

Representatives of nature conservation and ecotourism in different biomes of Sri Lanka

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4 figures and 7 tables

Abstract

BREUSTE, J.; JAYATHUNGA, S.: Representatives of nature conservation and ecotourism in different biomes of Sri Lanka. – *Hercynia N. F.* 43 (2010): 257–276.

Tourism in nature-based destinations is prominent in many countries where mass tourism takes place. The study focuses on the representatives of nature conservation and ecotourism in all biomes of Sri Lanka. It aims at the investigation of nature conservation strategies adopted and of which ecosystems are highly utilised for tourism. Simultaneously, the representation and interaction between biomes, nature conservation strategies and ecotourism are evaluated in order to identify the influence and effectiveness of each other. Digital maps show the defined biomes in the different bioregions. The bioregions are demarcated in accordance with geographical, climatical and biological features and characters. Major biomes identified in the country are forest, wetland, coastal and marine biomes. The management categories of nature conservation, namely strict nature reserves, nature reserves, national parks, marine reserves, sanctuaries, natural forests and wetlands are evaluated in accordance with their objectives, efficiency and effectiveness. Activities of nature-based tourism take place in different biomes like jeep safaris, nature trekking and boating and are categorised in different aspects as wildlife watching, bird watching and nature admiring.

The study shows the dominance of state involvement in nature conservation in different kinds. Many nature conservation strategies are concentrated on forest biomes. Nature-based tourism is not equally distributed among all biomes and is mainly focused in the forest biomes in the dry-zone bioregion. In this bioregion, many national parks are situated and infrastructure for tourism has been developed. In other biomes is much more potential available for promoting tourism. A physical study should be conducted to determine what the reasons and constraints of the actual situation are as well as to answer the question what other biomes offer potential for further expansion and development of ecotourism in terms of nature conservation and socioeconomic development of the local people.

Key words: ecotourism, nature conservation, bioregions, protected area, national parks

1 Introduction

Nature conservation is not a new concept in Sri Lanka. It goes back twenty-five centuries, when the King Devanampiyatissa established the world's first wildlife sanctuary in the 3rd century BC (MAHAVAMSA—THE GREAT CHRONICLE OF SRI LANKA). The basic concept of nature conservation and its management is as old as the recorded history of the country, dating back over 2,000 years. When the monarchs of old proclaimed edicts for the preservation of wildlife in defined areas, they were, in today's context, establishing "protected areas". When the village communities systematically organised their landscape, with the irrigation tanks and cultivated areas in the low-lying land, the settlements and higher levels, and the catchments in the hilly areas, left under forest, they recognised the environmental value of conserving the natural forest in the catchments (MEF 1998).

The country, though small in size (65,610 km²), has a varied climate and topography which has resulted in a rich biodiversity, distributed within a wide range of ecosystems (MEF 1998). The high diversity of ecosystems has provided habitats for a rich species diversity and for edaphic and climatic variants of indi-

vidual species, particularly among the plants. The country is highly dependent on its biological resources to sustain its economy, making it incumbent upon us to make very serious note of the threats to its indigenous biota and to the natural ecosystems which they are a part of (MEF 1998).

An important feature of the climate is that there are mainly two basic ecozones. This is due to the position of the central mountains, which intercept the monsoonal winds. This has created an ever-wet region in the southwestern quarter of the island and a rain shadow in the remaining area. Since these demarcations are not sharp, but grade off from one to the other, it is customary to recognise an intermediate transition zone termed the intermediate zone. Small sections to the northwest and southeast which escape the monsoons have a climate that approaches arid conditions (Fig. 1). Within this broad differentiation of climate types, there is a multitude of ecosystems. Among these terrestrial ecosystems forests are varying from wet evergreen forests to dry thorn forests, grasslands and a complex network of rivers, wetlands and freshwater bodies. These ecosystems constitute, together with the marine ecosystems such as sea-grass beds, coral reefs, estuaries and lagoons, and associated mangrove swamps, the panorama of natural ecosystems in the country (MEF 1998). These contrasting ecosystems make Sri Lanka a haven for nature lovers who want to do exploring to their heart's content.

2 Target and methodology

The main targets of the paper are:

- Defining biomes representing the full range of highly diversified natural ecosystems of the country.
- Evaluation of nature conservation policies and strategies in terms of nature conservation and the ecological set-up of the country.
- Evaluation of ecotourism activities in different biomes and comparison of representatives of biomes with ecotourism activities taking place.

Methodology. The first phase of this paper is the formulation of a comprehensive literature review on biomes of the world and biomes, bioregions, nature conservation, protected areas, tourism in nature-based destinations in Sri Lanka was done to define the biomes in representing the full range of highly diversified natural ecosystems of the country. Materials such as books, magazines, journals, scientific papers, policy documents and reports, internet websites and maps were used to describe the concept and evaluate the findings. Bioregions, different ecosystems (biomes) and protected areas (national parks) of the country were mapped and over there ecotourism taken place is incorporated. The institutional structure and the legislative set-up of the natural resource management of the country were evaluated to elaborate the ways and dimensions of intervention for nature conservation.

The bioregions of the country were divided into fifteen regions based on the topographical and ecological conditions, out of them seven as inland (arid zone, dry zone, intermediate zone, lowland wet zone, sub-montane midlands, wet highlands, intermediate highlands) and eight as coastal and marine (Mathiraveli to Mulativu [mineral sands], Panama to Kathiraveli [eastern lagoon systems], Tangalle to Panama [wildlife habitats], Hikkaduwa to Tangalle [near-shore coral beds], Chilaw to Hikkaduwa, Kandakuliya to Chilaw [western marshes], Mannar to Kandakuliya [large off-shore coral beds], Mullative to Mannar [limestone beds]) (MEF 1998). Because these eight regions have similar ecological characters and geographical features, they were combined for this study to one region, namely the coastal and marine bioregion.

Ecotourism means responsible travelling to fragile, pristine, and usually protected areas that strives to be low impact and (often) small scale. It aims to educate the traveler, to provide funds for conservation, to directly benefit the economic development and political empowerment of local communities, and to foster respect for different cultures and for human rights. Ecotourism is held as important by those who participate in it, so that future generations may experience aspects of the environment relatively untouched by human intervention (HONEY 2008).

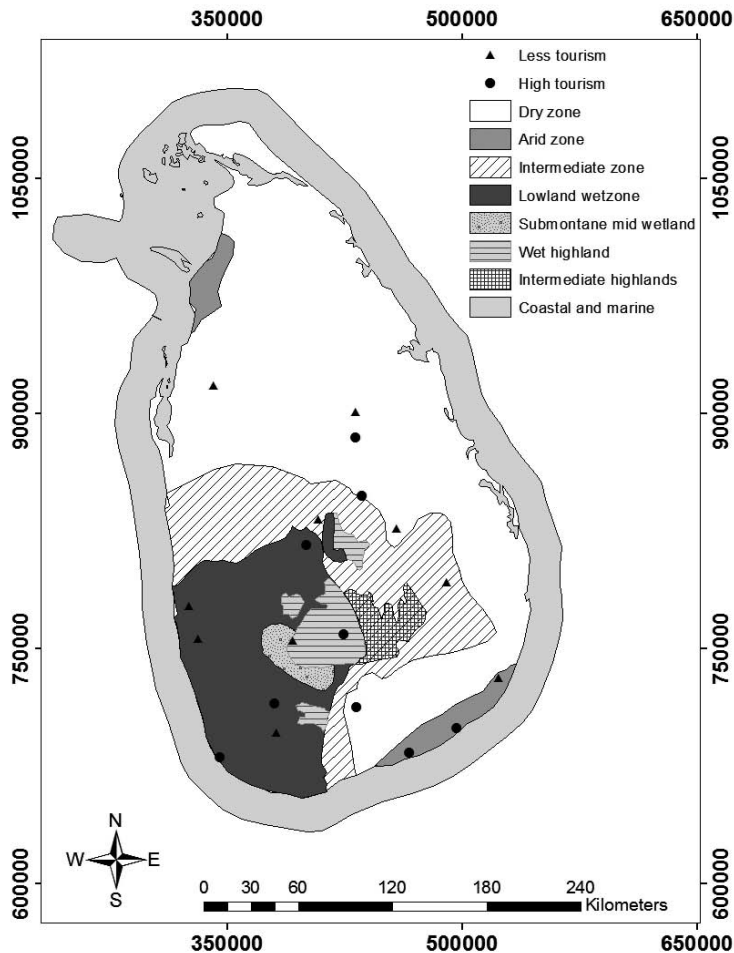


Fig. 1 Bioregions and nature-based tourism distribution in Sri Lanka (Source: SOMASEKARAM 1997).

