

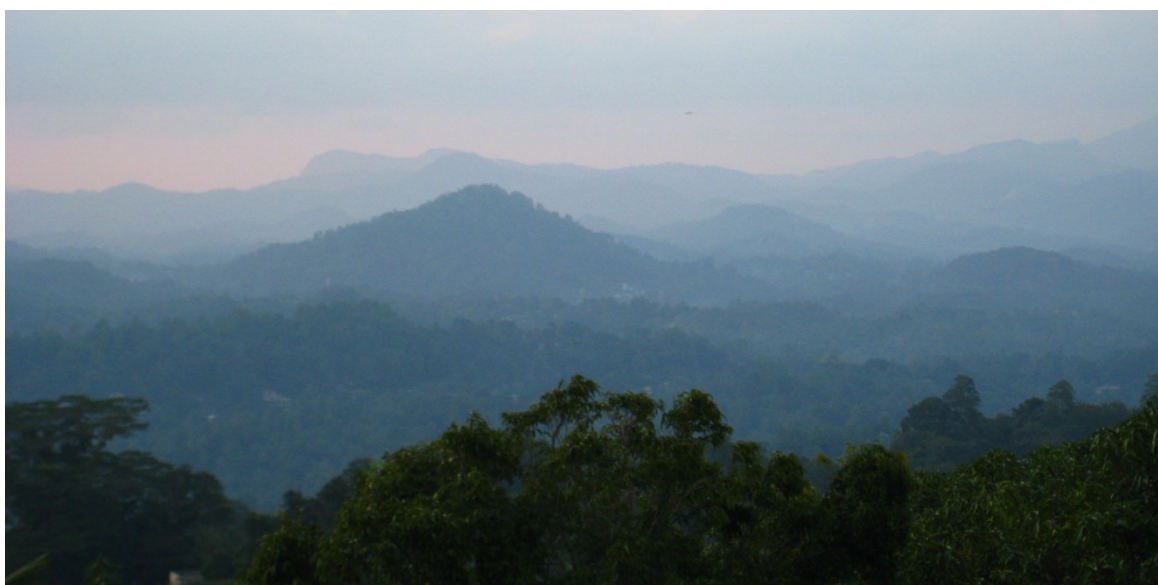
Country Report Sri Lanka

Land-use change and forestry at the national and sub-national level

Rickard Näsström, Eskil Mattsson

Focali Report

2011:04



Focali - Forest, Climate and Livelihood research network - is a Swedish knowledge-based network aiming to contribute to the provision of relevant knowledge to Sida and other Swedish authorities for the effective use of forest operations to reach climate and poverty objectives. Focali also aims to increase the flow of relevant information between academia, government authorities, and civil society.

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The **Forest Initiative** is a strategic partnership between **Sida, the Swedish Forest Agency** and **the Swedish Forestry Association**. The overall objective of the Initiative is poverty reduction through promotion of sustainable management and administration of forest resources within Swedish development cooperation. Sida is the main donor of the Forest Initiative, which is based on the belief that forests play an important role for poor people and can contribute to economic and social development as well as a better environment.

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1. Introduction

In this report we aim to assess and evaluate historic and current changes in land use and forestry at the national and sub-national level in Sri Lanka. Different drivers, policies and data related to forest and land use will be assessed to explore factors that have contributed to changes.

2. General notes

- Sri Lanka has a total land area of 65 610 km², and a population close to 21.3 million. 14 percent of the population is living in urban areas.
- The climate is characterized by two major monsoon periods; the southwest monsoon from May to September and the northeast monsoon from December to February.
- The south-central part of the country is a mountainous area, surrounded by vast coastal plains, the highest peak is Pidurutalagala which reaches 2524 m.a.s.l.
- In general, Sri Lanka is classified into three climatic zones; wet, intermediate and dry. The first two zones are located in the southwestern-central part of the island covering 23 percent and 12 percent respectively of the total land area (Fig. 1). The dry zone is located in the north and eastern part of the country covering the remaining 65 percent.
- Administratively, the country is divided into nine provinces that are further subdivided into 25 districts. A district is further divided into different Divisional Secretariat (DS) divisions; the DS division is finally separated into a number of Grama Niladhari (GN) divisions which constitute the lowest administrative level in Sri Lanka.

3. Economical overview

Sri Lanka's total Gross Domestic Product (GDP) for 2010 was 106.5 billion USD in terms of purchasing power parity (PPP), which put the country in 69th place globally. Despite high budget deficits, the country's real growth rate is 9.1 percent (9th in the world) and GDP/capita (PPP) is 5000 USD in 2010. At the moment Sri Lanka is pursuing social development and reconstruction projects, especially in the eastern and northern part of the country after the war between the government and the Liberation Tigers of Tamil Eelam (LTTE) officially ended in 2009. These initiatives include both infrastructural and technological development and support a policy agenda which seeks to reduce poverty, promote increased agriculture to use a combination of policies and incentives to private investors to promote growth in poor areas (CIA, 2011).

- Between 1990 and 2002 the proportion of the population living below the poverty line fluctuated around 25%. By 2010 this figure was down to 9% (Department of Census and Statistics, 2011; Centre for Poverty Analysis, 2011).
- In 2010, the total value of exports was 8.3 billion USD while the total value of imports was 12.2 billion USD.
- From 1980 until today, Sri Lanka's Human Development Index (HDI) has increased by 0.8 percent annually. Sri Lanka is ranked 91 out of 169 countries in the HDI (UNDP, 2010).

The government promotes Sri Lanka as an economic hub in South Asia and in recent years Sri Lanka's stock market has been recognized as one of the best performing markets globally (ADB, 2010; CIA, 2011). The service sector contributes most to the GDP with 58 percent, and employs 41 percent of the labor force. The industrial sector is responsible for 30 percent of GDP and employs 26 percent of the labor force while the agricultural sector accounts for only 12 percent of GDP, but employs 33 percent of the labor force (CIA, 2011). Production and export of agricultural products such as tea, rubber, coffee and sugar became important during the 1800s and 1900s and are still central commodities. Similarly, the country has moved steadily towards an industrialized economy with the development of textiles, apparel, telecommunications, finance and food processing (Ministry of Finance, 2010).

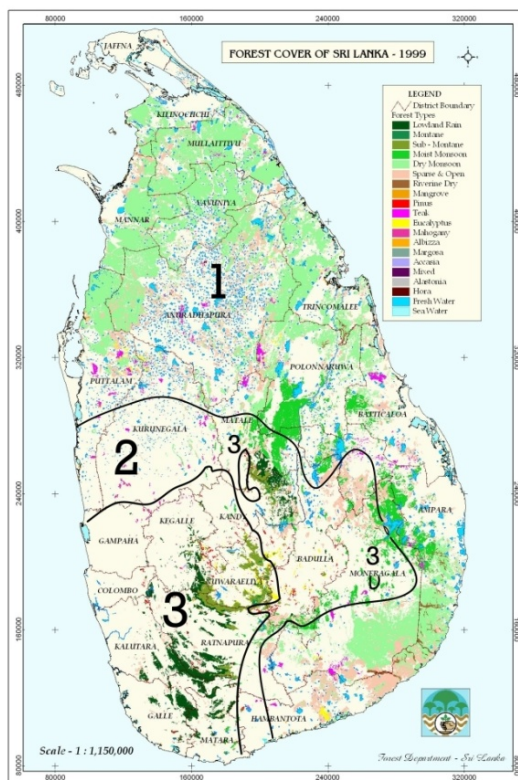


Fig. 1. Map of Sri Lanka showing the forest cover in different districts in 1999 and climatic zones where (1) is dry zone, (2) intermediate zone and (3) wet zone. Modified from GOSL (2000).

