



An Assessment of Post Tsunami Restoration and Conservation Initiatives in Coastal Stretch of Matara

IUCN-Sri Lanka Country Office



Ecosystems & Livelihoods Group, Asia



This is a working paper to be finalized during a stakeholder consultative workshop scheduled from March 16-19, 2009.

Introduction

In 2004, an earthquake of unimaginable magnitude occurred in the ocean floor of the Pacific Ocean, close to the island of Sumatra. It triggered a tsunami that severely devastated many of the coastal communities living in the countries of South and South East Asia. Sri Lanka was one of those countries that were badly affected. The coastal districts of Western, Southern, Eastern and Northern Sri Lanka suffered extensive destruction and out of the 14 districts along the coastal belt, 13 districts were affected by the tsunami waves. Approximately 31,000 people were killed and 4,100 were reported missing. In addition, the people who lived in the districts that were worst affected had their livelihoods totally disrupted while industries such as tourism and fisheries experienced great losses.

Although the destruction caused by the tsunami was high in coastal districts, research shows that natural coastal habitats such as mangroves, coastal vegetations and sand dunes significantly reduced the damage cause to coastal communities. For example, the sand dunes protected the communities of the Panama and Bundala areas while mangroves in the Rekawa lagoon absorbed the force of the tsunami waves and significantly reduced the harmful effects and saved many lives (Bambaradeniya et al. 2006). Research that was carried out in western Java after the tsunami also shows that coastal vegetation absorbed the destructive force of the tsunami waves and protected coastal communities (Latief and Hadi, 2006).

Many environmental and relief agencies, including the government sector, international relief agencies, NGOs, CBOs and academic institutions, recognised the key role that was played by coastal vegetation in protecting the coastal communities from the tsunami waves. As a result, all parties involved in post-tsunami rehabilitation projects were interested in the restoration of the natural coastal habitats that were damaged due to the tsunami waves.

A survey was carried out along the coastal belt of the Matara district in Sri Lanka to investigate the status and impacts of coastal habitat restorations projects, which were implemented by various agencies. This study focused on assessing the status of the environmental impacts from restoration projects on the coastal habitats and their biodiversity. Although this survey was carried out two years after the tsunami occurred, findings from this study will help decision makers in environmental conservation to learn lessons from the coastal ecosystem restoration activities conducted by many agencies.

Objectives

The following objectives were focused on in the survey:

- To evaluate the status of the ecological impact from the restoration projects.
- To assess the status of post-tsunami restoration activities.
- To assess the lessons learned from coastal ecosystem restorations.

Matara district

The Matara district is located in the Southern Province of Sri Lanka and consists of sixteen divisional secretariat divisions which administer to the Matara district. Out of sixteen divisional secretariats, four divisions have coastal boundaries, namely Dikwella, Devinuwara, Matara and Weligama. The Matara district is located in the wet zone of Sri Lanka. Although the eastern margin of the coastline, Nilwella of Dikwella AG division, is the boundary of the intermediate zone and dry zones. The beaches of the Matara district are heavily eroded and narrow. Most of the land on the coast is privately owned as a result only a few stretches of beach remain open for the greening activities. Although some agencies have been able to grow plants on privately owned land, most of the agencies have failed to convince private landowners to establish coastal green belts.

Effect of tsunami to Matara district

Four coastal divisional secretariat divisions in the Matara district were badly affected by the tsunami. As a result, Matara district was recorded to have 1,342 human deaths and 613 missing persons. More than 20,675 households were affected due to the tsunami and 2,904 families were internally displaced. A large amount of infrastructure such as roads, bridges, buildings, electric and telephone lines and fishing harbors were destroyed. The main livelihoods, such as fishing and coir industry of the area also collapsed due to the tsunami.