Abb. 1 Die Verteilung von Bioregionen und naturnahem Tourismus in Sri Lanka.

Accordingly it was identified in this paper where the tourism takes place in different nature-based destinations in Sri Lanka and the tourism was classified as jeep safaris, nature trekking and boating and in the purpose of visiting like wildlife watching, bird watching and nature admiring. A geophysical map was prepared by dividing the country into eight bioregions, namely the arid zone, the dry zone, the lowland wet zone, the intermediate zone, the sub-montane midlands, the wet highlands, the intermediate highlands and the coastal and marine zone with reference to the climatic and geographical features and characters (Fig. 1). It apparently reveals that the representatives of nature conservation in different biomes and bioregions with specifying types of ecotourism how distributed among diversified ecosystems of the country.

Tab. 1 Bioregions and its climatic and biological characters in Sri Lanka (Source: MINISTRY OF ENVIRONMENT AND FORESTRY 1998).

Tab. 1 Die klimatischen und biologischen Charakteristika von Bioregionen in Sri Lanka.

Bioregions	Climatic features and biological characters
Arid zone	Altitude 0–100 m. Annual rainfall less than 1,250 mm, mainly from Oct.–Jan. More than five dry months with less than 50 mm rainfall. Tropical thorn scrub vegetation with isolated trees.
Dry zone	Altitude 0–500 m. Annual rainfall 1,250–,900 mm, mainly from Oct.–Jan. Four to five dry months. Dry mixed evergreen forest vegetation.
Intermediate zone	Altitude 0–1,000 m. Annual rainfall 1,900–2,500 mm. Less than three dry months. Moist evergreen forest vegetation
Lowland wet zone	Altitude 0–1,000 m. Annual rainfall 2,500–5,000 mm. No dry months. Tropical (lowland) wet evergreen forest vegetation.
Sub-montane midlands	Altitude 1,000–1,500 m. Annual rainfall 2,500–5,000 mm. No dry months. Sub-montane evergreen forest vegetation
Wet highlands	Altitude 1,500–2,500 m. Annual rainfall 2,500–5,000 mm. No dry months. Montane evergreen forest vegetation.
Intermediate highlands	Altitude 1,000–1,500 m. Annual rainfall 1,900–2,500 mm. Less than three dry months. Dry patanas vegetation.
Coastal and marine zone	Corel reefs, lagoon habitats, rocky habitats, mangrove habitats, sandstone habitats, swamps and salt marshes, mud flats, deltas and estuarine system, mineral sands, extensive sand dunes, sandy beaches. Large marine mammals (whales) are present.

3 Results

Biomes of the world: The biomes of the world could be commonly identified and classified as tropical rain forest, coniferous forest (Taiga), temperate deciduous forest, marine, savannah, grassland, wetland, desert and tundra (UCMP 2006, THS 2006, COTF 2006, RCN 2006, NASA 2006).

Bioregions in Sri Lanka: A new concept for identifying bioregions of the country with the support of existing climatic and geographical classifications, faunal and floral distribution patterns, and biological diversity richness of different parts of the country led to the identification of mainly eight terrestrial bioregions. Seven bioregions are situated in the inland and one is situated around the country as the coastal and marine bioregion. The inland bioregions are the arid zone, the dry zone, the intermediate zone, the lowland wet zone, the sub-montane midlands, the wet highlands and the intermediate highlands. These bioregions have been classified based on altitude, precipitation, type of vegetation and its heritage status. Details are presented in Tab. 1, and the geographical location is shown in Fig. 1. Recognising the significance of international value, some of the biomes have been declared as World Heritage Sites, UNESCO Man and Biosphere Reserves, and RAMSAR sites (RAMSAR Convention on Wetlands).

Biomes of Sri Lanka: Scientists have developed the term “biome” to describe areas on earth with similar climate, plants, and animals (THS 2006). CAMPBELL (1996) has defined biomes as “the world’s major communities, classified according to the predominant vegetation and characterised by adaptations of organisms to that particular environment”. Biomes in Sri Lanka have been classified as “ecosystems”. However, the way of defining an ecosystem is quite similar to the definition of a biome. Accordingly, four types of ecosystems, namely forests, wetlands, coastal and marine ecosystems, and agriculture have been identified (MEF 1998). The major ecosystem types and their subcategories are presented in Tab. 2.

Tab. 2 Major ecosystems (biomes) of Sri Lanka (Source: MINISTRY OF ENVIRONMENT AND FORESTRY 1998).

Tab. 2 Bedeutende Ökosysteme (Biome) Sri Lankas.

1. Forests	Natural Forests	<ul style="list-style-type: none"> ● Montane forests ● Sub-montane forests ● Lowland wet-evergreen forests ● Moist evergreen forests ● Dry-mixed evergreen forests ● Riverine forests ● Sparse forests ● Grasslands
	Man-made forests	<ul style="list-style-type: none"> ● Pure plantations ● Mixed plantations
2. Wetlands		<ul style="list-style-type: none"> ● Mangroves ● Marshes ● Lagoons ● Lakes ● Rivers ● Tanks
3. Coastal and marine		<ul style="list-style-type: none"> ● Coral reefs ● Beaches & seacoasts ● Sand belts & dunes
4. Agricultural systems		<ul style="list-style-type: none"> ● Paddy fields ● Vegetable gardens ● Fruit fields ● Other plantation crops

The agriculture ecosystem will be excluded in the further discussion as it has not been categorised among world biomes. Among the sub-biomes, some are repeating in different biomes such as mangrove forest and mangrove, and paddy fields. Therefore, they are only discussed in this study under one category, e.g. “mangrove” is only considered under the wetland ecosystem. Paddy fields are one segment of agriculture. However, it is obviously a wetland under the definition of Ramsar.

Forest Biome: The tropical rain forest is the climax vegetation of the southwestern wet zone with wet evergreen forest present at higher altitudes. The intermediate zone of the seasonally dry northern and eastern plains has tropical semi-evergreen forest (moist monsoon forests) which gives way to tropical mixed evergreen forest (dry monsoon forests) in the dry zone. The arid zone of the northwestern and southeastern fringe of the island is covered with tropical thorn forest. Sri Lanka had more than 70 % forest cover at the turn of this century but rapidly lost that due to expansion of plantation agriculture, agriculture scheme and expansion of the human population. At present, the closed-canopy forest covers amounts to about 23.9 % of the country and the open-canopy forest covers amounts to 7.01 % (FSMP 1995).

The forest biome comprises many sub-biomes such as montane forests, submontane forests, lowland wet-evergreen forests, moist evergreen forests, dry-mixed evergreen forests, riverine forests, sparse forests, grasslands and mangroves (Fig. 4). Forests in the highland hills above 1,500 meters are called montane evergreen forests. The forests that occur in the mid hill country between 900–1,500 meters are identified as submontane evergreen forests in the country. Lowland wet evergreen forests represent the vegetative climax of the wet zone in the southwestern sector of the country. Moist evergreen forests

are characteristic for the intermediate zone. Dry-mixed evergreen forests have characteristics of four types of forests. They are moist deciduous forests, wet semi-evergreen forests, dry evergreen forests and tropical thorn forests. Dry evergreen forests also occur mainly in the dry zone. Tropical thorn forests are found in the northeastern and southwestern corners of the country. The arid zone bioregion consists of a low open thorny scrub with isolated patches of trees. Riverine forests in the country are distributed mostly along the rivers and streams (IUCNSL 2007). Sparse forests spread commonly in the dry and intermediate zones.