4. Emissions profile

Even though Sri Lanka's contribution to the global emission of green house gases (GHG) is considered low, it is still vulnerable to the effects of a changing climate. Climate change would mostly affect areas like agriculture, forestry and hydro-electricity (Government of Sri Lanka, 2000).

Sri Lanka's total emissions of carbon dioxide (CO₂) amounted to 26 MtCO₂ in 2005 excluding land-use change and forestry (LUCF). This amounts to only 0.07 percent of the world's total emissions. Emissions per capita are 1.3 tonnes of CO₂ (CAIT, 2010). No recent data on emissions

derived from LUCF are available, but according to UNFCCC (2005) approximately 50 percent of the total emissions in 1994 were derived from LUCF.

Sri Lanka meets its energy demand via three sources; hydroelectricity, biomass and petroleum. In 1996 biomass was responsible for 57 percent, petroleum and crude oil products accounted for 32 percent and hydro electricity for 11 percent. In 2000 about 50 percent of all households were electrified, but the demand for electricity is growing, and projections made in 2000 suggested that the use of petroleum would increase most. (Government of Sri Lanka, 2000).

Storing carbon in forests as a means to mitigate climate change has received significant international attention in recent years. Reducing emissions from deforestation and forest degradation, conservation, forest enhancement, and sustainable forest management, all of which are covered in the programme Reducing Emissions from Deforestation and Forest Degradation (REDD+), have been discussed frequently within the United Nations climate change negotiations (Gibbs et al., 2007; Angelsen, 2009). REDD+ proposes that developed countries should provide incentives and financial compensation to developing countries for the carbon sequestration benefits that their standing forests provide in terms of mitigating climate change. REDD+ can have an impact on Sri Lanka, since it has a medium to high forest cover, a high deforestation rate, degraded forests, and forests under conservation (UNCCD, 2000; Bandaratilake and Fernando, 2003; da Fonseca et al., 2007). Its observer member status in the UN-REDD programme since 2009 gives Sri Lanka access to benefits, such as networking and knowledge sharing, to help it reduce emissions from deforestation and forest degradation (UN-REDD, 2009; Mattsson et al. under review). A possible REDD+ implementation will require a reference level for recent forest carbon stocks against which future performance can be measured. Reference levels illustrate what the emissions scenario would be in the absence of REDD+ implementation, and thus provide a benchmark for measuring its success. Accurate information on historical and current forest changes and its emissions are therefore needed.

5. General land-use trends

Agricultural land accounts for about 35 percent and forest and wildlife conservation areas for 31 percent of the total area of Sri Lanka (FAO, 2009). The remaining 34 percent is a combination of urban areas, tea plantations, pasture and patina grass. Fig. 2 highlights these relations and accounts also for other land-use classes (ibid.). Eighty-six percent of the natural forest is located in the dry and intermediate zones (Fig. 1) and these areas contain 85 percent of the closed canopy forests (>70 percent crown cover) and 90 percent of the sparse (open) forests in Sri Lanka (Wijesooriya, 2007). According to the Ministry of Environment a forest is defined as a minimum land area of 0.05 hectares (ha) with a minimum tree canopy cover of 20 percent and a canopy height of at least 3 meter (Chokkalingam and Vanniarachchy, 2011).

Spatial differences in land use can be observed. In the wet zone utilized land has reached its peak with more than 80 percent and there is hardly any room for expansion. Forest covers around nine percent of the wet zone. In 1996, 135 000 ha of the land area was covered with forest plantations, many of which were generated by land reforestation programmes that

started in the late 1950s (FAO, 2001). In the dry zone, 30 percent is utilized. The remaining 70 percent is under chena¹ cultivation.

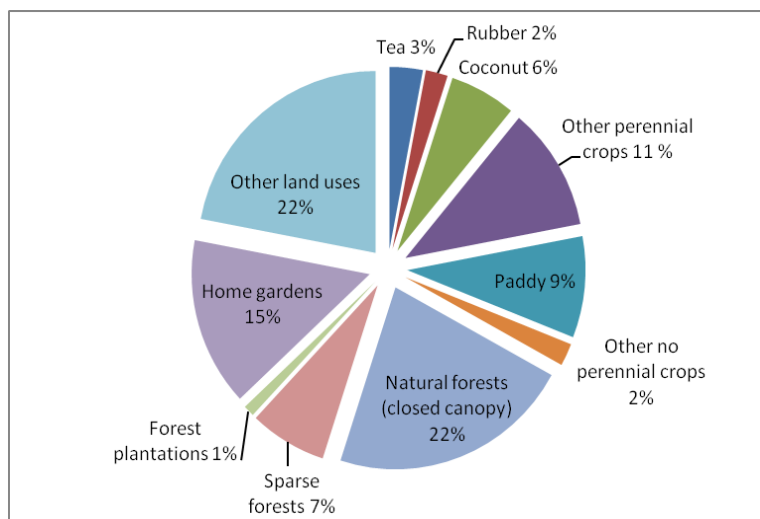


Fig. 2. General land use categories for Sri Lanka in relation to total land area. Modified from FAO (2009).

The land per capita ratio in Sri Lanka is 0.36 ha/person, although the amount of land readily available is 0.15 ha/person (FAO, 1999). The limited amount of available land is one of the biggest problems facing Sri Lanka, especially given that more land is due to be set aside for natural conservation (Peiris, 2006). Along with the latest forest policy in 1995, the government banned all logging of natural forests in 1990 (Perera, 2001) and issued a Forestry Sector Master Plan (MFE, 1995; Peiris, 2006) which gave high priority to following international conventions and initiatives (Bandaratillake and Fernando, 2003). Major forest inventories in Sri Lanka have been carried out by Koelmeyer (1957), Andrews (1961) Government of Sri Lanka in cooperation with FAO (FAO/GOSL, 1986), Legg and Jewel (1995) and Government of Sri Lanka (GOSL, 2000). The eight national forest categories used historically for inventory purposes are defined according to elevation and rainfall. Lowland rainforest, sub-montane and montane forests are to be found in the wet zone located in the southern and central parts of the island. The dry zone on the other hand carries the bulk of the dry and moist monsoon forests, riverine dry forests, mangroves and sparse forests (Table 1).

Table 1. National forest classification and definitions (FAO, 2010a).

