and a vast plain surrounding it describe the topography of the island. There is significant temporal and spatial variation in the island's climate. The annual temperature in the coastal belt ranges from 26°C while in the central highlands it ranges from 15–19°C. The country is divided into low (<300 m), mid (300–900 m) and up country (>900 m) based on the elevation. The highlands (>1,000 m above mean sea level) constitutes 3 per cent of the land mass. Based on the rainfall received, the island is divided into three climatic zones, the dry (<1,750 mm), intermediate (1,750–2,500 mm) and wet zones (>2,500 mm). The southwest part of the country receives an annual rainfall of 2,500–5,000 mm through the southwest monsoon whereas the vast plains of the northeast part receive an annual rainfall of less than 1,900 mm through the northeast monsoon (MERE 1999; Punyawardane 2008; MERE 2010c). Sri Lanka, despite its small size, has a rich diversity of soils. Nine out of the ten major soil orders based on the US Department of Agriculture (USDA) soil taxonomic system are distributed throughout the country in a mosaic pattern. Fourteen great soil groups have been recognized within the country (Mapa et al. 2010). The coastline of the country is laced with 103 river basins, which end as sand bars, deltas, lagoons, marshes and mangrove swamps. Geologically, Sri Lanka shares with India the South Asian tectonic plate, since the time of the breakup of the Gondwanaland. The variation of elevation, rainfall, temperature and other geological aspects makes Sri Lanka a diverse country in terms of agro-ecological regions (46), bioclimatic regions (six), floristic regions (15) and several types of natural vegetations (Ashton and Gunatilleke 1987; MERE 1999; Punyawardena 2008; MERE 2010c). The occurrence of a wider array of environmental conditions has given rise to numerous living and non-living resource bases which constitute the country's natural capital.

The population of Sri Lanka in 2010 was 20.65 million and the natural increase in population is estimated at 1.1 per cent annually. Sri Lanka is one of the most densely populated countries in Asia. Population density per square km rose from 54 people in 1900 to 139 people in 1956 and to 329 people in 2010. The wet zone, occupying just 24 per cent of the country, is under great pressure, because

it is settled by 55 per cent of the island's population. Thus, population density in the wet zone is much higher (650 people per square km) as compared to the dry zone (175 people per square km). Over 72 per cent of the country's population lives in rural areas, while less than 22 percent of the population is in the urban areas and 6 per cent in upland plantation areas (MERE 1999; UNEP 2001; CBSL 2010, 2011, 2012; Pushpakumara et al. 2012a).

During the last three decades, the country has steadily moved towards an industrialized economy with the development of textiles, apparel and food processing. The Sri Lankan economy registered a strong growth in the last ten years despite the prolonged civil war (ended in 2009) and tsunami in 2004, the deadliest natural disaster in recorded history. Per capita income has increased from US$ 473 in 1990 to US$ 2,836 in 2011, elevating Sri Lanka to the middle income category, although high regional disparities remain. Sri Lanka is in a transition from agriculture to industry and currently the agriculture sector contributes only 12 per cent to the economy as compared to industries (29 per cent) and the service sectors (59 per cent). However 33 per cent of employment is drawn from the agriculture sector while the industry and service sectors provide 24 and 43 per cent of employment respectively (CBSL 2010). The high population density and sustained efforts to improve living standards in the country have exerted tremendous pressure on the natural environment of the country. As a result, during past few decades the resource base has been substantially diminished due to unsustainable use. Therefore, many initiatives from the government, private and other sectors have been undertaken to promote sustainable development in the country.

Scope, coverage and objectives

The main objective of this chapter is to provide an up-to-date insight on the state of the environment and environmental challenges and governance in Sri Lanka. The next section offers a brief overview of the state of the natural resources of the country followed by a section on emerging environmental challenges and their impacts. This is followed by a section on the state of the environmental governance in the country including the institutional setup and the legal framework. Finally recommendations and policy suggestions are given based on the analysis undertaken.

State of natural resources

The natural resource base of Sri Lanka consists of lands, biodiversity, forests, minerals and water resources. The status of each of these natural resources is briefly discussed below.