Mangrove plants include trees, shrubs, ferns and palms. These plants are found in the tropics and subtropics on riverbanks and along coastlines, being unusually adapted to anaerobic conditions of both salt and freshwater environments (UNEP 2007). Mangroves constitute a relatively minor type of forest in Sri Lanka, where they form a thin belt around lagoons and river mouths. The area extent of mangroves in Sri Lanka is 8,688 ha (MEF 1998).

Wetland Biome: What is wetland? One of the broadest and widely used definitions of wetland was adopted during a conference in Ramsar, Iran in 1971. It describes wetlands as “areas of marsh, fen, peat land or water, whether natural or temporary, with water that is static, flowing, fresh brackish or salt, including areas of marine water, the depth of which at low tide does not exceed 6 m” (MEF 1998). Since wetlands are defined in a broad way and many areas in Sri Lanka are wetlands, some even say the whole country with all its rivers, man-made tanks, marshes, lagoons and paddy fields should be considered wetland. Sri Lanka is blessed with many different kinds of wetlands, such as estuaries, lagoons, sea grass beds, mangroves and marshes. These areas are of immense environmental, economic and social importance. Today many wetlands in Sri Lanka are being recognised as important, both regionally and globally. Both natural and man-made wetlands occur throughout the country comprising about 15 % of the total of the country (MEF 1998).

Rivers and streams, riverine floodplains, small isolated freshwater bodies, freshwater springs, seasonal ponds, and freshwater marshes comprise natural inland wetlands. Coastal wetlands include estuaries and lagoons with associated mangrove swamps, saline marshes, mudflats, and coastal sea grass beds. The man-made wetlands are rice paddies, irrigation tanks, large reservoirs, irrigation canals, and aquaculture ponds. As many wetland ecosystems in Sri Lanka have been and, to a large extent, still are, indiscriminately exploited for commercial, agricultural, residential and industrial development and dumping of waste, it is not surprising that many wetlands are under threat. In the common opinion, wetlands are wastelands and thus are considered for economic benefits.

Coastal and Marine Biome: Sri Lanka consists of a broad coastal plain encompassing the country. The coastal zone of the country is defined by statute as a two kilometer wide band of ocean and an adjoining strip of land extending 300 m inland; where a water body connected to the sea occurs, the zone extends two kilometers inwards from the mouth of the water body. The coastal and marine bioregion has been defined within a belt extending 300 m inland from the level of high tide through to 22.2 km (12 nautical miles) into the ocean. The coastline, which is about 1,585 km in length, supports highly productive marine ecosystems such as fringing coral reefs and shallow beds of coastal and estuarine sea-grasses. Other coastal habitats comprise an extensive system of estuaries and lagoons (158,017 ha), mangroves (12,500 ha), salt marshes (23,819 ha), sand dunes (7,606 ha), beaches (11,788 ha), coastal marshy wetlands (9,754 ha) and other water bodies (18,839 ha) (MEF 1998).

Coral reefs are rich in biodiversity and important as habitats for fauna and flora, for containing coastal erosion, and for sustaining the coastal fishery. Sri Lanka has well developed reefs, the majority is of sandstone and rock; boulder reefs are common along the southern and eastern coasts. The shoreline and near-shore areas contain a variety of marine habitats, including sea-grass beds. The mangrove areas are discontinuous, but they are important breeding grounds for marine organisms. The flora found here comprises both true mangroves and mangrove associates, some of them are limited in distribution to specific parts of the coastline. Beaches in Sri Lanka vary in size and type. Many are wide and sandy and have a high potential for tourism.

3.1 Policies and institutional structure of nature conservation

Policies: In Sri Lanka there are many policies, laws and regulations in force today that are in relation with environmental protection and nature conservation. The most effective policies cited in this field are the National Environment Policy (2003), the National Forestry Policy (1995), the National Wildlife Policy (1990), the National Watershed Management Policy (2005), the National Wetlands Policy (2004) and the National Fisheries and Aquatic Resources Policy (2006). The most frequently cited acts and ordinances are the National Environmental Act (1980), the Fauna and Flora Protection Ordinance (1937), the Forest Ordinance (1907), the Felling Trees (Control) Act (1951), the National Heritage Wilderness Areas Act (1988), the Plant Protection Act (1987), the National Aquatic Research and the Development Agency Act (1981), and the Fisheries and Aquatic Resources Act (1996), etc..

These policies related to natural resources are supported to be constant with, and give effect to, the National Environmental Policy and other relevant international conventions, protocols, treaties, and agreements. They are particularly the Ramsar Convention on Wetlands of International Importance (1971), the Convention on Conservation of Migratory Species of Wild Animals (1979), the Convention on Biological Diversity (1992) and the United Nations Convention to Combat Desertification (1999), etc.. These policies and regulations significantly affect the conservation and management of the natural resources of the country. Such regulations are important because they change the property right regimes and entitlements of good and services to people and thus directly affect the fabric of social institutions that in-turn provides sustenance to the natural resources. The enforceability of rules and regulations for the protection and conservation of natural resources is gradually streamlining and empowering. In addition, efforts and investments for conservation of biodiversity in protected areas are continuously increased leading to a comprehensive network of well-conserved natural ecosystems. It is obvious that a lot of different legislations have been introduced over the years to meet various temporal needs to sustain the natural resources of Sri Lanka.

Institutional setup: There are numerous organisations involved in the form of stakeholders and shareholders for the conservation of natural resources in the country. Among these, there are several leading organisations, whose policies, rules and regulations, programs and activities are determined for the implementation of natural resource management. Table 3 shows those organisations, their roles and responsibilities, the effecting policies, rules and regulations in brief. Among the leading institutions for environment and nature conservation in Sri Lanka are the Ministry of Environment and the Ministry of Fisheries and Aquatic Resources. Within these two ministries, there are numerous departments and statutory bodies (Tab. 3) (JAYATHUNGA 2009).

3.2 Nature conservation and protected areas in Sri Lanka

The World Conservation Union (IUCN) defined the protected area as “an area of land and / or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means”. Although all protected areas meet the general aspects contained in this definition, in practice the precise purposes for which protected areas are managed differ greatly. The main purposes for managing protected areas are: scientific research, wilderness protection, preservation of species and genetic diversity, maintenance of environmental services, protection of specific natural and cultural features, tourism and recreation, education, sustainable use of resources from natural ecosystems, maintenance of cultural and traditional attributes (IUCN 2007). The IUCN has defined a series of protected area management categories based on management objectives. Definitions of these categories and examples of each are provided in the Guidelines for Protected Area Management Categories (IUCN 1994).

Sri Lanka is recognised as one of the global biodiversity hot spots due to its varied climatic and topographic conditions. Sri Lanka has an extensive protected area network, covering almost 13 % of its land area. This extent is the area that is managed by the Department of Wildlife Conservation. The highly environmentally sensitive and fragile forests that are managed by the Forest Department have not been

Tab. 3 Organisations and their responsibilities with respective policies for natural resource management in Sri Lanka (Source: JAYATHUNGA 2009).

Tab. 3 Organisationen und ihre Verantwortlichkeitsbereiche mit den entsprechenden Vorgaben für das Management von Naturressourcen in Sri Lanka.