National class	Definition
Closed Canopy Forests	All lands, with a forest cover with canopy density of 70 percent or above
a. Montane Forest	Altitude 1500 – 2500 m.a.s.l. Annual rainfall 2500 – 5000 mm. No dry months
b. Sub-Montane Forest	Altitude 1,000 – 1500 m.a.s.l. Annual rainfall 2500 – 5000 mm. No dry months

¹ Chena is a local name for shifting cultivation, a traditional way of agriculture where fields are swidden and cleared for cultivation before the start of the rain season. The fields are traditionally abandoned after a few seasons, when soil nutrients have declined (Cornell, 2007).

c. Lowland Forest (Tropical Wet Evergreen Forest)	Altitude 0 – 1000 m.a.s.l. Annual rainfall 2500 – 5000 mm. No dry months
d. Moist Monsoon Forest (Moist Evergreen Forest)	Altitude 0 – 1000 m.a.s.l. Annual rainfall 1900 – 2500 mm. Less than three dry months
e. Dry Monsoon Forest (Dry Mixed Evergreen Forest)	Altitude 0 – 500 m.a.s.l. Annual rainfall 1250 – 1900 mm. Four to five dry months
g. Mangrove Forest	Area covered by Mangrove vegetation
f. Riverine Dry Forest	Forests found along the rivers and streams
Open Canopy Forests a. Sparse Forests	All lands, with a forest cover with canopy density less than 70 percent

6. Legislations and policies

Ninety-three percent of forest land, or about 80 percent of the total land area, is formally owned and administered by the State which is responsible for its management and development (Chokkalingam and Vanniarachchy, 2011). Since the State Land Encroachment Ordinance was enacted 1840 (see Appendix 2), all forest land, wasteland, unoccupied and uncultivated land has presumed to be the property of the government, unless private ownership can be proven. At present the administration and management of all state land is handled by nearly 60 institutions across the country (Ridgway and Silva, 2005). The two largest state ministries responsible for forest and wildlife issues are the Forest Department and the Department of Wildlife Conservation (DWLC) which together manage around 40 percent of the total land area. The Forest Department is responsible for the management, protection and the development of forest resources in Sri Lanka (FAO, 2009).

According to the present policy initiated in the Forestry Sector Master Plan (MFE, 1995; FAO, 2009), the main objectives of the Forest Department are to:

- to conserve forests for posterity, with particular regard to biodiversity, soils, water, and historical, cultural, religious and aesthetic values;
- to increase the tree cover and productivity of forests to meet the needs of present and future generations for forest products and services;
- to enhance the contribution of forestry to the welfare of the rural population, and strengthen the national economy, with special attention to equity in economic development.

DWLC administered 44 percent of forested lands in 2009, mainly national parks, nature reserves, strict nature reserves, jungle corridors and sanctuaries (FAO, 2009). Three acts dealing with land allocation (Land Settlement Act of 1931, Land Development Act of 1935, and Crown Lands Act No 8 of 1947) deal with control and allocation of lands. These acts along with the have made a great impact on the allocation and management of forest land. Many land allocation decisions have been made under these acts without considering the ecological status of the

forests. This has led to irreversible erosion of the ecosystems and fragmentation of forest resources (FAO, 2001).

Sri Lanka's first National Communication to the United Nations Framework Convention on Climate Change (Government of Sri Lanka, 2000) identified eight sectors, one of which is forestry, that are considered as the most vulnerable to climate change. Longer and more severe droughts will increase the risks of forest fires and approximately 70 percent of Sri Lanka's climate change emissions will emanate from the forestry sector if it is not managed properly (ibid). Communities can play a large role in sustainable forest management mitigation and adaption, but not alone, therefore involvements of relevant stakeholders on different state levels as well as private sector are needed to complement, support and encourage community participation (Keller, 2009). Different regions face different challenges and the methods applied should therefore be site specific (Chokkalingam and Vanniarachchy, 2011). Close collaboration with stakeholders at different levels also opens up the possibility of up-scaling and policy guidance (Keller, 2009).

The current national forest policy makes it possible for the government to meet the demand for wood by establishing large scale forest plantations with private sector involvement. In 2002, 26 agreements were signed in line with the policy. The policy did not just provide an opportunity for collaboration between the government and private sector, but also encouraging participatory management between the government, local people, NGOs, communities and private actors (Chokkalingam and Vanniarachchy, 2011). See appendix 2 for additional information over laws and policies that have affected management of land use in Sri Lanka.

7. Forests

7.1. Forest cover change at the national level

A drastic change in land-use policy after the British invasion in the early 19th century resulted in denudation of the natural forest. Forest cover was close to 80 percent in the late 1800s, a figure that had reduced to 44 percent by 1956, 30 percent by 1996 (Table 2) and is presently close to 25 percent according to the recent Global Forest Resources Assessment of the FAO (2010b). Even though deforestation is a phenomenon throughout the island it has had largest consequences in the wet parts of the country. From 1956 to 1981 the areas under forest cover in the wet and intermediate zone dropped from 16 percent to 11 percent (Peiris, 1996). Forest cover change is shown in Table 2, which includes sparse forests and plantations and Table 3 which is based solely on closed canopy forest area.

Table 2. Forest cover change 1956–1996 for all natural forest classes including sparse forests and forest plantations (FAO, 2009).

Total forest cover			Difference			Annual depletion (%)
Year	Area (ha)	Percent of land area	Time period	Area (ha)	Percent change	
1956	2 898 842	44.2				
1983	2 458 250	37.5	1956–1983	- 440 592	15.2	0.6
1992	2 046 599	31.2	1983–1992	- 411 651	16.7	1.9
1996	1 942 219	29.6	1992–1996	- 104 380	5.1	1.3

Figures in Table 3 differ in total forest cover or annual rate of change; however both studies indicate a total decline in forest cover. Since 1956 all major land use types increased in area except natural forest and monocropped plantations. The natural forest decreased by 1 170 000 ha during this period, of which 60 percent has become wasteland (Peiris, 2006).

Table 3. Closed canopy forest cover change 1983–2001 using figures from two studies. Ratnayake et al. (2002) are using figures from Legg and Jewell (1995) in 1983–1992.

	Forest of total area (%)	Forest of total area (%)	Forest area (ha)	Forest area (ha)	Annual Change	Annual Change
1983	27.1		1 757 995			
1992	24.4	26.0	1 582 858	1 685 278	-1.1	
1996	24.1	25.8	1 560 639	1 673 671	-0.4	-0.1
2001		24.8		1 604 834		-0.5
Ratnayake et al. (2002)						
Legg and Jewell (1995); GOSL (2000)						

FAO (2010b) estimates that 81 percent of the total forest area is naturally secondary forest. Perera (2001) define secondary forests as “forest regenerating largely through natural processes, after significant human disturbance of the original forest vegetation at a single point in time or over an extended period and it displays a major difference in forest structure and/or canopy species composition with respect to nearby primary forests on similar sites”. Most parts of the secondary forests originate from chena agriculture and are situated in the dry zones. The Forest Department considers secondary forests together with other types of open canopy forests and describes all these areas as sparse forests (Perera, 2001). In 1992 sparse forests accounted for 22 percent of the total area under natural forest, with almost 95 percent located in the dry and intermediate zones. The districts with largest increase in sparse forests 1983–1992 were Colombo, Gampaha, Kalutara, Ratnapura and Kegalle.