Lands

Land is the most vital and heavily threatened natural resource in Sri Lanka (MERE 1999). The total land area of Sri Lanka besides the area occupied by inland waters is only 6.44 million ha. The land–man ratio is low, which is only 0.37 ha/person, however, after allowances are made for forest cover, steep and

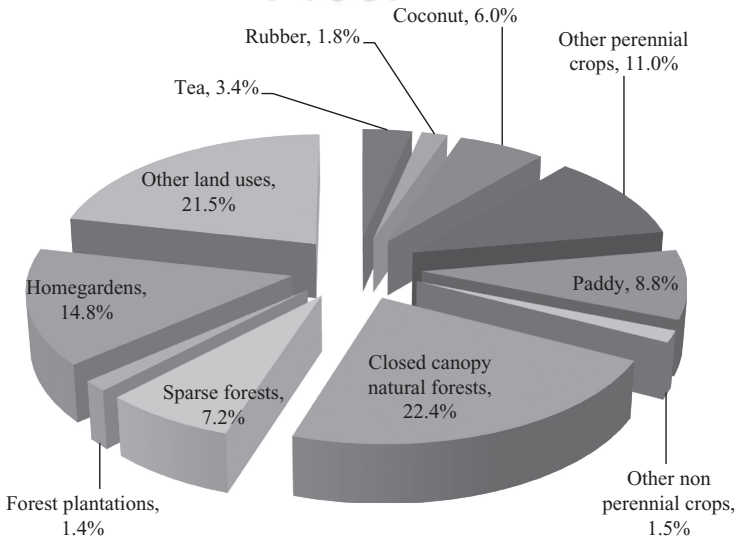

Figure 5.1 Agriculture and other land use categories in Sri Lanka
Source: DCS (2011)

barren lands, urban and rural dwellings, only about 2.5 million ha (nearly 39 per cent of the total land area) is available for further settlements and agricultural production. Thus, the per capita extent of croplands is as small as 0.14 ha. The majority of land area of the country is rain-fed and is in the dry zone. This explains why the competition for land is severe among the sectors using it. The major land use sectors in the country are agriculture (paddy, tea, rubber, coconut and other perennials, non-perennial crops), close canopy and sparse forests, homegardens and others as illustrated in Figure 5.1 (DCS 2011). Spatial differences of land use can be observed in Sri Lanka; in the dry zone only 30 per cent of land is utilized. In contrast, in the wet zone utilization of land has reached its peak with more than 80 per cent and there is hardly any room for expansion. Forest covers around 9per cent of land area of the wet zone.

Biodiversity

The island exhibits a wide range of terrestrial and freshwater ecosystems which carry a high biodiversity. Sri Lanka along with the Western Ghats of India is regarded as one of the global biodiversity hotspots in the Asia–Pacific region (Conservation International 2007). The ecosystem diversity extends from forest ecosystems to coastal and marine ecosystems, which include all wetlands and other agricultural ecosystems within the country (MERE 2011). Among the terrestrial ecosystems the richest in biodiversity are tropical lowland rain forests, which refuge 90 per cent of the endemic woody plants and 75 per cent of the endemic animals (MERE 2011).

The species diversity per unit area in Sri Lanka is the highest in the Asian region particularly among flowering plants and all vertebrate groups except birds (NSF 2011). In terrestrial and freshwater ecosystems fresh water crabs (98 per cent), amphibians (85 per cent) and land snails (83 per cent) show the highest endemism (MERE 2012). Many components of biodiversity are vital to meet the consumptive and economic needs of the country and conserved biodiversity would provide a wide range of ecosystem services that include providing fresh water, improving the climate, reducing soil erosion, regulating surface runoff and providing bio-resources for subsistence use as well as domestic and export-oriented market services (NSF 2011).

Forests

According to most recent estimates, Sri Lanka's forest cover is 29.6 per cent of the land area, with closed canopy natural forest amounting to 22.4 per cent (MERE 2010b). The total area of dense natural forests in the country is 1,675,000 ha of which 167,000 ha are identified as primary forest, while the remaining area is categorized as naturally regenerated forests (Table 5.1).

Eighty-six per cent of the natural forest is located in the dry and intermediate zones of the country, and these areas contain about 85 per cent of the closed canopy forests and 90 per cent of sparse (open) forests in Sri Lanka. Almost all the natural forests of Sri Lanka are owned, managed and protected by the state Forest Department (FD) or the Department of Wildlife Conservation (DWLC). Forest resources owned by other sources are minute and negligible. Due to the policy changes of the government of Sri Lanka on exploitation of natural forests, a logging ban in natural forests was imposed in 1990 and it is still continuing. The forests, which were subjected to felling prior to 1990, are now in an advanced regeneration stage and are managed purely as conservation forests. Land fragmentation and degradation, environmental concerns of logging and consideration of conservation and sustainable use are the major driving forces behind the change from exploitation to conservation (FD 1995). A change to this policy is not to be anticipated in the near future. Natural forests are thus mainly used for nature conservation, ecotourism activities, Reducing Emissions from Deforestation and forest Degradation (REDD+). The production orientation has changed to protection orientation. Other than natural forests and forest plantations, genetic resources of forest trees are also managed outside natural forests. In this respect, homegardens; coconut-based, tea-based and rubber-based agro-forestry