Organisation	Responsibilities	Policy / rules / regulations
1.0 Min. of Environment (1990)	leading to manage the environment and natural resources Policy formulation and supervision of policy implementation	National Environmental Policy, National Forestry Policy, National Wildlife Policy, National Mineral Policy, National Wetlands Policy, National Sand Policy, National Watershed Management Policy
1.1 Forest Department (1887)	protection, conservation and management of forests	National Forestry Policy (1995), Forest Ordinance (1907)
1.2 Department of Wildlife Conservation (1949)	protection, conservation and management of wildlife	National Wildlife Policy (2000), Fauna and Flora Protection Ordinance (1937), National Heritage Wilderness Areas Act (No. 3 of 1988)
1.3 Sri Lanka Wildlife Trust (1991)	conducts education and awareness programs on wildlife conservation	
1.4 Central Environmental Authority (1981)	protection, management and enhancement of the environment regulation, maintenance and control of the quality of the environment	National Environmental Policy (2003), National Wetlands Policy (2004), National Environmental Act (1980)
1.5 Marine Pollution Prevention Authority (1981)	protects the marine environment from pollution	Marine Pollution Prevention Act (1981)
1.6 Geological Survey and Mines Bureau (1993)	regulating exploration, mining and trading of minerals in sustainable manner	National Mineral Policy (1993), National Sand Policy (2005), Mines and Minerals Act (1992)
2.0 Ministry of Fisheries & Aquatic Resources	leading to manage and utilise fisheries and aquatic resources in sustainable way	National Fisheries and Aquatic Resources Policy (2006), Fisheries and Aquatic Resources Act (1996)
2.1 Department of Fisheries and Aquatic Resources	sustainable development of fishing industry through sound resource management	
2.2 Coast Conservation Department (1984)	development, management and conservation of coastal resources to meet the set standards	Coast Conservation Act (1981)
2.3 National Aquatic Resources Research and Development Agency (1981) – NARA	conducting and coordinating research, development and management on aquatic resources in Sri Lanka.	The National Aquatic Resources Research and Development Agency Act (1981)
2.4 National Aquaculture Development Authority of Sri Lanka (1999)	manages, conserves and develops the aquaculture and inland fisheries sector	National Aquaculture Development Authority Act (1998)

included in the protected area network. The first example of planning for protected areas management in the country goes back to 1986 when IUCN involvement in forestry programs took place by formulating conservation management plans for two critically important rainforests called Sinharaja and Knuckles in collaboration with the Forest Department. Later on two more conservation management plans were prepared for two important forests, namely Kanneliya-Dediyagala-Nakiyadeniya (KDN) and Peak Wilderness with funding support of the Government of New Zealand and United Kingdom respectively (IUCN 2006b). In addition, IUCN Sri Lanka has completed the preparation of management plans for mangroves located north and south of Colombo in collaboration with the Forest Department and the Ministry of

Environment. Furthermore, Conservation of Globally Threatened Species in the rainforest of Sri Lanka by the Forest Department and Conservation of Rekawa Ussangoda and Kalametiya Lagoon ecosystems by the Coast Conservation Department are being implemented with funding support of GEF/UNDP. In addition to that, there are some major foreign funded projects currently going on under the jurisdiction of the Ministry of Environment and Natural Resources and the Ministry of Fisheries and Aquatic Resources, for instance the Forest Resources Management Projects, the Protected Area Management and the Wildlife Conservation Project, the Upper Watershed Management Project, and the Coastal Resources Management Project (JAYATHUNGA 2009).

3.3 Nature conservation strategies and approaches

Nature conservation strategies and approaches go back many centuries to the appointment of forest officers (*Kelekorala*) and the establishment of state organisations to protect the nature in the country under the British colonisation. At present, there are many state organisations and non-governmental organisations involved to conserve and protect the natural resources of the country. Forests and wildlife have apparently been divided into two sectors to be managed by two different departments. The forests have been classified into three classes in accordance with the objectives of management and utilisation. Class I is used for the conservation of habitats and scientific studies only. Class II forests are managed for conservation, recreations and studies. Class III forests are managed for conservation, non-wood forest products for the communities living around the forest, socioeconomic studies and community involvements. Most of these forests have a core area and a buffer zone. Within the buffer zone, local people are allowed to collect non-timber forest products. The Forest Department manages 17 % of the forests of the country (FsMP 1995).

The forests managed by the DWLC are defined as protected areas of the country and have been classified into six categories as strict nature reserve (SNR), national parks, nature reserves, sanctuaries, jungle corridors, and marine reserves having specific management objectives. These management objectives differ from each other. The management objectives of the SNRs are mainly conservation and protection of their habitats. However, conducting scientific studies is allowed with a special permission. There are three SNRs declared with a total extent of 31,574 ha. The second category of protected areas is the category national parks. National parks are managed especially for wildlife viewing and studying while conserving the fauna and flora. Eighteen national parks have been declared under the Fauna and Flora Protection Ordinance (FFPO) and the total land area that comes under this category is 505,601.5 ha (Tab. 4).

The third category of protected areas is nature reserves. Nature reserves are protected for the conservation of biodiversity, studying is allowed but wildlife viewing is not allowed. However, traditional human activities are allowed for the communities who have already settled within the area. Nevertheless, those activities are not transferable to the next generation. The fourth management category of protected areas of the country is the category sanctuaries. There are 56 sanctuaries that have been declared under the FFPO (DWLC 2004). Within these sanctuaries, wildlife viewing is allowed, but not regularised. Traditional human activities are allowed for the people who live within the boundaries of sanctuaries as private lands have not been excluded when declaring the boundaries. The main purpose of this category is providing wildlife habitats and conserve biodiversity. The fifth management category is the jungle corridor. At present, two jungle corridors have been declared. The main purpose of these corridors is to provide paths for animals, especially for wild elephants, so they can move from forest to forest without harming agricultural lands and the communities who settle adjacent to the protected areas. The sixth category of protected areas is the category marine reserves. Their main purpose is to conserve and protect marine habitats and coastal ecosystems. There are three marine reserves that have been declared under the FFPO. Studies are encouraged in this category, whereas tourism is not yet legalised.

Wetlands in the country are managed by the Forest Department and the DWLC where wetlands are located under the control of their territories. However, the main responsible government agency for wetlands is the Central Environmental Authority. Wetlands are managed under the National Wetland Policy, the National Environment Act as well as under the FFPO and the Forest Ordinance.

Tab. 4 Distribution of national parks and ecotourism among bioregions and biome (Source: investigations by the authors; JAYATHUNGA 2009).

Tab. 4 Die Verteilung von Nationalparks und des Ökotourismus auf Bioregionen und Biome.

National Park	Bioregion	Biome	Ecotourism
1. Bundala	Arid zone	Sparse forest	high
2. Flood Plains	Dry zone	Sparse forest	unopened
3. Gal Oya	Intermediate zone	Sparse & moist evergreen forests	low
4. Hikkaduwa	Coastal & marine	Coastal and marine	high
5. Horagolla	Lowland wet zone	Lowland wet evergreen forest	low
6. Horton Plains	Wet highlands	Montane forest	high
7. Kaudulla	Dry zone	Dry mixed evergreen forest	low
8. Lahugala	Dry zone	Dry mixed evergreen forest	unopened
9. Lunugamwehera	Dry zone	Sparse forest	unopened
10. Maduru Oya	Dry & Intermediate zones	Sparse and dry mixed evergreen forests	low
11. Minneriya	Dry zone	Dry mixed evergreen forest	high
12. Paravi Dupatha	Dry zone	Sparse forest	unopened
13. Yala (Ruhuna)	Arid zone	Sparse and dry mixed evergreen forests	high
14. Somawathiya	Dry zone	Dry mixed evergreen forests	unopened
15. Udawalawa	Dry & Intermediate zones	Sparse and moist monsoon forests	high
16. Wasgomuwa	Dry & Intermediate zones	Moist evergreen forest	high
17. Wilpattu	Dry zone	Dry mixed evergreen forests	low
18. Kumana (Yala East)	Dry & Arid zones	Dry zone forest	low

3.4 Tourism in nature-based destinations in Sri Lanka

Sri Lanka has a protected area network with many natural attractions that are used to invite tourists (BUULTJENS et al. 2005). The potential of tourism development in the country has been recognised by the government in the 1960s (BUULTJENS et al. 2005) and the first tourism management plan was prepared in 1967 (CTB 1968). Initially, the efforts have been launched for the tourism sector development other than the nature-based or ecotourism development in the country. Mainly the beach-associated tourism has been expanded by providing extensive infrastructure. However, nature-based and ecotourism products have been developed with an increasing awareness amongst the government and private-sector organisations that these are important market segments that can provide substantial benefits with minimised impacts. In 2001 the Sri Lanka Tourist Board, the authority responsible for promoting tourism, and the Sri Lankan Ecotourism Association developed an ecotourism framework for the country. Despite the lack of development of the nature-based market, a number of international and domestic tourists are interested in viewing wildlife, especially elephants, in their natural habitat (BUULTJENS et al. 2005). As a result of this interest there are many tourists visiting national parks in the country today (Tab. 5).