Methodology

A literature survey was carried out to gather basic information of the environmental, geographical, institutional and post-tsunami environmental initiatives. A field survey was subsequently conducted over a period of five days (27th to 31st of August 2007) by four ecologists, using rapid and direct pre-determined techniques based on specific ecological indicators and/or parameters and the information was supplemented with site-specific digital photographs. Major governmental institutions with authority over district environmental aspects, as well as selected NGOs, were consulted to verify the data. Three coastal restoration projects were selected randomly to conduct a detailed survey of the interventions.

The following criteria were used to assess the performance, particularly of the three major agencies;

- Environmental and economical soundness of the project for the site.
- Coordination between relevant stakeholders.
- Visibility of the project.
- Sustainability of the project.
- Overall evaluation based on the ecological impact of the project.

Study sites

A field survey was conducted to cover the entire coastal stretch of the Matara district; from Kudawella to Midigama. Observations were made at approximately 20 sites along the Matara coastal stretch. Qualitative assessments of the post-tsunami ecological interventions were made by using the following criteria.

- Suitability of the ecological restoration
- Selection of plants and the restoration methodology.
- Natural recovery of the ecological interventions.

Dikwella Divisional Secretariat area beach stretch

The coastline of the Dickwella AG division of the Matara district is composed of barrier beaches that scale between moderate and small. These beaches are intersected in places by rocky headlands that form bays.

The study was carried out on the beach stretches of Kudawella, Nilwella, Dikwella, Batheegama and Lunukalapuwa which belong to the Dikwella AD division.

Most of the natural vegetation that grows on the coastal stretch of the Dickwella AG division has been altered by humans. Coconut plantations are found to dominate the coastal belt of Dikwella. A thin stretch of Pandanus, (*Pandanus odoratissimus*,) is maintained by the community to reduce the sea breeze. Other dominant plant species native to the coastline are *Thespesia populnea*, *Scaevola taccada*, *Terminalia cattappa*, *Barringtonia asiatica* and *Hibiscus tiliaceus*. Bin Tamburu (*Ipomoea pes-caprae*) is also a common plant species found on the sandy beaches of this coastal stretch.



Rocky headland of Dikwella area

Dewinuwara Divisional Secretariat area beach stretch

The coastline of the Dewinuwara Divisional secretariat area is also composed of moderate to small sized barrier beaches and these beaches are also intersected in places by rocky headlands which form bays. This coastline faces heavy ocean current and high wave action, especially during the southwest monsoon period. Most parts of the coastal line are not suitable for the replanting program due to the presence of rocky beaches.



Rocky beach and the high wave actions in the Dewundara coastal area

Matara Divisional Secretariat area beach stretch

The coastline of the Matara Divisional secretariat division is composed of medium to large size barrier beaches and these beaches intruded into the sea in places as rocky headlands. Rocky breakwaters constructed by the Coast Conserveation Department (CCD) protect some parts of the coastline. Most dominant coastal vegetation type in this coastal stretch is coconut plantations. The Nilwala river estuary is located in this coastal stretch and a large amount of freshwater enters into the sea through the Nilwala estuary. The shallow sea near the Polhena beach stretch, which is located to the west of the Nilwala river estuary, harbors a healthy coral reef.



Barrier beach of the Thalaramba area of the Matara divisional secretariat area

Weligama Divisional Secretariat area beach stretch

The coastline of the Weligama divisional secretariat is composed of a large bay called the Weligama bay, which is made up of moderate to small sized barrier beaches that are intersected places by rocky headlands. A small river named Polwathumodera, discharges its water into the Weligama bay. Polwathumodera estuary has a heavily degraded Mangrove habitat. Pandanus (*Pandanus odoratissimus*,) plants are common in this coastal stretch and there are also a few fishing harbours located in this coastal stretch.



Barrier beach of the Weligama coastal stretch

Results

Out of the 16 sites surveyed, only three sites followed the established coastal ecosystem restoration guidelines and those projects were implemented by Forest Department. *Pandanus odoratissimus* was the most commonly planted species by the green belt restoration projects, followed by *Terminalia cattappa*, *Barringtonia asiatica* and *Thespesia populnea*. According to the available information, soon after the tsunami, some of the humanitarian agencies planted species such as *Filicium decipiens*, which are not suitable for sandy beach habitats (See annex 01 for the restoration status of the 16 beach stretches of Matara district). Most of the planting projects that were conducted along the Matara coastal stretch after the tsunami did not follow the technical aspects of the green belt restorations.