Table 5.1 Changes of area of primary, naturally regenerated and planted forests in Sri Lanka

Main forest characteristics	*Area (000 ha)*			
	1990	*2000*	*2005*	*2010*
Primary forests	257	197	167	167
Naturally regenerated forests	1,851	1,664	1,571	1,508
Planted forests (forest plantations)*	–	–	–	79.4

Sources: *FD (2009); FRA (2010)

systems; and other agricultural landscapes play a dominant role (FD 1995; Ariyadasa 2002; Pushpakumara et al. 2012b). About 70 per cent of the supply of construction and industrial wood comes from homegardens, rubber and coconut plantations and trees planted along boundaries, on roadsides and urban areas.

Minerals

Minerals and rocks in Sri Lanka can be classified under several categories of economic geology. Economic minerals are classified into four major groups: energy minerals, the ferrous and ferro-alloy group, the non-ferrous group and the non-metallic group. Energy minerals, uranium, uranite, thorite (the silicate of thorium), thorianite (the oxide of thorium) and monazite have been found in Sri Lanka (Herath 1975).

Magnetite, hematite and iron oxides are the most common minerals found in the island and the recently found magnetite-hematite deposit at *Wellawaya* is one of the best ferrous and ferro-alloy mineral deposits in Sri Lanka. Forty per cent of the copper-magnetite deposit at *Seruwawila* is considered as iron while 2 per cent is estimated as copper. Sri Lankan beaches are rich with mineral sands such as ilmenite, rutile, monazite, zircon, garnet and silica. The largest deposit of mineral sands (ilmenite, rutile and zircon) is found in *Pulmoddai.* The silica sand deposit at *Madampe* and *Naththandiya* is used for the glass industry. Non-metallic minerals such as feldspar, gems, apatite, graphite, mica, quartz and halite are widely excavated. Three main types of clays (kaolinite, ball clay and brick clay) are used to produce domestic and export goods. Further, graphite in Sri Lanka is of high purity in carbon (99 per cent), which occurs as massive veins in rocks. Major mines are in *Kahatagaha-Kolongaha* and *Bogala*. The *Eppawala* apatite deposit has been estimated at 40 million tonnes of phosphate. However, this phosphate has a very low water solubility and a concern of many chemists and geologists has been finding a method to increase its water solubility. Silica rich (100 per cent) high-quality quartzite is found in many places of Sri Lanka, such as *Galaha, Wellawaya, Ambalamana* and *Akarella.* Mining vein quartz produces a lot of weather-resistant waste material.

The recovery of gems in Sri Lanka has over 2,000 years of history. Sri Lanka has long been recognized for varieties of corundum, chrysoberyl, spinel, garnets, beryl, tourmaline and zircons. Sri Lanka is the largest producer of gem varieties per square kilometer in the world. The gem trade accounts for nearly 60 per cent of the five mineral-based, foreign-exchange earning industries of Sri Lanka (Kuo 2003).

Water resources

There are 103 distinct rivers that begin from the central highlands and flow radially towards the sea. Their basins cover 90 per cent of the island. The southwest quarter of the island has seven major basins and the *Mahaweli* River is the largest basin with a catchment area of 10,448 square km. Only 17 of the 103 basins exceed 1,000 square km. The total runoff in Sri Lanka is estimated at 49.2 km^3/year (NARESA 1991).