The nineteen nature-based destinations which national parks and natural forests based on the infrastructure and facilities developed by the authorities (department of wildlife conservation and forest department) were identified (Fig. 2) and based on the number of tourists visited in those destinations that have been categorised as high and less tourism in this paper.

Tab. 5 Visitors in major nature-based destinations in Sri Lanka from 1995 – 2005 (Source: DEPARTMENT OF WILD-LIFE CONSERVATION & FOREST DEPARTMENT, Sri Lanka, unpublished documentation).

Tab. 5 Besucherzahlen an bedeutenden naturnahen Destinationen in Sri Lanka von 1995 bis 2005.

Year	Yala	Bundala	Horton plains	Udawalawa	Wasgamuwa	Minneriya	Sinharaja	Udawattakele
1995	211696	33174	111182	28722	6731	-	21321	-
1996	94971	22325	133505	39782	11909	-	14043	-
1997	43630	33748	154712	57281	13792	-	23696	-
1998	97538	37612	174746	64834	22558	4049	24456	-
1999	122441	28431	175212	90874	21632	8967	28551	-
2000	143270	26924	151475	80575	31228	9256	28323	-
2001	137284	18396	124466	56907	23616	7612	27470	24555
2002	158051	14468	172826	58992	24147	22892	30829	26765
2003	205954	17551	196684	81519	38518	16955	28503	31643
2004	205943	19243	190145	82856	36350	44503	33634	36879
2005	111886	7172	194685	67413	41286	31930	28040	45096

4 Discussion

Major biomes in Sri Lanka were limited to three categories as forest, wetlands, coastal and marine. Forest is the major biome in the country. In terms of nature conservation, more attention has been paid to the forest biome. However, it is hard to conclude that other biomes are neglected for nature conservation as the area extent of wetlands and marine ecosystem is less compared to the forest biome. It proves that 45 wetland sites, including three Ramsar sites, have been identified for the conservation and management (Table 6). Although tourism is distributed among all bioregions and biomes, the highest number of tourist destinations is limited to the dry zone bioregion. Also, the arid zone bioregion is smaller than the dry, wet and intermediate zone. There are three well established tourism destinations: Yala, Bundala and Kumana (Yala East) National parks. Yala and Bundala National parks are crowded with tourists (Tab. 5). This small region reveals a threat for nature as there is an increased number of park visitors but no control mechanism for visitor management available (JAYATHUNGA 2009). These three national parks diverse with the sparse forest biome, the dry mixed evergreen forest biome and the wetland biomes. They provide favourable habitats for all kinds of fauna and flora. This high biodiversity invites nature lovers and eco-tourists. Compared to other bioregions the dry zone and the arid zone bioregions play a tremendous role in terms of nature conservation and nature-based tourism in the country. Sparse forest and dry mixed evergreen forest in these bioregions are not densely spread. This provides space for large mammals like elephants, samburs, deers, wild buffalos and wild boars in herds, and habitats for birds (DWLC 2004). One of the main reasons for increasing visitor numbers in these parks is the possibility of viewing wildlife which is not as much the case in tourist destinations situated in other bioregions. In addition, it shows that more potential for ecotourism is possible in the dry zone bioregion, as there are still five unopened national parks available. 77 % of national parks in Sri Lanka are spread over the sparse forest biome and the dry mixed evergreen forest biome and it represents 73 % nature-based tourism in the country (Tab. 7). Nearly 69 % of nature conservation strategies are covered in these two biomes (Tab. 6). However, the highest contribution to nature conservation and tourism is presented in the dry zone bioregion with combination of the dry mixed evergreen forest biome in the country.

Among the management category of protected areas, three Strict Nature Reserves (SNR) have been declared. The total land area of these three reserves is 31,575 ha. They are namely Ritigala SNR (1,528 ha)

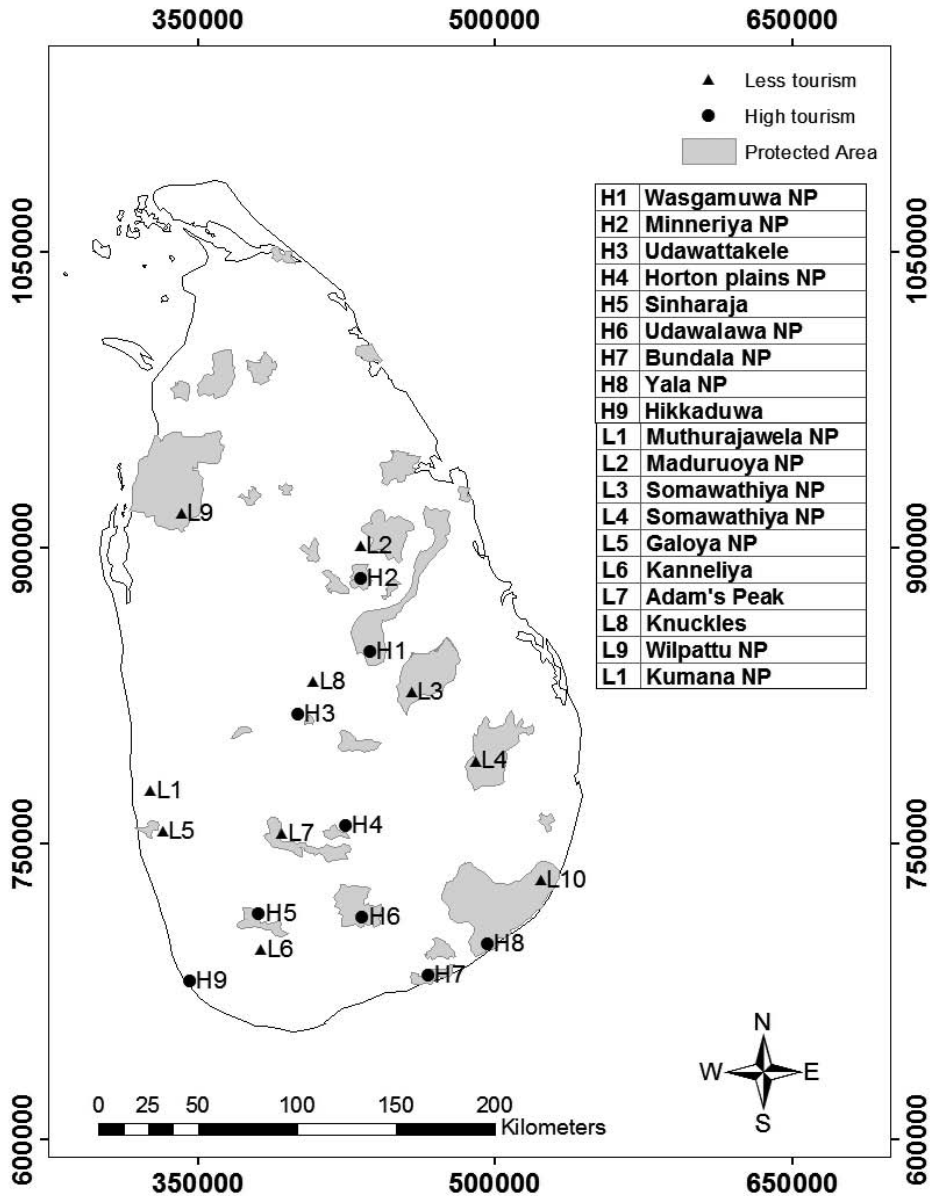


Fig. 2 Protected areas and nature-based tourist destinations in Sri Lanka (Source: SOMASEKARAM 1997).