Although large numbers of agencies have participated in the green belt restoration work, the lack of coordination with relevant government agencies makes it impossible to identify the implementing agency of the restoration initiatives. Villagers living near the restored coastal habitats and officers of the relevant government agencies indicated that a large number of restoration work has been implemented since January 2005 in the Matara Coastal stretch but most of them failed due to lack of maintenance.



Poorly planted *Pandanus* washed by sea water



Pandanus planting program in the inter tidal zone

Rehabilitation of Thotamune (near Nilwala river mouth) area

Implementation Agency – University of Peradeniya collaboration with the collaboration of Municipal council of Matara

Description of the project

The University of Peradeniya in collaboration with the Municipal council of Matara implemented the establishment of a 250m coastal green belt project in the Thotamune area. The area of Thotamuna is located on the right hand side of the Nilwala riverbank which as severely affected by tsunami. The Coast Conservation Department (CCD) has constructed 100-meter long water breakers, which is parallel to the coastline as this area is extremely vulnerable to re-current environmental hazards such as storms and tidal waves. The establishment of a green belt was carried out along the earth wall on the beach and extended another 150 meters behind the water breakers.

The implementing agency was trying to establish a 100m green belt behind the water breakers but the survival rate of the plants were as low as 10% due to the strong sea spray. Most of the plants in the 100m stretch were dead and no re-planting activity was conducted. In addition, the growth rate of the surviving plants was very slow due to the strong sea spray, high temperatures during the day and lack of fertile soil. A 150m long narrow strip of plants was established beyond the water breaker wall and plant species such as *Pandanus odoratissimus*, *Terminalia catappa*, *Accacia sp.* and *Casuarina equisetifolia* were planted in that stretch. These were planted on the beach and a 40%-50% survival rate was recorded in that stretch. It was also recorded that *Casuarina equisetifolia* was the only species that became well established in this site.

Stakeholder participation

According to the project information board, which was assigned to the project site, this project was implemented by University of Peradeniya, Saitama University of Japan (with the collaboration of Municipal council of Matara) and funded by the Heiwa Nakajima Foundation of Japan. The Municipal council has carried out the maintenance of the restoration project, but the Environmental and CCD officers who represent Municipal council are not fully aware of the project. In addition, the surrounding community was not involved in the project activities and they have no knowledge about the project.

Observations of the project

This is a typical post-tsunami green belt restoration project that has been conducted without proper coordination or technical guidelines. This project was a donor driven fast track project, which was conducted without any consultation from the relevant authorities. The implementing agency may only have selected the sites and planted some tree species to show their donors that they have established a green belt in the tsunami affected areas.



Casuarina plants in Thotamune replanting site



Information board about the project



Planted area behind the break water wall, however only the cover of the plants are remaining

Rehabilitation of Epitamulla (Kamburugamuwa) coastal area.

Implementation Agency - Visura Development Foundation

Description of the project

A coastal belt, about 300m long, was established in the Epitamulla area by the Visura development foundation. This green belt was established on privately owned land in the Matara Divisional Secretariat division. Many other organisations such as the Green Movement, Sarvodaya Movement and the Fishing Community Federation of the South claim that they also have established a green belt on the same site. It seems that these organisations may have planted vegetation in the same site at different periods over the past two years since the tsunami, but very few plants have survived due to a lack of post-planting maintenance. Although there are

many agencies involved in establishing the green belt in this site, currently only the Visura Development Foundation is conducting post-planting maintenance. Most of the plants that were originally planted have been destroyed by various external factors such as tidal waves and high temperature. The Visura Development Foundation is now following the technical guidelines and conducting a fresh planting program on the green belt establishment. Plant selection was conducted appropriately and plant species such as *Pandanus odoratissimus*, *Barringtonia asiatica*, *Cocos nucifer* and *Terminalia catappa* were selected for the current replanting cycle in this site. The survival rate of the plants was as high as 50% -60% and continuing post care was observed in this sites.