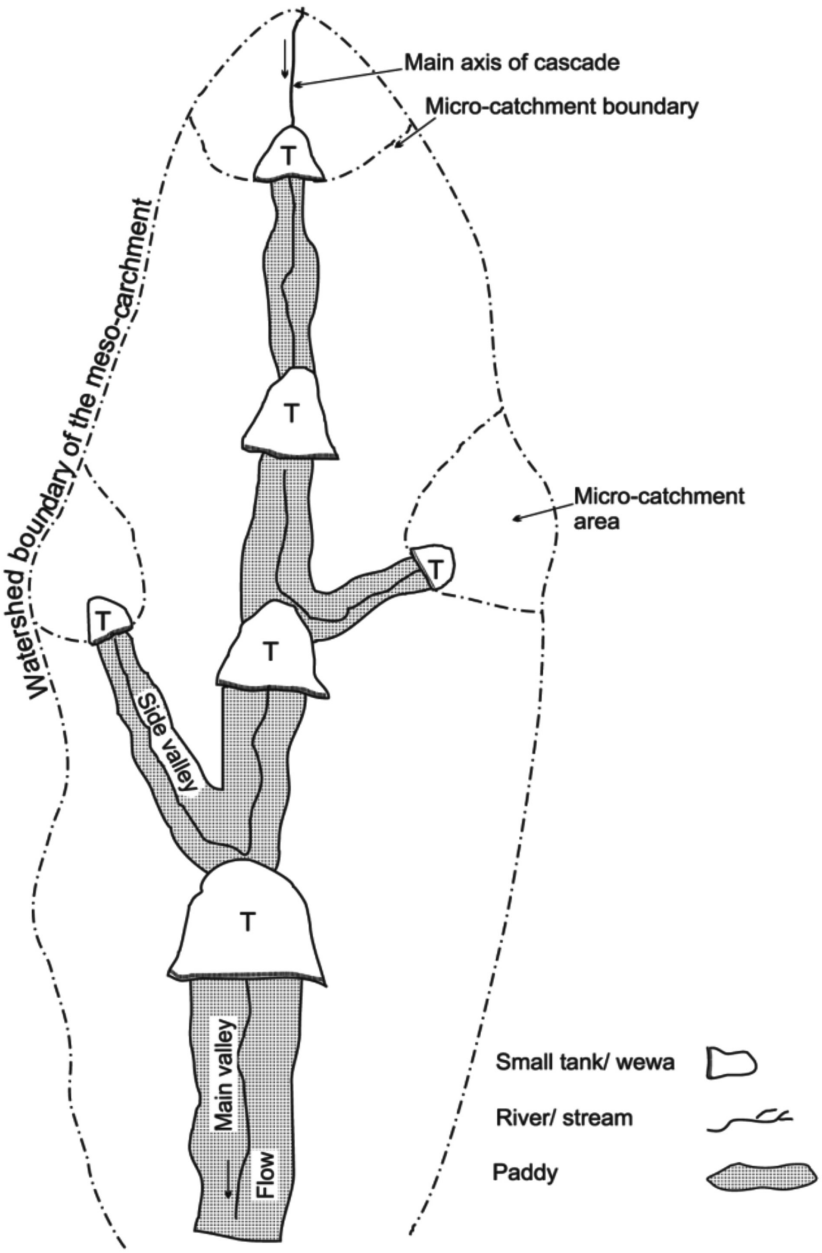

Figure 5.2 Representation of the tank cascade system in Sri Lanka
Source: DCS (2011)

The dry low-lying plains of Sri Lanka were irrigated mainly for lowland paddy farming with an interconnected mini-watersheds referred to as the Tank Cascade System (Figure 5.2). This is a traditional micro- (or meso-) watershed management system that retards negative consequences from chronic and recurrent droughts, seasonal flooding, land degradation and enhances food security while attaining self-sufficiency in rice production. The average tank density is one tank per 2.6 square km and about 30,000 tanks have been built in the land area of about 40,000 square km of the dry zone.

During the post-independence era, a series of multipurpose reservoirs were constructed, and the Victoria Reservoir is the largest with a storage capacity of 0.73 km^3. The gross theoretical hydropower potential in Sri Lanka is estimated at 8,000 GWh/year mainly from large- to small-scale reservoirs.

Groundwater resources are characterized by six aquifer categories based on the base material (Panabokke and Perera 2005). Shallow karstic aquifers in *Jaffna* Peninsula are considered high yielding aquifers due to sink holes, caverns and stream passages in the Miocene limestone. Coastal sand aquifers are very vulnerable to any contamination due to high transmissivity of the system.

Sri Lanka's coastline circles along about 1,585 km of sandy beaches, extensive lagoons, estuaries, mangroves, costal marshes and sand dunes. Two types of estuaries are found in Sri Lanka: a basin estuary where the river discharges into a basin and then the basin connects with the sea, while a riverine estuary has the river directly discharge to the sea. The large and small lagoons that can be found along the coastline have high concentrations of nutrients and are therefore highly productive in terms of fishes and prawns.