The two latest forest inventories from Legg and Jewel (1995) conducted in 1992 and GOSL (2000) conducted in 1996 were used to estimate the forest area needed for the reporting to the Forest Resources Assessment (FRA) to the FAO. Figures 1990 and 2000 FRA were estimated using linear-interpolation and the figure for 2005 was forecasted using linear extrapolation (FAO, 2005). According to newly reported figures to FAO 2010 (FAO, 2010b) the trend of declining of forest land reported to the FAO in 2005 was unfeasibly high. One reason identified for this is the inaccuracy of calculations of GOSL forest cover mapping (GOSL, 2000) published with satellite imageries taken in the year 1996. In addition, pilot studies carried out with 2008 satellite imageries have proven this hypothesis and indicated that forest cover loss is less than 50 percent of the trend reported in 2000–2005. To achieve more realistic figures for 2010, 50 percent of the declining rate of the 2005 trend forest land was used. The reported figures to FAO FRA (2010b) gives the following total forest cover including open forests (less than 70 percent crown cover) and forest plantations; 2 350 000 (35.8 percent), 2 082 000 (31.7 percent), 1 933 000 (29.5 percent) and 1 860 000 (29 percent) ha for 1990, 2000, 2005 and 2010 respectively. This gives a deforestation rate of 1.2 percent from 1990–2000, 1.47 percent from 2000–2005 and 0.77 percent from 2005–2010. A 2010 national forest cover assessment has been finalized

and will give new information on recent changes from 1996–2010 on a national and sub national level but the results are not yet published.

7.2. Forest cover change at the district level

Figure 3 illustrates latest available district wise trends from 1983 to 2001. The biggest loss of closed canopy forest occurred in Ampara, Badulla, Hambantota, Kiliochchi, Moneragala, Polonnaruwa and Vavuniya, all of which recorded losses of over 15 000 ha. On the other hand, in Kalutara, Mannar, Matale and Ratnapura districts, forest cover increased more than 5000 ha per district. It is notable that all the districts reporting a decrease in forest cover are located in the dry zone and have participated in the Mahaweli Ganga Development Project during that period (Legg and Jewell, 1995). Government measures such as protective measures and increases in forest plantations aimed to support agriculture and power production from the valuable water resources in these districts are believed to one of the reasons for the increased forest cover increase in the central regions (Ratnayake et al., 2002). Between 1983 and 1992 the government designated approximately 57 000 ha for development schemes.

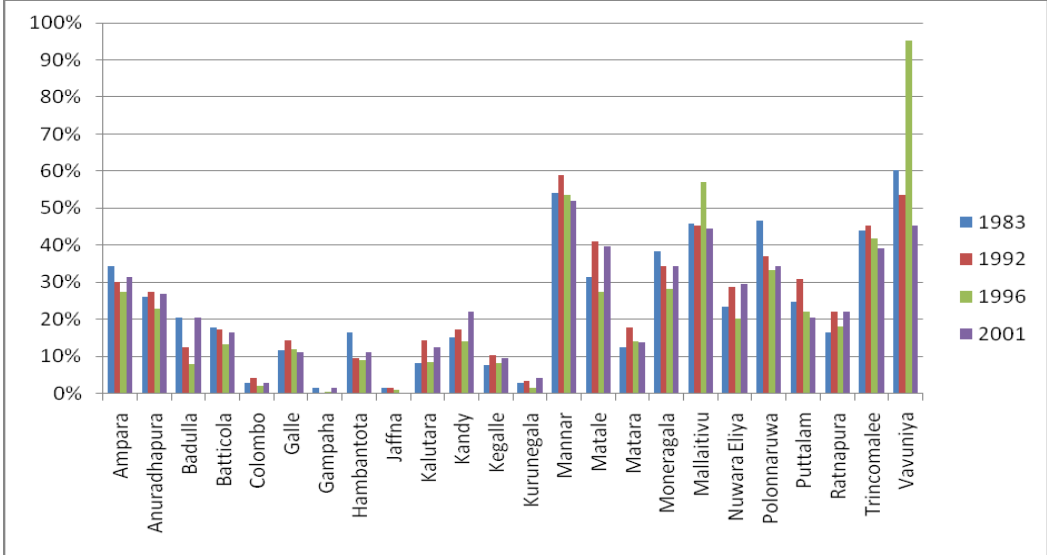


Fig. 3. Forest area change for all districts 1983–2001. Modified from GOSL (2000) and Ratnayake et al. (2002).

In Fig. 4, annual deforestation rates are compared between two different studies from 1983–1996–2001. The figures show inconsistent values, partly because different methodologies are used to estimate changes. The districts of Moneragala, Polonnaruwa and Hambantota show a steady decrease according to both studies. Adjustments of the borders between the districts of Mullaitivu, Vavuniya and Kiliochchi in 1982–1992 make the estimates for these districts uncertain (Legg and Jewel, 1995). Recent assessments of forest cover in five districts (Vavuniya, Mullaitivu, Mannar, Killinochchi and Jaffna) in the northern province show that forest cover has increased by three percent from 1999–2008 including dry monsoon forest, riverine forest and mangroves (Gunawardane et al., 2010).

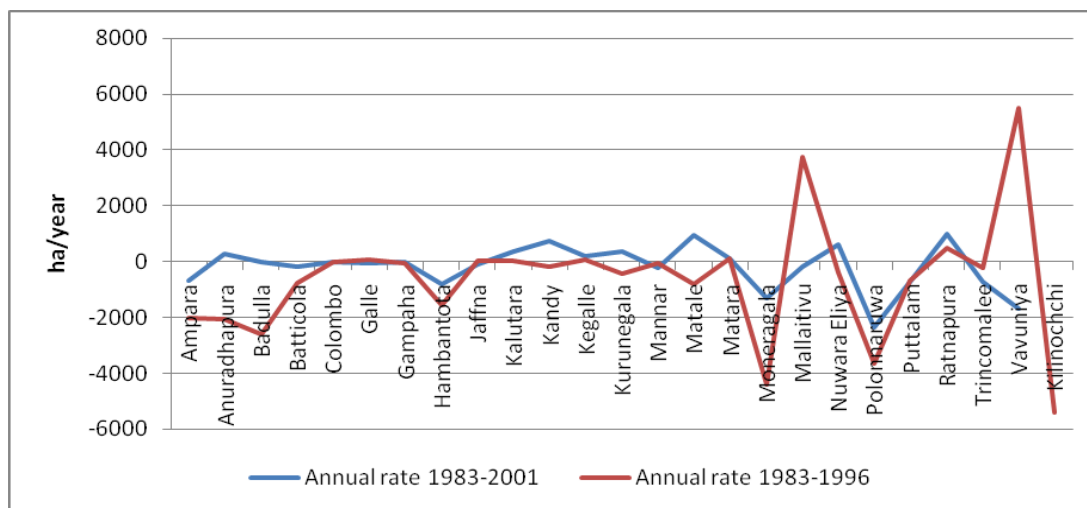


Fig. 4. Comparison of annual deforestation rates for all districts using two different studies. Figures from 1983–2001 are based on Ratnayake et al, 2002, while the figures 1983–1996 are based on Legg and Jewell (1995) and GOSL (2000).