Stakeholder participation

The project was implemented by the Visura Development Foundation and funded by The World Conservation Union, Sri Lanka country office. The planting activities were mainly conducted on privately owned land located along the coastal stretch. Due to this, it was not possible to involve the local community. .



Epitamulla green belt restoration project

Observations There was a high demand for the establishment of green belts after the tsunami, due to the large number of donors who were willing to provide funds. This site is a good example as many organisations have repeatedly conducted the same activities on the same site without much success. The success of these initiatives depends totally upon technically sound implementation, as well as post maintenance until the plants become well established; which is what most agencies failed to follow.

Rehabilitation of Midigama and Thappawatta coastal area

Implementation Agency – Forest Department

Description of the project

The coastal belt re-greening project was carried out by the Forest Department and was funded by the Government of Finland. Although the project was implemented in several locations, the assessment was conducted only in two locations during current survey. The Midigama and Thappawatta re-greening locations were evaluated. Both of these sites are located in the Weligama Divisional Secretariat division.

Although the extent of the project area was comparatively low, the coastal re-planting project was conducted effectively. Both Midigama and Thappawatta coastal stretches were extended to about 100m, while measuring 25m in width.

The Thappawatta restored site is located between the sea and human settlements, due to this, the project site is protected by fencing and a project information board was on display in the restoration area. 50% -60% of the plants have survived in this site, but the survey team did observe some gaps. Coastal plant diversity was maintained on this site by the selection of local coastal plant species that are grow here naturally, such as *Pandanus odoratissimus*, *Barringtonia asiatica*, *Thespesia populnea*, *Terminalia catappa* and *Cocos nucifera*. The Forest Department will continue post-care of the site until plants are well established.

The Midigama coastal area is a narrow stretch of beach, located between the sea and the Colombo-Matara highway. Most of the natural coastal plants were destroyed by the tsunami and only coconut plants remain along this coastal stretch. Villagers as well as hoteliers have encroached upon some parts of the coastal area and although this planting site was not fenced for protection, the survival rate of the plants was about 50%-60%. Native coastal plant species such as *Pandanus odoratissimus*, *Barringtonia asiatica*, *Thespesia populnea* and *Terminalia catappa* were planted in this site. In addition to the local species, exotic species like *Casuarina equisetifolia* have also been planted during this restoration activity. The eastern end of the project area is connected to a small brackish water body which connects to the sea during high tides. The mangrove vegetation found around the lagoon was destroyed due to anthropogenic activities and the tsunami. The Forest Department has also conducted mangrove restoration activity around the lagoon by using *Rhizophora mucronata* and *Bruguiera* species.

Stakeholder participation

Staff of the Forest Department carried out all the project activities. The local people who provided labour have benefited financially by the restoration project as well. The Government of Finland and the FAO are major stakeholders as they funded this project. Although the local community thinks of this project as a "government replanting project", they value the ecological benefits they will derive from these initiatives.



Forest department green belt restoration project at Thappawatta



Some plants in the restoration site

Observations.

This is one of the few successful projects that were conducted along the Matara Coastal stretch. This project was conducted by the Forest Department and they have followed the technical guidelines for coastal re-greening and used an appropriate plant selection. In addition, information provided to the community about coastal ecosystems and plant species was greatly by the locals.