Emerging environmental challenges and impacts

The Ministry of Environment has identified land degradation due to soil erosion, depletion of coastal resources, loss of biodiversity, waste disposal and inland water pollution as key environmental issues in Sri Lanka (MERE 2010a). UNEP(2008) has identified climate change, food security, water security, energy security and urbanization as main environmental issues in South Asia. MERE and UNEP (2009) have drawn attention to key environmental concerns under seven broad categories such as urbanization, management of solid waste, biodiversity conservation, land degradation, freshwater and marine resources, abatement of air and noise pollution, and energy conservation. MERE and UNEP (2009)have further highlighted that accessibility to safe drinking water, basic sanitation, improving the living standards of slum dwellers and waste management are the primary considerations of the Sri Lankan government. Environmental safety issues are further imperative due to: the land mines in Northern and Eastern parts (MERE and UNEP 2009) and increasing vulnerability to landslides in the central highlands of the country (DMC and UNDP, 2009). Since Sri Lanka is in a transition from an agricultural to industrial economy, the country will face many production-related environmental issues in the future.

Environmental pollution

Air pollution poses a serious problem in urban areas with rapid urbanization and industrialization. Continuous air quality monitoring at different locations show that air pollution is increasing, as explained by Illeperuma (2000). Ozone, SO_2 and fine particles exceed World Health Organization (WHO) standards in major cities such as Colombo and Kandy. In most cases, dust fall exceeded 0.3 mg/100 square cm/day (Illeperuma 2000). Detailed studies on this domain are scarce and, therefore, a definite conclusion cannot be drawn.

Water pollution in Sri Lanka is broadly from natural and anthropogenic activities such as industries and agriculture. Frequent algal blooms are reported in inland tanks and reservoirs due to eutrophication. The causes are discharge from hospital and organic waste, and sewage (Illeperuma 2000). Large quantities of agricultural and industrial chemicals are released to natural water sources. Textile, paint, tanning, fertilizer and food industries and landfill leachate discharge the wastewater directly into the water bodies, without pre-treatments.

The excessive use of pesticides and fertilizer contaminate groundwater and surface water sources (Weerasooriya et al. 1982; Dissanayake et al. 1987; Illeperuma 2000; Jayasekera et al. 2011; Wijesekara et al. 2011). High nitrate concentrations due to excessive use of fertilizer and sewage contamination have been reported from *Jaffna, Batticaloa* and *Kalpitiya* aquifers, leading to a high incidence of cancer patients (Maheswaran and Mahalingam 1983; Kuruppuarachchi 1995; Jayasekera et al. 2011). Coastal groundwater is threatened due to its high vulnerability to contamination by various sources (sewage from population increase, sea level rise, industrial effluent and landfill leachate and overuse of agro-chemicals).

Groundwater pollution in Sri Lanka is mainly due to the natural contamination of waters by weathering and dissolution of different ions (Dissanayake 2005). Fluoride is one of the predominant groundwater pollutants reported in the dry zone of Sri Lanka that exceeds WHO standards for drinking water. High hardness and excessive iron is reported in deep groundwater wells in the dry zone of Sri Lanka (Dissanayake 2005). The occurrence of Chronic Kidney Disease with unknown etiology (CKDu) and dental fluorosis in the dry zone of Sri Lanka are caused by an array of anomalies in groundwater and foods.

Several issues have arisen with water pollution in Sri Lanka, such as: a) only few water quality parameters are monitored, b) monitoring of toxic heavy metals and organic pollutants is almost absent (Illeperuma 2000), c) a database for drinking water sources is not maintained, d) assessments on climate change impacts on coastal groundwater, demographic changes, saline water intrusion, water mining and pumping rates are scarce and e) research on water and public health is inadequate.

Land degradation and deforestation

The soil erosion, loss of soil fertility, salinization and water logging in irrigated lands of the dry zone and intensive farming in steep slopes have resulted in land degradation (MERE 2002b). The main manifestations of the land degradation

issue are loss of arable lands, decreasing agricultural productivity, loss of irrigation and hydropower generation capacity due to siltation of reservoirs and intensification of natural hazards (MERE and UNEP 2009).

Despite the soil conservation act in operation, poor soil conservation methods and insecurity of tenure in agricultural lands preclude the permanent investment in soil conservation. Poor water management, lack of awareness on land degradation, high demand for agricultural lands, drought and uncertainty of rainfall, failures of land-use policies, lack of government incentives and inadequate capacity of governmental organizations to implement a systematic program on conservation as well as loss of forest cover, shifting cultivation, landslides, exposure of building sites and road cuttings, gem and clay mining etc. have been identified as direct causes for soil erosion (MERE 2002a).

Though the current status of deforestation is minimal, during the last century the forest cover was depleted substantially, due to forest clearing for irrigation, agriculture, settlements, hydropower generation, timber extraction and shifting cultivation (MERE 2002a). The population increase and per cent change in forest cover up to 1999 show an inverse relationship during the last century (Figure 5.3). Gunawardane (2003) has reported that shifting cultivation, expansion of tea plantations, gem mining, illegal logging, encroachment and hunting are the main threats faced by the forests in the wet zone.