Abb. 2 Schutzgebiete und naturnahe Ziele des Tourismus auf Sri Lanka

located in the lowland wet-evergreen forest biome in the dry zone bioregion, Haggala SNR (1,142 ha) located in the montane forest biome in the wet highlands bioregion, Yala SNR (28,905 ha) located in the dry-mixed evergreen forest biome in the arid zone bioregion and the dry zone bioregion (Tab. 6, Fig. 3). These three SNRs are situated in different biomes and bioregions.

Tab. 7 Representativeness of nature-based tourism on different biomes in Sri Lanka (Sources: JAYATHUNGA 2009; unpublished documents of Sri Lanka Tourist Board)
* repeating values

Tab. 7 Repräsentativität des naturnahen Tourismus in verschiedenen Biomen Sri Lankas (Quellen: JAYATHUNGA 2009, unveröff. Arbeit des Sri Lanka Tourist Board)
* sich wiederholende Werte

Biomes: Nature based tourism (extent in hectares, (number))3270Li							
Forest ecosystems	Jeep Safari	Nature trekking	Boating	Wildlife watching	Bird watching	Nature admiring	Total
Montane forests		3,575(2)		3,154(1)	3,154(1)*	3,575(2)*	6,729 (1.16 %)
Submontane forests		4,381(1)				4,381(1)*	4,381(0.76 %)
Lowland wet evergreen forests		13(1)					-
Moist evergreen forests		16,720(6)		11,187(1)	11,187(1)*	16,720(6)*	27,907(4.81 %)
Dry mixed evergreen forests	416,118(9)			391,754(8)*	24,364(1)*		416,118(72 %)
Patanas and villus							
Riverine forests							
Mangrove forests							
Sparse forests	6,216(1)			6,216(1)*			6,216(1 %)
Wetlands ecosystem							
Lagoons	12,616(3)	412(1)	412(1)*	12,616(3)*	13,943(5)		26,971(4.66 %)
Marshes	24,364(2)	3,162(1)		27,526(3)	27,526(3)*	3,162(1)*	82,023(14.2 %)
Mangroves			248(1)		248(1)*	915(1)	1,163(0.2 %)
Paddy fields							
Rivers, lakes and tanks			7,700(1)		7,700(1)*	7,700(1)*	7,700(1.33 %)
Coastal and marine ecosystems							
Coral reefs			45(1)				45(0.007 %)
Beaches and coasts							
Sand belts and dunes							
Total							579,253

The second management category of nature conservation under DWLC (national parks) has been limited for tourism. The other five categories are entirely being managed for the conservation of biodiversity, habitats and nature. This is a good sign of a sustainable management of natural resources. Also, all national parks are still not opened for wildlife viewing. Gradually they could be opened for visitors for the purpose of reducing the impact in national parks that are already crowded by visitors. However, for the management of visitors and the control of visitor numbers, there is no particular method introduced. Therefore, there is a doubt of having a threat for the carrying capacity of the ecosystem where high numbers of tourists visit.

Forests managed by the Forest Department that are opened for tourism, namely Sinharaja, Knuckles, Udawattakele, and Kanneliya-Dediyagala-Nakiyadeniya, are also strictly managed for the conservation of nature as well as tourism. These forests are opened for visitors only for nature trekking with a trekker trained by the department. There are less visitors in these forests compared to national parks. Also, as most visitors are nature lovers and as the trekker handles the group of visitors, there is less impact on nature.

In accordance with the location of national parks in the country, only one national park (Horton Plains) is situated in the montane forest biome of the wet highland bioregion (Fig. 3). Three national parks (Bundala, Yala and Kumana) are comprised of characters of sparse forest biome in the arid zone bioregion (Fig. 3) where precipitation is very low (Tab. 1) (JAYATHUNGA 2009). However, Yala and Kumana (Yala East) are spread over the arid zone bioregion and the dry zone bioregion (Fig. 3). They comprise the dry monsoon forest biome and the sparse forest biome. Four national parks, Udawalawa, Gal Oya, Maduru Oya and Wasgamuwa, are situated in the dry zone bioregion and the intermediate bioregion. While Udawalawa

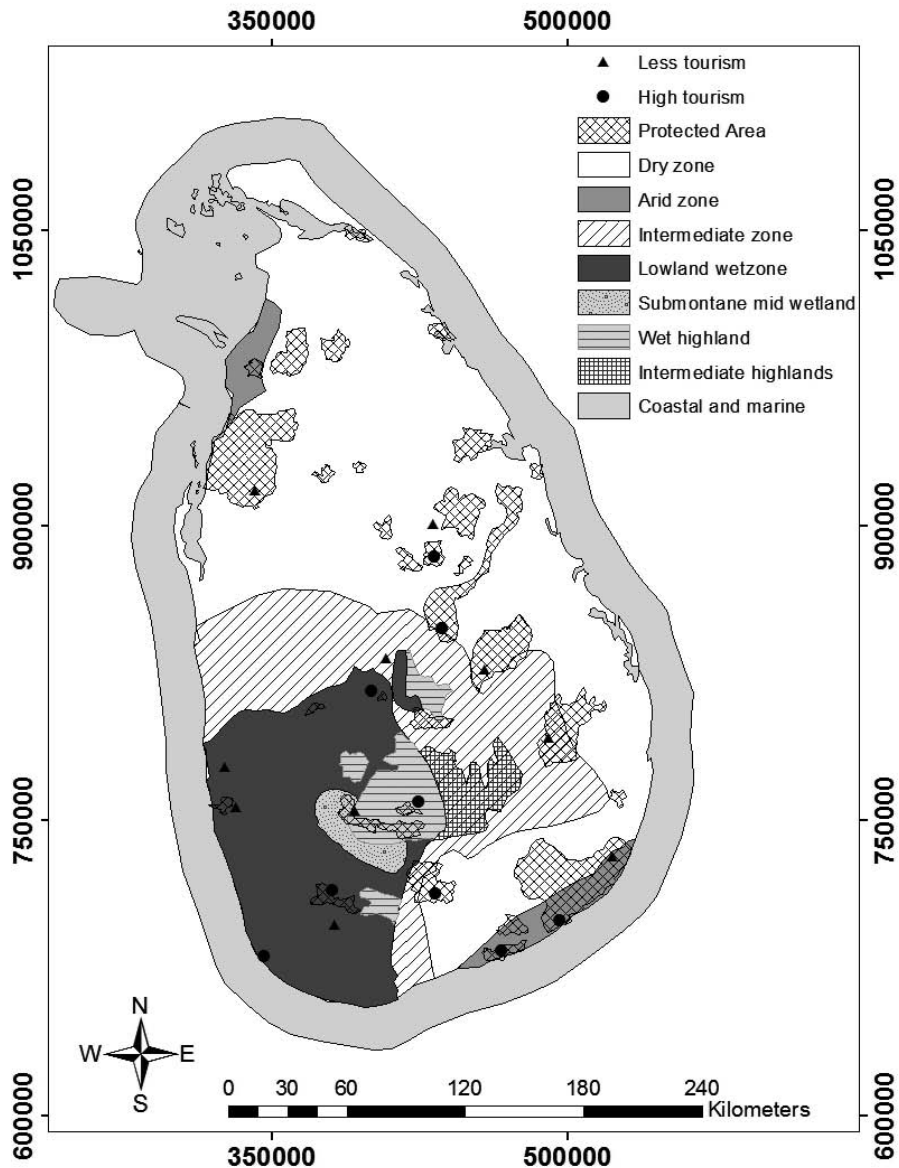


Fig. 3 Bioregions, protected areas and nature-based tourism in Sri Lanka (Source: SOMASEKARAM 1997).