The main findings of the survey:

Post tsunami restoration projects have been implemented in almost all beach stretches in the Matara Coastal stretch, excluding some rocky areas. However, most of the green belt projects have not been implemented according to the established guidelines and site selection was done in a very 'ad-hock' manner due to pressure from donors. There has also been a lack of coordination of environmental rehabilitation efforts between the relevant authorities, NGOs, international and local aid agencies. Hence, planting was conducted without following the technical guidelines. Planting was often done on the same site by many institutions, as there was a high demand to establish coastal re-greening projects. Thus, many of the planting projects were conducted by considering site-specific conditions but failed to understand the ecology of overall coastal landscape. Most of the green belt projects that have been implemented in the first two years since the tsunami have failed. Ecological mistakes such as introducing inappropriate species into new areas have been made. These species may become invasive, which could degrade the existing sensitive habitats. *Pandanus sp.* was the dominant plant species selected for replanting projects followed by *Barringtonia asiatica*, *Terminalia catappa*, *Thespesia populnea* and *Casuarina equisetifolia*.

Annex 01

Evaluation of ecosystem restoration initiative in the 16 coastal stretches in Matara district

Site and Area	Natural habitat type and dominant vegetation	Nature of the Intervention & Plant species selected for re plantation	Seedling Mortality	Status of the Initiative	Maintenance	Implemented Agency
Kudawella	Rocky beach- <i>Pandanus odoratissimus</i> <i>Thespesia populnea</i>	Reforestation <i>Casuarina equisetifolia</i> , <i>Azadirachta indica</i> , <i>Terminalia bellirica</i> , <i>Bauhinia racemosa</i> , <i>Cassia fistula</i> , <i>Pongamia pinnata</i> , <i>Berrya cordifolia</i> , <i>Filicium decipiens</i> , <i>Delonix regia</i>	Not recorded	successful	Good (by villagers)	Forest department and Green Movement
Nilwella	Rocky & Sandy beach <i>Thespesia populnea</i> <i>Cocos nucifera</i>	Reforestation <i>Terminalia catappa</i>	High	Unsuccessful	Neglected	Unknown
Dikwella	Sandy and rocky beach <i>Pandanus odoratissimus</i> <i>Cocos nucifera</i>	Reforestation <i>Pandanus odoratissimus</i>	High	Unsuccessful	Neglected	Unknown
Batheegama	Sandy seashore & Coconut plantation- <i>Pandanus odoratissimus</i> , <i>Ipomoea pes-caprae</i> , <i>Scaevola taccada</i>	Reforestation <i>Pandanus odoratissimus</i>	High	Unsuccessful	Neglected	Unknown
Lunukalapuwa	Sandy seashore & Coconut plantation- <i>Ipomoea pes-caprae</i> ,	Reforestation <i>Pandanus odoratissimus</i> , <i>Terminalia catappa</i>	High	Unsuccessful	Neglected	Unknown

	<i>Cocos nucifera</i> , <i>Pandanus odoratissimus</i>					
Thalalla	Sandy seashore & rocky water break- <i>Barringtonia asiatica</i> , <i>Ipomoea pes-caprae</i> , <i>Scaevola taccada</i> , <i>Sesuvium portulacastrum</i>	Reforestation <i>Pandanus odoratissimus</i> , <i>Barringtonia asiatica</i> , <i>Thespesia populnea</i> , <i>Terminalia catappa</i> , <i>Calophyllum inophyllum</i>	High	Unsuccessful	Neglected	Unknown
Kottagoda (Samagi)	Sandy seashore & rocky water break- <i>Thespesia populnea</i>	Reforestation <i>Pandanus odoratissimus</i> <i>Thespesia populnea</i> <i>Terminalia catappa</i>	High	Unsuccessful (few plants are still survive)	Neglected	Unknown
Mathara kotuwe (Ginigasmulla)river mouth	Sandy seashore - <i>Ipomoea pes-caprae</i> & <i>Cocos nucifera</i>	Reforestation <i>Casuarina equisetifolia</i>	Medium	Moderately successful	Moderate	Unknown
Thotamune (University of Peradeniya site)	Sandy seashore & rocky water break - <i>Ipomoea pes-caprae</i>	Reforestation <i>Pandanus odoratissimus</i> <i>Terminalia catappa</i> <i>Accacia sp.</i> <i>Casuarina equisetifolia</i>	High in water brake area medium in sandy shore	Moderately successful	Good	University of Peradeniya
Paramulla	Sandy seashore & rocky water break - <i>Ipomoea pes-caprae</i> , <i>Cocos nucifera</i> & <i>Hibiscus tiliaceus</i>	Reforestation <i>Pandanus odoratissimus</i>	High	Unsuccessful	Neglected	Unknown
Madihe	Sandy seashore - <i>Crinum sp.</i> ,	Reforestation <i>Pandanus odoratissimus</i> ,	Moderate	Moderately successful	Neglected	Unknown