7.3. Drivers of deforestation

Detailed accounts and reports of deforestation processes in Sri Lanka are scarce, especially for recent years. Differences between climatic zones can be observed. In the dry zone, forest is generally converted into paddy (rice) land, while clearing of forest for non-irrigated agricultural activities has been concentrated mainly to the wet and intermediate zones. Additionally, the intermediate zone forest has also suffered losses to sugar cane plantations. Homegardens and residential land have increased consistently in all zones. In the wetter parts most of these lands are derived from forests and plantations while in the drier parts they are derived from forests and wastelands (Peiris, 2006).

More specifically, the main causes of deforestation and forest degradation are according to Bandarathillake and Fernando, (2003);

- Conversion of forests to non-forest uses; mainly through shifting cultivation;
- Overexploitation of forests for timber production;
- Lack of established forest boundaries, due to a lack of a national land-use policy;
- Illegal felling of timber and encroachment² on state forests

Population growth and migration patterns have historically been main contributors to land-use changes and conversion of forest to non-forest uses through agricultural plantations and shifting cultivation (Bandarathillake and Fernando, 2003; Lindström and Mattsson, submitted). The only significant natural causes for deforestation and forest degradation are fires, cyclones (Bandarathillake and Fernando, 2003) and the tsunami that hit Sri Lanka in 2004 (Mattsson et al., 2009).

² Encroachment can be separated into two types, direct, in which the encroachers live in the forest area, or indirect encroachment, where the land is simply leased out to local farmers or to migrants (Iftekhar and Hoque, 2005).

The private sector controls only around 20 percent of the land in Sri Lanka, of which 70 percent is owned by cultivators who only return for harvesting. In the absence of alternative employment opportunities, wood resources or land available for utilization, marginal land, is continually encroached upon by people who do not have the motive or resources to manage it in a sustainable way (Dent and Goonewardene, 1993; Chokkalingam and Vanniarachchy, 2011).

Silva (2001) mentions numerous reasons for land encroachment:

- land hunger – the state owns a majority of all land, and they fail to keep up with the land pressure.
- availability of land – 80 percent of the total land area in the country remains state property, spread out under different government departments and agencies. Some land areas are protected and some are subject to land distribution schemes.
- lack of employment opportunities – the possibility for economic maintenance outside the agricultural sector is sparse.
- inefficiency of laws – the laws, rules and regulations concerning encroachment are inefficient and not enforced.
- absence of policies – encroachers expect from the government that their cases will be met with sympathy, and their encroachment's regularized.

Another historical driver of natural forest cover loss was the initiation of the Mahaweli Ganga Development Project in the early 1970s – one of the largest irrigation schemes carried out in Asia. The purpose of the project was to use the longest river in Sri Lanka, the Mahaweli Ganga (approximately 330 km) and adjoining river basins to irrigate the northern and northeastern parts of the dry zone lowlands (Erdelen, 1988). The Mahaweli Development Project encompasses about 55 percent of the dry zone or 39 percent of the total area of the island. The scheme was located in a part of Sri Lanka still densely forested and resulted in a 2428 km² loss of natural and secondary forests within a period of eight years. On the other hand large investments in reforestation activities by the forest department resulted in a significant increase of forest plantations in the catchment area, from 280 ha in 1956 to 3500 ha in 1991 (White et al., 1995).

In light of the various deforestation processes in the country several constraints to the forestry sector have to be resolved. Bandarathillake and Fernando (2003) mention a number of shortcomings, among them a lack of participatory forest management and benefit-sharing mechanisms and inappropriate national accounting systems which do not consider the total value of forest products and services. In addition, the laws in Sri Lanka are considered insufficient and ineffective (Silva, 2001), and laws are hard to enforce since responsibility is scattered among several ministries, departments and agencies. Also, the boundaries where districts' authority begins and ends are sometimes unclear, and therefore laws and regulations are hard to enforce (Chokkalingam and Vanniarachchy, 2011).

Information and accounts of deforestation processes related to the civil war between the government and the LTTE in 1983–2009 are scarce. Government soldiers cleared forests along roads as a way to reduce possibilities for rebel forces to hide (Butler, 2006) and rebel forces harvested trees for construction purposes. The civil war also relocated rural communities into forested areas (Chokkalingam and Vanniarachchy, 2011). Suthakar and Bui (2008) claim that more than 700 000 people in the Jaffna region migrated and over 65 000 people were forced to

abandon their fields, especially in 1991–1996, due to an economic embargo by the government. In addition, 18 percent of the agricultural land was inaccessible and classified as high security zone area by the government. As a result, people were displaced and activities related to agriculture and forestry was banned. An estimated 3.6 million palmyrah palm trees and coconut palms were cut down for security reasons and for timber purposes (Suthakar and Bui, 2008; Gunawardane et al., 2010). Homegardens, crops, tree crops and barren land decreased slightly in extent from 1984 to 2004 while some ecosystems such as rangeland (grass and scrub) and marshland increased by 40 and 50 percent respectively. Forest cover was reduced rapidly from 1984 to 1991 followed by a slow increase. Marshland increased over time to become the third largest land cover type in 2004. Degradation of agricultural land as a consequence of the civil war has had serious environmental impacts. In 1995, the District Department of Agriculture of Jaffna estimated that more than 2500 ha of paddy land had been lost due to increased salinity in the lagoons and coastal sites. Two main factors were identified; 1) damage during the war to all saltwater protection bunds, which the government did not maintain, and 2) unsustainable sand mining and cutting of mangroves in coastal areas (ibid.). The recent increase of forest cover (three percent) in the northern districts (Gunawardane et al., 2010) from 1999–2008 is mainly due to natural regeneration as a result of limited human activities and disturbances to the forests. Due to the socioeconomic development programs in this region after the civil war, the demand for timber and fuel wood has increased. Present demand is met from legal and illegal palmyrah plantations in the coastal belts, but there is a growing potential for commercial timber plantations in the northern province (ibid.).

7.4. Mangroves

Mangrove forests are one of the most exploited ecosystems in the country, with shrimp farming posing as the greatest threat. Depletion of mangrove forests have historically mostly been observed in the western coastal parts of the country mainly due to construction of industrial shrimp farms (Karunathilake, 2003). Along with the destruction of ecosystems, this has created other problems such as lack of clean water and loss of employment opportunities for fishermen. In the southern districts on the other hand, a growth of mangrove has been observed, as a result of irrigation channels.

Other contributors to the degradation of mangrove ecosystem are human settlement expansion, tourism and agriculture and illegal encroachment (IUCN, 2011). In order to avoid further degradation, management priorities such as conservation of undisturbed habitats and restoration of disturbed and degraded habitats are essential (ibid.). Proper law enforcement and improved administrative efficiency are important to achieve ecological sustainability and protection of the mangrove ecosystems (Dahdouh-Guebas et al., 2001). Activities to conserve mangrove forest have been launched by rural communities, government agencies, international organizations and other non-governmental organizations. However existing conservation measures are inadequate compared to the decline rate of mangrove forests (Karunathilake, 2003).