Abb. 3 Bioregionen, Schutzgebiete und naturnaher Tourismus auf Sri Lanka.

and Wasgamuwa national parks comprise the characters of the moist evergreen forest biome, Gal Oya and Maduru Oya national parks spread over the moist evergreen forest biome and the sparse forest biome (Fig. 4). The majority of national parks, Wilpattu, Minneriya, Kaudulla, Lunugamvehera, Lahugala, Flood Plain, Somawathiya and also partly Wasgamuwa, Udawalawa, Gal Oya and Maduru Oya, are located in the dry zone bioregion. These national parks extend over the dry mixed evergreen forest biome, the moist evergreen forest biome and the sparse forest biome. The smallest national park, Horagolla (13 ha), is lo-

cated in the lowland wet zone bioregion with the lowland rainforest biome. The last two (Paravidupatha and Hikkaduwa) are located in the coastal and marine bioregion with characteristics of the sparse forest biome and the coastal and marine biomes respectively.

The wetland biome has five sub-categories: lagoons, marshes, mangroves, paddy fields and inland water bodies (rivers, lakes and tanks). In this study, forty-five wetlands are represented in different nature conservation categories such as sanctuaries, national parks, Ramsar sites and wetlands. However, this representation apparently does not distinguish the whole extent of demarcation with consisting of the real

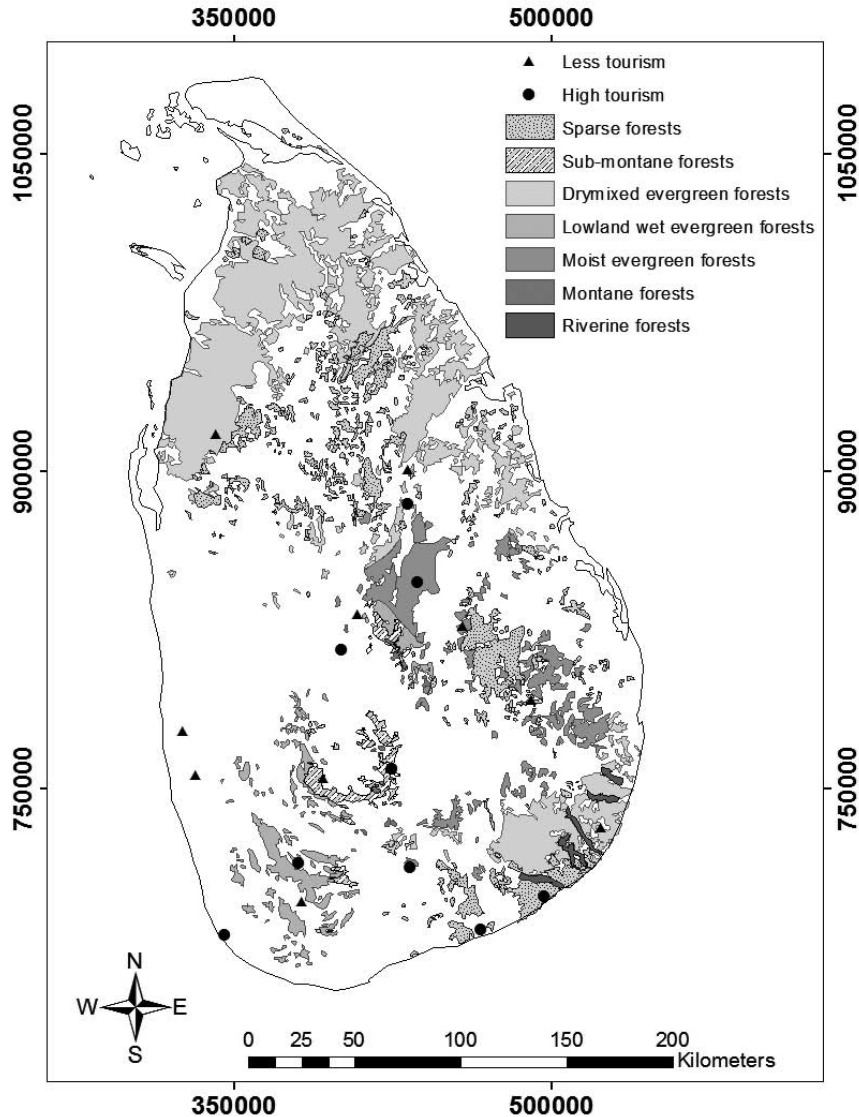


Fig. 4 Forest biomes and nature-based tourist distributions in Sri Lanka (Source: SOMASEKARAM 1997).

Abb. 4 Waldbiome und naturnahe Ziele des Tourismus auf Sri Lanka.

definition it has. In Table 7 under the nature-based tourism categories it is revealed that jeep safaris are impossible in lagoons and marshes. Nevertheless, these sub-biomes have been recognised and declared in accordance with their major characteristics and extents. Accordingly, some parts of these biomes consist of land area where safari vehicles could be driven for the purpose of wildlife and bird watching. Paddy fields are neither represented in the nature conservation categories nor in the nature-based tourism categories although in some areas in the country tourists admire the beauty of extended rice fields in the lowland area and rice terraces in the hilly areas.

The coastal and marine biome consists of sub-categories, namely coral reefs, beaches and seacoasts, sand belts and sand dunes. Representatives of nature conservation categories in these biomes and sub-biomes are presented in Tab. 6. Although the coral reefs spread over inshore and offshore in the coastal belt, there are only three sites identified as a national park, a nature reserve and a marine reserve under the nature conservation categories. A tremendous damage to coral reefs identified with the Tsunami occurred and the people living in the coastal area mine limestone by destroying live and dead corals for construction industry in the country. There are two types of coral mining primarily targeting lime production: traditional mining of ancient fossilised coral reefs found inland and below ground, and a more recent and harmful activity of mining both living and dead corals from the sea (RAJASURIYA 1997). Therefore, more attention should be paid to conserve and protect this ecosystem. Tourism takes place only in one place according to Tab. 7, but in many places in the southern coast there are people used to show corals for tourists. Unless any specific beaches and coasts have been identified under nature conservation categories separately, there are some already covered under national parks, nature reserves and marine reserves. Along the coastal line, almost all beaches and coasts are utilised for the tourism industry from southwestern to northeastern and including southern beaches. Coastal areas, particularly beaches and areas with fringing reefs, have become important locations for tourism development. Swimming, snorkeling, scuba diving and exploring corals through glass bottom boats are popular activities. The majority of hotels along the coastline have been constructed with improper environmental concerns and as result, numerous problems such as liquid and solid waste disposal have become major issues (NAKATANI et al. 1994, RAJASURIYA et al 1995). The coastal and marine biome is more vulnerable to environmental damages caused by beach tourism and less attention has been paid to this biome in terms of nature conservation than has been to other biomes.

In terms of nature-based tourism in the country, the moist and dry-mixed evergreen forest biomes play a tremendous role. They represent nearly 77 % and 16 sites. In respect to nature conservation, these two biomes have taken a specific place. In other forest biomes (montane forests, submontane forests, lowland wet evergreen forests and moist evergreen forests) nature conservation is limited to 7 % compared to the total nature conservation area and nature-based tourism confine to 6 %. Tourism in biomes except for the moist evergreen and the sparse forests biomes is entirely restricted to nature trekking. Tourists trek for admiring nature and viewing wildlife and birds (Tab. 6 and 7). These dense forests are paradises for nature lovers. Table 6 shows that 15 % of the total nature conservation area recorded is covered by wetlands. Bird watching is the main tourist activity in wetlands, especially in Muthurajawela, Bellanwila-attidiya, and in two Ramsar sites as Anawilundawa and Bundala. Nature-based tourism is contributed around 20 % by the wetland biome of the country (Tab. 7).