Climate change impacts

Sri Lanka is a negligible contributor to global warming compared to developed countries but it is highly vulnerable to the impacts of global climate change. The national climate change adaptation strategy for Sri Lanka (MERE 2010b) has

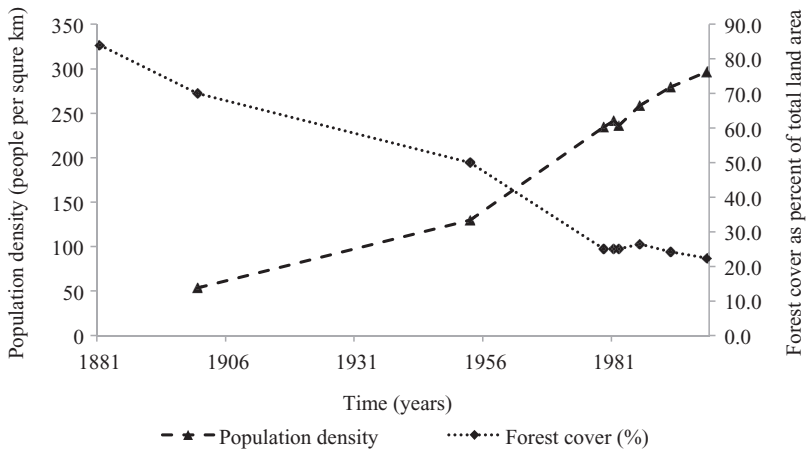

Figure 5.3 Change in the forest cover and population density during the last century in Sri Lanka

Source: Gunawardane (2003)

identified several key implications, namely: a) an increase in the frequency and intensity of disasters such as droughts, floods and landslides, b) variability and unpredictability of rainfall patterns, c) increase in temperature and d) sea-level rise. The natural resources in the country would be vulnerable for climate change particularly on a) land degradation due to extreme weather events, natural hazards and soil erosion that cause loss of soil fertility and agricultural productivity, b) changes in water quality and quantity in inland freshwaters, c) degradation of vegetation in watersheds, d) changes in terrestrial, wetland, marine and maritime ecosystems, their species and ecosystem services, due to changes in rainfall regimes, rising temperatures, ocean acidification and sea-level rise and e) changes in growth and reproduction rates, geographic ranges of species and phenology of plants (MERE 2010b).

Climate change would be one of the reasons to lose a large proportion of agricultural lands in the dry northern and eastern regions and cool central highlands (Seo et al. 2005). Climate change predictions demonstrate an increase in tropical dry forest (7–8 per cent), tropical very dry forests (5 per cent) and a decrease in tropical wet forest (2–11 per cent) (Somaratne and Dhanapala 1996). The tea sector is highly vulnerable to predicted climatic changes, and this subsequently leads to economic, social and environmental problems (Wijeratne 1996). Recent studies show that the paddy water requirement would be increased by 13–23 per cent, threatening the more than 72 per cent of the population whose staple food is rice (De Silva et al. 2007).

Degradation of biodiversity

Although Sri Lanka is rich in biodiversity according to the National Red List 2012, many of the endemic flora and fauna are under threat of extinction (Table 5.2). The highest threatened groups are amphibians and mammals, and among vertebrates, 21 species of endemic amphibians have not been recorded during last century and thus are considered as extinct.

Among the inland indigenous vertebrates recorded to date, 223 (30 per cent) species have been categorized as nationally threatened, of which 138 (62 per cent) are endemic to the country. Of the surviving inland vertebrates, 57 species are critically endangered and currently facing an extremely high risk of extinction in the wild. Poaching, habitat loss and change, forest fragmentation, overexploitation of species, spread of alien invasive species, environmental pollution and climate change have been identified as major reasons for the extinctions in the wild (IUCN and MERE 2007; MERE 2012).

Most of the threatened species are found in the wet zone where the population density is high (MERE 2010c). Meegaskumbura et al. (2002) has highlighted that measures to preserve Sri Lanka's amphibian diversity should include preservation of remaining forest fragments as well as habitat restoration. Also populations of bees and wasps have declined that are important pollinators, which could affect the agro-biodiversity. Further it is reported that the extensive use of fertilizers and pesticides has affected forest and wetland flora and fauna (MERE 2010c).