8. Land-use change at district level

Rice or paddy is the major food crop in Sri Lanka. In 1994, 655 000 ha of rice were cultivated under irrigation and 230 000 ha under rain-fed conditions (Sri Lanka, 2000). In the dry and intermediate zones the extent of paddy increased by 12 000 ha during 1993–1999. The increase occurred mainly in the districts of Polonnaruwa and Ampara, the two main beneficiaries of the Mahaweli Ganga Development Project. In the wet zone the area under paddy decreased almost by 6,100 ha in the same period. The districts with the largest decrease were Gampaha, Kalutara, Galle and Matara. The main causes for abandonment of paddy lands were low returns, scarcity of land and irrigation water, sea water intrusion and high demand for land from non-agricultural users (Silva, 2001).

Tea plantations in the estate sector decreased by almost 34 000 ha during 1983–1994. The largest decrease occurred in mid-country, where soil erosion, ageing plants, poor management and decline in tea prices made it non-profitable. The extent of tea plantations in the small holding sector increased by approximately 15 000 ha altogether, the largest increase was recorded in the southwestern part of the island. This spatial difference was due to increasing demand and increased profit for low country teas. Although the extension of tea plantations decreased by almost 18 000 ha between 1983 and 1994, the production increased by approximately 35 percent, most likely due to the transition to higher yield seeds. In 1994–1999, the area of tea plantations most likely increased, although it is not possible to distinguish any district-wise trends. During the same period the production increased, not solely due to the area increase but also because of higher market prices for tea. The general trend is that tea plantations decreased in mid-country areas in benefit of low country areas, due to more suitable soils and higher demand and price (Silva, 2001).

During 1982–1992, rubber cultivation declined from 171 000 ha to 161 000 ha. The largest decreases were recorded in the wet zone districts of Kalutara, Galle and Matale. One of the main reasons for the decrease was production costs, which increased by approximately 64 percent in the estate sector and 56 percent in the small holding sector during the same period. Low profits resulted in a shift from rubber cultivation to crops that generated better revenues. During 1994–1999 many districts recorded losses in the small holding sector in favor of the estate sector. In total, the net area under rubber cultivation declined by approximately 2700 ha. Most of the potential rubber growing areas in the wet zone have been utilized already; therefore an expansion to meet the growing domestic demands for rubber needs to take place in the dry and intermediate zones (Silva, 2001).

Table 4. Changes in area extent for various crop 1982–1992–1999, Modified from Silva, (2001). Spatial trends for different land uses are also presented in Appendix 1.

Changes in Extent (ha)	1983– 1993	1993– 1999	1982–1999
Major export crops			
Tea	-18 181	6 034	-12 147
Rubber	-9 678	-3 322	-12 000
Coconut	4 081	18 669	22 750
Minor domestic crops			
Pepper	17 131	2 466	19 579
Cashew	10 194	1 432	11 626
Cloves	7 269	76	7 345
Coffee	4 424	280	4 704
Cinnamon	3 057	10	3 067
Cocoa	-2 088	931	-1 157
Cardamoms	-878	225	-653
Tobacco	-3 127	-3 990	-7 117
Domestic Agriculture			
Paddy	29 615	5 903	35 518
Potatoes	211	-4 208	-3 997
Vegetables	2 832	3 971	6 803

Cultivation of coconuts is concentrated in the coconut triangle, which encompasses the districts of Gampaha, Kurunegala and Puttalam. All production is not from plantations. Coconut is a common crop to grow as scattered trees, and very popular in homegardens. Although no nationwide information is available to analyze changes in coconut plantations, it is possible to see a general trend that scattered trees increased in all districts where data is available. The patterns vary across the country, but the largest increase of scattered trees was recorded in Colombo, Gampaha, Kalutara, Ratnapura and Kegalle between 1983 and 1993. For plantations, the largest decreases occurred in Colombo metropolitan area, due to high demand for land for urban activities, and the coastal districts of Galle and Puttalam, due to industrial activities. The extent under coconut plantation cannot be estimated from 1994–1999 since two inconsistent sets of figures for each year exist. However, yields and production have fluctuated, which may be due to weather conditions and use of fertilizers (Silva, 2001).

Coffee growing districts are mainly Kandy, Kegalle, Matale, Nuwara Eliya, Kurunegala and Gampaha. From 1982 to 1993 all growing districts, except Badulla, Ratnapura and Kurunegala recorded increases. Kandy and Matale contributed approximately 50 percent of the increase during this period, most likely as a result of development schemes in these districts. Cocoa is concentrated to Kandy and Matale districts. The extent under cocoa and coffee increased slightly from 1993–1999. The increase of cocoa occurred in the main growing districts, Kandy and Matale, while coffee increased in all producing districts (Silva, 2001).

Cultivation of pepper is located in all of the wet and intermediate zone districts, including Hambantota and Puttalam. The main growing districts are Kandy, Matale, Kegalle, Kurunegala, Ratnapura, Gampaha and Hambantota. These districts accounted for 75 percent of the recorded increase from 1982 to 1993. During 1993–1999 increase took place in most growing districts,

with the bulk recorded in Matale and Kandy. This trend was a result of lucrative prices and support from the export agriculture crop assistance scheme (Silva, 2001).

Cinnamon is grown in most of the wet zone districts, Matale and Kurunegala in the intermediate zone and Hambantota in the dry zone. Galle, Matara, Kalutara, Ratnapura and Hambantota accounted for 97 percent of the 25 000 ha under cinnamon cultivation in 1999. Cashew plantations are found in almost all districts but production is predominantly found in Gampaha, Kurunegala, Hambantota, Puttalam and Batticaloa. From 1994–1999, the area of cashew plantations increased with almost 1500 ha. The increases occurred mainly in Badulla, Ratnapura, Matale, Moneragala and Anuradhapura while 95 percent of the losses occurred in Gampaha, Matara, Hambantota and Puttalam (Silva, 2001).

Tobacco is grown in all intermediate zone districts, and in some of the districts in the dry and wet zone. The main districts are Kandy, Matale, Polonnaruwa, Anuradhapura, Moneragala, Badulla and Nuwara Eliya. All districts except Polonnaruwa, Batticaloa and Matale recorded a decrease in extent of tobacco. In total, the area of tobacco cultivation decreased by almost 50 percent from 1994–1999, mainly in the wetter parts of the country as a result of a worldwide decline in demand (Silva, 2001).

High value crops such as potatoes and vegetables are grown seasonally, both on rainfed and irrigated lands. Trends indicate a decline in potato cultivation, due to low yields and high production costs, in favor of vegetables. The decline is significant in Nuwara Eliya and Badulla, which also are the main growing districts together with Jaffna. District-wise changes for different land uses 1982–1992–1999 are presented in Table 4 and in Appendix 1.