Policies related to nature conservation and environment management have been issued in the beginning of the 20th century. However, most acts and ordinances for the sector had been applied before the policies came up. In certain statutes, there is overlapping and sometimes conflicts. If one statute is strictly regulated and controlled any natural resources, may be permitted more freely under another. A notable case is the Fauna and Flora Protection Ordinance and the Fisheries and Aquatic Resources Act in respect of import and export of fish and other aquatic organisms (MEF 1998). Another evidence is that the mining of minerals in forests is strictly controlled by the Forest Ordinance while the Geological Survey and Mines Act has provisions to issue exploration and mining licenses for minerals in forests. Regarding the management of protected areas and other state forests, the statutes covering this activity are generally with its acts that are prohibited and the penalties for infringement – the command and control concept (MEF 1998). It's necessary to reform these policies and acts in order to meet the present objectives of natural resource management of the country in a sustainable manner.

The institutional framework established for the nature conservation of the country is outstanding. They have a well-formulated vision, mission and objectives for achieving set goals and annually prepared action plans, management plans lying on secured place without coming to action. They have their own acts and ordinances for implementing for their own peripheries. They lack the coordination and correlation among them for implementation of sectoral policies, rules and regulations. Integrated natural resource management mechanism is far away from the practice. However, they are trying their best to overcome problems and obstacles that they are facing in the sector wise being limited to their written mandatory. There is very little space for participation of non-governmental stakeholders in the management of these areas. Also, the rights that communities have who live adjacent to forests that have enjoyed for generations are not duly recognised. Concerning the state's obligations, except for the Coast Conservation Act and the National Wilderness Areas Act, there is no direction to the implementing agencies as to their responsibility for the proper management of the areas under their jurisdiction (MEF 1998).

Under the nature conservation strategies and approaches, forests have been divided mainly into two with eight categories according to management objectives. However, these classifications have not been done based on as per forest biomes classified. That means under one forest biome, there are few categories of forests managed by both departments. On the other hand, many forest types classified and managed by two departments can be found within one forest biome. Therefore, it is revealed that for the purpose of managing natural resources in the country a biological classification is not much concerned. The objectives of managing natural forests of the country are most similar with these two departments. For instance, Class I forests managed by Forest Department is similar to the Strict Nature Reserves managed by the DWLC.

5 Conclusions

The nature conservation of the country has been organised in a very effective manner. Different ecosystems such as forest, wildlife, wetland, mangrove, coastal and marine are managed in different state institutions with specific policies, acts and ordinances. Mandates, roles and responsibilities of these institutions for their respective sectors are clearly defined. The country's natural resources have been divided into many categories in terms of management to meet the different objectives of natural resource management. However, the biological classifications and managerial classifications of biomes differ. 30 % forests are managed by two different state departments for the conservation and the wise use of the country's natural resources. In terms of nature and biodiversity conservation in different bioregions and biomes have been paid the equal attentions for instance that three SNRs declarations. It's a good sign of nature conservation is shown that only one category (national parks) out of six management categories of forests managed by DWLC is permitted for nature-based tourism. The forest and wetland biomes are more vulnerable for the threat as these biomes are highly utilised for nature-based tourism in the country at present. Nature trekking is limited to two biomes and bird watching is mostly confined to wetlands in which nature conservation represents in 15 % and nature-based tourism in 20 %. It's necessary to refine the existing policies and regulations related to natural resources management. A broadly defined and well established institutional system has been established for nature conservation and natural resource management.

6 Recommendations

1. Defining the protected areas in the country only by concerning forests that are managed by the DWLC could be redefined including forests that are managed by the Forest Department.
2. Unopened national parks should be opened for tourism with better developed infrastructure and facilities with participation of community involvement to ensure ecotourism in those sites and to minimise environmental impacts and to ensure the maintenance of carrying capacity of national parks where high tourism takes place.

3. Studies and research could be conducted in national parks where a high number of tourists visit in order to identify the carrying capacity of such ecosystems.
4. The existing policies and regulations should be reformed to meet the present and future challenges of environmental issues and to ensure community involvement and benefits sharing.
5. Collaboration and coordination at the implementation level is to be improved among the institutional set-up and other stakeholders to ensure nature conservation and community involvement in terms of eco-tourism development.

7 Zusammenfassung

BREUSTE, J.; JAYATHUNGA, S.: Repräsentanten von Naturschutz und Ökotourismus in verschiedenen Biomen Sri Lankas.– *Hercynia N. F.* 43 (2010): 257–276.

Der Naturschutz des Landes wurde auf sehr effektive Art und Weise organisiert. Verschiedene Ökosysteme wie Wälder, wildlebende Tiere, Feuchtgebiete, Mangroven, Küsten und das Meer werden in verschiedenen staatlichen Organisationen mit spezifischen Agenden und Verordnungen verwaltet. Mandate, Rollen und Verantwortlichkeiten dieser Institutionen für die jeweiligen Bereiche sind klar definiert. Die natürlichen Ressourcen des Landes wurden in eine Vielzahl von Kategorien untergliedert, um die verschiedenen Aufgaben des Managements von Naturressourcen optimal zu bewältigen. Dennoch divergieren die biologischen und institutionellen Klassifikationen von Biomen. 30 Prozent der Wälder werden von zwei unterschiedlichen Einrichtungen verwaltet. Im Bereich Natur- und Biodiversitätsschutz gibt es zum Beispiel drei relativ ähnliche Verordnungen. Es kann als gutes Vorzeichen für den Naturschutz gewertet werden, dass nur eine von sechs Waldmanagement-Kategorien (Nationalparks) vom DWLC für naturnahen Tourismus geöffnet wurde. Die Wald- und Feuchtgebiete sind deutlich sensibler, da diese Bereiche derzeit stark für naturnahen Tourismus genutzt werden. Wanderungen sind auf zwei Biome und Vogelbeobachtung vornehmlich auf Feuchtgebiete beschränkt, in denen Naturschutz 15 Prozent und naturnaher Tourismus 25 Prozent ausmachen. Es ist notwendig, die derzeitigen Regularien mit Bezug auf Naturressourcenmanagement zu verfeinern. Dennoch ist festzuhalten, dass ein breit angelegtes und gut ausgebautes institutionelles System für Naturschutz und Naturressourcenmanagement etabliert werden konnte.

Als Empfehlung kann ausgesprochen werden, die Schutzgebiete, welche derzeit nur Wälder umfassen, die vom DWLC verwaltet werden, um jene zu erweitern, welche vom Forest Department verwaltet werden. Derzeit nicht für Besucher zugängliche Nationalparks sollten für den Tourismus geöffnet werden. Hierzu sind besser ausgebaute Infrastruktureinrichtungen ebenso wie die Einbindung der Gemeinschaft notwendig, um zu gewährleisten, dass an diesen Orten Ökotourismus betrieben und die negativen Umwelteinflüsse minimiert werden. Bei einem starken Touristenandrang muss der Erhalt der Tragfähigkeit des Ökosystems gewährleistet werden. In diesem Zusammenhang sollten Studien angestrebt werden, welche die Tragfähigkeit von Ökosystemen unter solchen Bedingungen analysieren. Derzeitige Regularien und Verordnungen sollten entsprechend den derzeitigen und künftigen Herausforderungen angepasst werden. Zudem muss die Partizipation der Gemeinschaft an den Entscheidungen und dem wirtschaftlichen Nutzen gesichert werden. Hierzu verlangt es Zusammenarbeit und Koordinierung aller Beteiligten auf der Ebene der Implementierung.

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Manuscript accepted: 1. September 2010

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Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Hercynia](#)

Jahr/Year: 2010

Band/Volume: [43](#)

Autor(en)/Author(s): Breuste Jürgen H., Jayathunga Sunimal

Artikel/Article: [Representatives of nature conservation and ecotourism in different biomes of Sri Lanka 257-276](#)