Table 5.2 Threatened inland vertebrates and selected plant categories of Sri Lanka

Taxonomic group	*Critically endangered*	*Endangered*	*Vulnerable*	*Total*
Pteridophytes	42 (10)	88 (11)	70 (12)	200 (33)
Angiosperms	218 (102)	552 (272)	615 (220)	1385 (594)
Spiders	41 (13)	21 (10)	–	62 (23)
Freshwater crabs	34 (34)	12 (11)	–	62 (45)
Dragonflies	26 (21)	18 (14)	17 (4)	61 (39)
Ants	25 (5)	18 (3)	16	59 (8)
Bees	48	38	20	106
Butterflies	20 (3)	40 (10)	36 (8)	96 (21)
Land snails	76 (66)	66 (62)	23 (20)	165 (148)
Freshwater fish	19 (16)	19 (17)	5 (4)	43 (37)
Amphibians	34 (34)	28 (27)	10 (9)	72 (70)
Reptiles	38 (36)	51 (40)	18 (11)	107 (87)
Birds	6	18 (7)	30 (9)	54 (16)
Mammals	13 (4)	24 (8)	16 (3)	53 (15)

Source: MERE (2012)

Waste and waste disposal

The management of Municipal Solid Waste (MSW) is a critical environmental concern in Sri Lanka. Recent studies report that daily generation of MSW is 3,700 tonnes in Sri Lanka. The daily generation of MSW in the western and central provinces is1,660 and 230 tonnes/day respectively (Menikpura and Basnayake 2009; MERE 2009). MSW is comprised of biodegradables (70 per cent), plastics (6 per cent), metals (3 per cent) and construction and demolition waste (4per cent) on weight basis (Menikpura and Basnayake 2009). The open dumpsites are the main disposal method of MSW in Sri Lanka. Local authorities maintain many open dumpsites while the western province itself has around 60 open dumpsites (MERE 2002b). However, only a few institutions practice composting, anaerobic digestion, incineration and recycling to produce compost, biogas, electricity and the recovery of valuable materials (Ekanayake et al. 2005). A comprehensive action plan and infrastructure are not available for disposing MSW, which has created a series of environmental hazards.

Many open dumpsites are located in lowlands such as marshy lands, paddy lands or highlands close to natural drainages, where leachate is discharged, which pollute groundwater (Menikpura and Basnayake 2009). Air pollution due to burning and anaerobic decomposition of waste cause smell nuisance and contribute to global warming by emitting CH_4 and CO_2 into the atmosphere. Further landfill liners have not been used in all dumpsites and therefore, leachate percolation pollutes the groundwater. Pollutants from the landfill sites have been characterized in a few studies (Wijesekara et al. 2011; Sewwandi et al. 2012) that

explain the leachate is highly contaminated with nitrates, phosphates and heavy metals.

Mining impacts on the environment

Rupasinghe and Cooray (1993) have explained the environmental impacts of gem mining in Sri Lanka, which is the main cause for soil erosion and sedimentation in *Ratnapura* district. Moreover, tunnel mining causes land subsidence and accumulated water in open mines acts as sites for breeding mosquitoes. Mechanical mining in riverbanks degrades riverine ecosystems. Decreased oxygen levels due to high-dissolved solids and turbidity alter the freshwater habitats. The environmental degradation from mechanized mining, however, is far more than that caused by traditional mining techniques.

Sand mining takes place in many downstream rivers such as the *Mahaweli, Kelani, Kalu, Nilwala* and *Maha Oya* Rivers etc. Sand from rivers is necessary to maintain the sandy beaches of Sri Lanka, which attract many foreign tourists. Therefore sand mining in rivers affects the development of sandy beaches and thereby leads to coastal erosion. Uncontrolled sand mining can collapse riverbanks, which leads to seawater intrusion. It is reported that the intrusion of sea water into the *Nilwala* and *Kelani* Rivers up to 8–10 km from the river delta has caused salinization of drinking water and a change in electrical conductivity up to 2,500 micro Siemens per centimeter (Piyadasa and Naverathne 2008).

Corals are intensively mined in the southern coast of Sri Lanka for quality limestone and ornamental reefs. These coral reefs reduce the effect of the wave and its destructive force during tsunami events such as in 2004. However, few research works have been carried out in this field of study (Kumara et al. 2005). Coral mining has increased coastal erosion along the west coast, south of Colombo and along the south coast of Sri Lanka (Wilhelmsson 2002). The low availability of larval influx, deteriorating environmental conditions (e.g. increased level of sedimentation) and competition with fast growing algae, caused by mining activities, would further retard the recovery rate of coral reefs and ultimately reduce tourists' footfalls (Kumara et al. 2005).