8.1. Homegardens

The total area of homegardens in the country was estimated to 977 700 ha in 2005. This is around 40 percent of the total forest area of Sri Lanka and 15 percent of the total land area (MFE, 1995; FAO, 2009). Homegardens are not classified as forests but are rather agroforestry systems that store large amounts of carbon. Tenure rights and benefits are potentially more secure for homegardens than for natural forests (De Zoysa, 2001). The average size of homegardens range from 0.05 to 2.5 ha, where the majorities are between 0.1 and 0.4 ha (Fernandes and Nair, 1986; Perera, 1991). Homegardens often provide a considerable part of household income and provide complementary food and material products (Perera, 1991; Pushpakumara et al., 2010). Fig. 5 shows the change in area by district where data is available 1982–1993. MFE (1995) expects an increase in homegarden area with one percent annually in the near future.

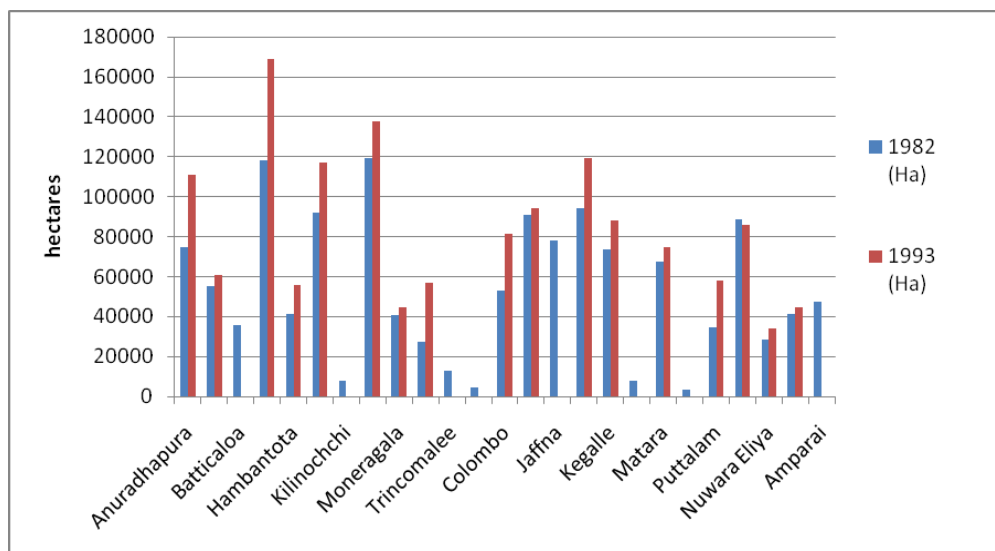


Fig. 5. District-wise extent and area changes in homegardens 1982–1993. Modified from Silva, (2001).

9. Discussion

Little information on recent changes in forest and land use changes is available for Sri Lanka and the data presented in this report only accounts for changes during the 1980s and 1990s. A new nationwide forest cover assessment managed by the Forest Department, using satellite imagery complemented by field verification is currently being finalized and will give new information regarding forest cover changes on national and sub-national scale (Chokkalingam and Vanniarachchy, 2011). This assessment may also complement the recent analysis in the northern districts reporting increased forest cover over the last ten years (Gunawardane et al., 2010) and give more information on whether trends of increased forest cover in the central districts reported by Ratnayake et al. (2002) have continued.

In terms of land-use, there are regional differences within the country. The wet zone has hardly any room for expansion, and with a forest cover of nine percent, one option is to provide incentives to local land-users to increase productivity in already utilized parts. As long as the state owns and governs the lion's share of all land and does not invest effort into policies and measures for agricultural intensification that generate employment opportunities for local land users, forest degradation and encroachment are likely to continue. Another factor often cited as contributing to deforestation is population growth. However, in Sri Lanka, a population growth has been low for many years. Migration, rather than population growth, as a result of promotion of agricultural expansion in some areas, might be a reason for reported forest loss. Gunatilake (1998) investigated the dependency of local communities on forest resources in two protected areas in Sri Lanka and found that better education, higher agricultural income and productivity, employment outside the agricultural and forestry sector and better access to outside markets can reduce dependency on forest resources.

The government early recognized the importance of forests for biodiversity protection and about 50% of all natural forests in the country, or 14% of the total land area, have been declared protected. Hence, the problem is often not a lack of legislation, but rather the lack of physical planning and law enforcement. Although mangrove forests have been destroyed in many places,

there are measures to conserve them. Conservation programs which include local communities participate are a promising approach and lessons-learned could be transferred to the remaining forestry sector to increase the prospects of reduced deforestation and sustainable development. Studies outside Sri Lanka (e.g., Gregersen et al., 2011) stress that local communities who control their forest resources can help slow and even reverse deforestation that forests managed by communities in general had lower and stable deforestation rates than protected forests (Porter-Bolland et al., 2011) and that protected areas are not the best governance structure for forest conservation (Hayes, 2006). Further research on these coupled links on different spatial scales and environments on a national and sub-national level could yield more information that is important for improving understanding and guidance needed for forestry and land-use planning.

Additional studies on the relation between land-use change and conflicts are needed to improve understanding of different drivers of forest loss and find lessons to be transferred to other countries as well. A study carried out by Suthakar and Bui (2008), is one of few reports that give quantitative information about population movements and major land-use changes and its effects in northern Sri Lanka during the years of war. It would be of great interest to further investigate the impacts and effects of former land-use changes in northern districts, especially on a socio-economic scale when population returns post-war, and villages are to be rebuilt and developed.

Given the scarcity and lack of consistency of data on forest cover and its changes over time, it is challenging for Sri Lanka to produce a reference level for REDD+. The data that is available, both from global assessments and national inventories, show little uniformity and diverge in forest area estimations. A REDD+ mechanism designed to also include ecosystems like homegardens and possibly also regeneration of mangrove forests could greatly enhance carbon absorption within a national REDD+ system without reducing the positive effects for climate, soil and local communities.

10. Conclusions

Historically, much of the deforestation was planned by the government for agricultural expansion, timber extraction and development projects.

If the objectives of the current forestry policy are to be met, participatory forest management is key, combined with a multi-stake holder approach also involving ministries concerned with land-use planning and agriculture in order to account for all direct and indirect factors influencing land-use and forest cover change. For the future, regulations need to be strengthened and new laws have to be introduced to keep the legislations up to date and to meet changing needs.

The general trend since 1983 has been a decline in tobacco, rubber and tea along with forest, mainly due to decline in profitability. A continued decline of these crops in favor of more profitable cash crops, such as peppers or cashew is to be expected depending on current demands on domestic and international markets.

As shown here Sri Lanka has limited forest data for establishing an accurate and equitable reference level. There is however a high mitigation potential in the national forestry sector and low overall contribution to emissions. Given these preconditions, REDD+ can have a role to play

for Sri Lanka and experiences from the ongoing readiness process can be transferred to other countries of similar size and natural conditions.