State of environmental governance

Environmental governance in Sri Lanka has drawn attention for its long history of more than 2,500 years, beginning with the establishment of the *Mahameuna* sanctuary in the third century BC. During the colonial era the island's forest cover was scarified to the expansion of plantation agriculture and the process resulted in adoption of strong legal framework and the institutional setup for environmental management and conservation.

The constitution of the Democratic Socialist Republic of Sri Lanka (1978) identifies protection of the environment as a responsibility of every citizen. Promotion of economic development, alleviating poverty, and provision of a quality life are the primary challenges faced by the Government of Sri Lanka.

For meeting these challenges, the government has identified that the environment should be safeguarded and natural resources should be wisely used to achieve sustainable development (MERE 2008). The National Conservation Strategy, which was ratified by the Government of Sri Lanka in 1988 and followed by an action plan prepared by the Central Environment Authority, was the first formal initiative made by the state. A list of environmental legislations that have direct and indirect impacts on the environment are given in MERE and UNEP (2009).

Environmental policies

In Sri Lanka around 82 per cent of the land is under some form of state control (MERE 1999; Sathurusinghe 2008). The National Environmental Policy was adopted in 2003, which aims to promote the sound management of Sri Lanka's environment balancing the needs for social and economic development and environmental integrity. The National Forest Policy (1995) enables the protection of remaining natural forests while increasing the tree cover. Major aims are to conserve biodiversity, soil and water resources. The National Wildlife Policy (2000) aims to conserve wildlife resources through promoting conservation, maintaining ecological processes and life sustaining systems, managing genetic diversity and ensuring sustainable utilization and the sharing of equitable benefits arising from biodiversity. Many related policies, such as the National Air Quality Management Policy (2000), National Watershed Management Policy (2004), Cleaner Production Policy (2004), National Biosafety Policy (2005), National Policy on Wetlands (2005), National Policy on Sand as a Resource for the Construction Industry (2006), Biodiversity Conservation in Sri Lanka: Framework for Action (2009) and the Action Plan for the *Haritha Lanka* (Green Sri Lanka) Program[1] (2009) have also been introduced.

Regulatory institutions

Sri Lanka has a diverse set of institutions with direct and indirect responsibilities on environmental policymaking. Various mandatory powers are decentralized from central government to regional institutions by the constitution originally and through amendments done later. The National Environment Act (1980) had the basic provisions to setup the Central Environmental Authority, which has the vision for a clean and green environment through service excellence and, is the main regulatory arm and coordinating agency of protection and management of the environment. A separate ministry for caring for the environment was established in 1991 and with that many environment-related institutions were clustered to this central body (MERE and UNEP 2009).

Conclusions and policy suggestions

Sri Lanka is now undergoing a transition to emerge as an industrial economy with a growing service sector. With this development, it is imperative to change the environmental concerns from poverty-related issues to production and

consumption-related issues. Detailed sectoral studies are the need of the hour to identify the evolutionary trajectories of environmental issues under Sri Lankan conditions. The following steps would play a crucial role in this context.

Accountability for the use of natural resources

Both the government and private sectors are responsible for the environmental degradation in the country. Agricultural and industrial pollution could be addressed though suitable polluter pays schemes and awareness programs. The accountability of resource use could be increased by improving all levels of curricula and increasing the access to higher education.

Effective way of low enforcement

Development projects are expected to follow a regular Environmental Impact Assessment (EIA) process and implement their recommendations. However, there are number of loopholes in existing regulations that make it difficult for law-enforcing authorities to bring the violator to the court. Whatever the situation, the government is responsible for strengthening the existing legislations with higher fines, formulating sound regulations for improving enforcement.

Conservation of biodiversity

The necessary policy setup and legal framework is properly established but biodiversity degradation will continue if necessary remedies are not introduced immediately. The conservation should be based at field level while improving the awareness and attitudes of all stakeholders. An immediate action to protect the nationally threatened flora and fauna is of paramount importance.

Institutional reforms

The entire administration system requires a comprehensive reform with special reference to the use of information technology in public management, low enforcement, procurement and institutional standards. The departmental-level management is now completely outdated. There should be performance-based promotion schemes and rewarding structures in public governance.

Note

1 The Action Plan for the Haritha *Lanka* Programme has been developed to function as the national platform and policy for achieving sustainable development in Sri Lanka. This policy integrates provisions in the Caring for Environment 2009–2013, National Strategy for Sustainable Development in Sri Lanka.

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