New information from the nationwide forest cover assessment in 2011 will most likely provide more detailed data to better estimate the forest change and the drivers of change. This can in turn be used to study opportunities, barriers, costs, revenues and reference levels for a possible REDD+ system.

The fact that 81 percent of the forest area is actually naturally regenerated forests and that the general trend is a declining deforestation rate highlights that the dimension of sustainable forest management and conservation included in the REDD+ could be more suitable for Sri Lanka in their aspiration to participate in the future REDD+ process.

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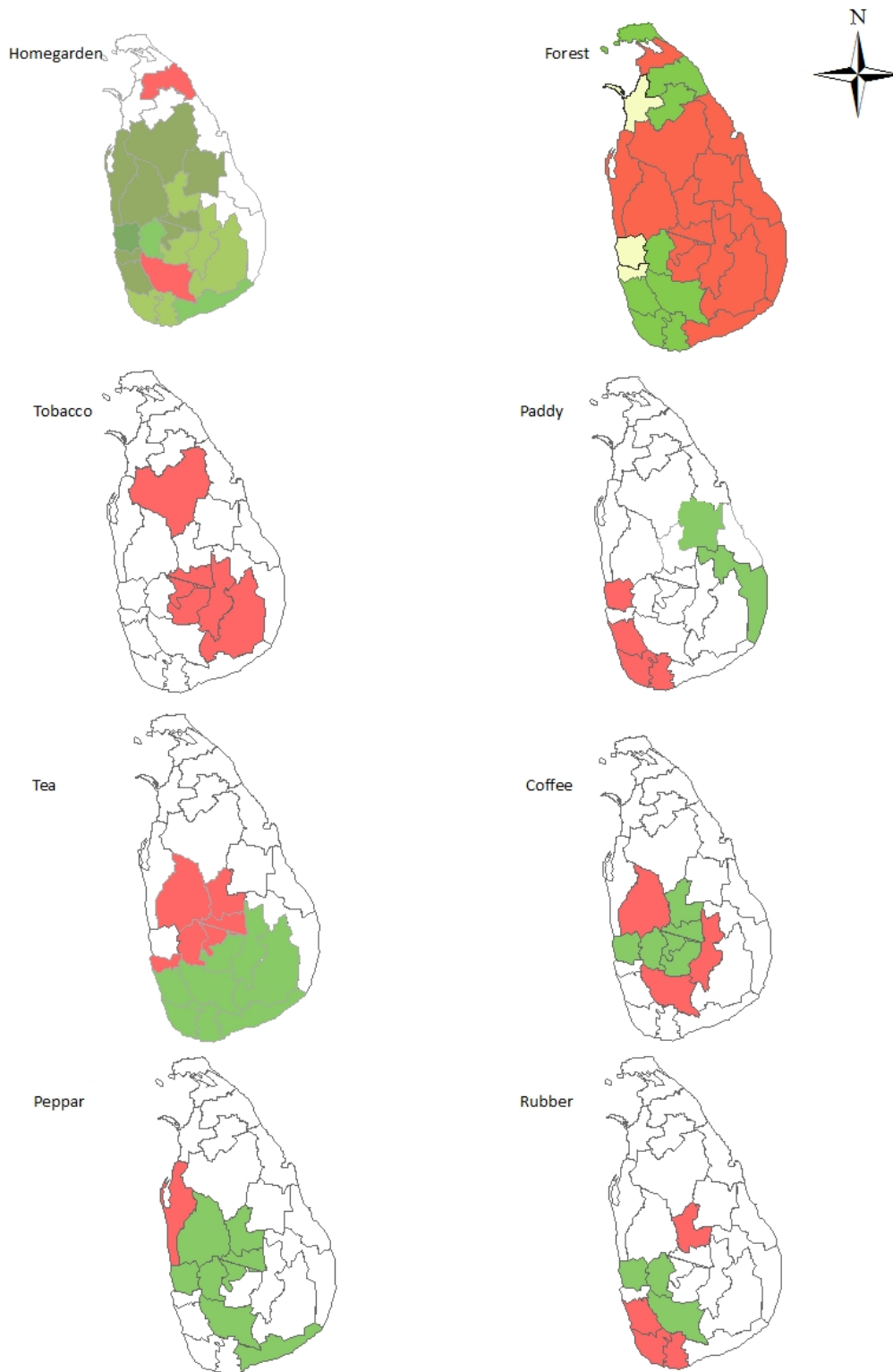
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Appendix 1. District wise land use changes 1983–1999



Maps showing area changes in forest, homegarden and major export and domestic crops from 1983–1999 for Sri Lankan districts. Green colour represents an increase and red colour symbolizes a decrease in land use. No color represents no data or no land-use class present for that district. Forest and homegardens are based on Legg and Jewell (1995) while the remaining land-use classes are based on Silva (2001).

Appendix 2. Historical forest and land-use policies

Forest Ordinance No. 10 – from 1885. Protection of forests and their products in reserved forest and villages forests, primarily for sustained production; also, protection of wildlife in sanctuaries.

The Forest Ordinance No. 16 – was enacted in 1907 by the British. It has been amended four times, the last time in 2009. It restricted the public's use of forests, and made it possible for the state to claim any land. Forest clearing, extraction and grazing were prohibited which made it impossible for communities to withhold their livelihood base.

The State Land Encroachment Ordinance – from 1840 made all unoccupied, uncultivated and chena land state property unless other could be proven.

The Land Acquisition Act No. 9 – from 1950 nationalized all plantations in the 1970s, and then reversed it in the 1990s, to meet increasing timber needs.

State Land Ordinance No. 8 – handles the power of the state to sell, lease or grant state land management.

The Registration of Title Act – addresses the problems of land records and titles. The Bim Saviya program aims to survey the act and to issue land titles and strengthen ownership.

The National Environmental Act – from 1980 is a dynamic law regulating the market of threatened forest resources and promotes reforestation. It demands a sane use of the national resources and also applies to investment programs, and forces them to seek environmental approval.

The National Environmental Regulations No. 1 – from 1993 is a regulation under the environmental act, and it ensures environmental protection under development activities. It prohibits forest conversion to non forest use for areas over one hectare. It also demands an environmental impact assessment for timber harvest and forest plantations in areas over 5 hectares.

Forestry Master Plan – from 1986, promoted comprehensive forest planning. The plan was prepared with minimal consultation and was criticized for lacking ecological perspectives since it recommended timber harvesting.

The National Conservation Review – from 1991 was conducted to evaluate the conservation values of Sri Lanka's national forests. The study led to 32 conservation forests, to cover gaps in Sri Lankan biodiversity and hydrology conservation.

Forestry Sector Master Plan – from 1995 was developed by different actors such as the Forest department, various Government departments, universities and NGOs. It contains strategies for the forestry sector until 2020.

The National Policy on Wildlife Conservation – from 2000 proclaims the's commitment to wildlife conservation and sustainable biodiversity management. It stresses the need for local community participation.

The National Environment Policy – from 2003 aims to help the management of the forests by linking together stakeholders with equitable sharing of benefits and costs. It also promotes strong land tenure ships and tenure stability.

The Forest Initiative Partnership