	<i>Thespesia populnea</i> , <i>Pandanus odoratissimus</i>	<i>Cocos nucifera</i>				
Epitamulla (Kamburugamu wa)	Sandy & rocky seashore- <i>Ipomoea pes-caprae</i> , <i>Scaevola taccada</i> , <i>Cocos nucifera</i>	Reforestation <i>Pandanus odoratissimus</i> , <i>Barringtonia asiatica</i> , <i>Cocos nucifera</i> , <i>Terminalia catappa</i>	Moderate	Moderately successful	Neglected	Unknown
Thalaramba (Thappawatte)	Sandy & rocky seashore- <i>Barringtonia asiatica</i> , <i>Ipomoea pes-caprae</i> , <i>Scaevola taccada</i> <i>Sesuvium</i> <i>portulacastrum</i>	Reforestation <i>Pandanus odoratissimus</i> , <i>Barringtonia asiatica</i> , <i>Thespesia populnea</i> , <i>Terminalia catappa</i> , <i>Cocos nucifera</i>	Low	Moderately successful	Moderate	Forest Department
Pelane (Weligama)	Sandy seashore - <i>Pandanus odoratissimus</i> L.f., <i>Scaevola taccada</i> (Gaertn.)Roxb., <i>Ipomoea pes-caprae</i> (L.)R.Br.& <i>Cocos nucifera</i> L.	Reforestation <i>Casuarina equisetifolia</i>	Moderate	Moderately successful	Moderate	Unknown
Kudabaddegama (Gurubewila)	<i>Cocos nucifera</i>	Reforestation <i>Pandanus odoratissimus</i>	low	Unsuccessful	Neglected	Unknown
Midigama (Forest Department site)	Sandy seashore & Coconut plantation <i>Ipomoea pes-caprae</i> (L.)R.Br., <i>Scaevola taccada</i> (Gaertn.)Roxb., <i>Pandanus odoratissimus</i> L.f.&	Reforestation <i>Pandanus odoratissimus</i> <i>Barringtonia asiatica</i> <i>Casuarina equisetifolia</i> <i>Thespesia populnea</i> <i>Terminalia catappa</i> <i>Bruguiera sp</i>		Moderately successful	Moderate	Forest Department

	<i>Cocos nucifera</i> L. Canal mouth with Mangroves- <i>Sonneratia caseolaris</i> (L.)Engl., <i>Bruguiera sexangula</i> (Lour.) Merr.& <i>Hibiscus tiliaceus</i> L.	<i>Rhizophora mucronata</i> Poir				
--	---	----------------------------------	--	--	--	--

Seedling mortality - High (more than 60%)
- Medium (30%-60%)
- Low (less than 30%)

REFERENCES & BIBLIOGRAPHY

Bambaradaniya C., Perera S. and Samarawichrema P. (2006), a rapid assessment of the post tsunami Environmental dynamics in relation to coastal zone rehabilitation and development activities in the Hambanthota district of Southern Sri Lanka. *Occ. pap no 10*. The World conservation union, Colombo, Sri Lanka. llii+27pp

D' Abrera, B. (1998). *The Butterflies of Ceylon*, Wildlife Heritage Trust, Colombo, 224pp.

Das, I. and De Silva, A. (2005). *Photographic guide to the Snakes and other Reptiles of Sri Lanka*. New Holland Publishers.

Dassanayake, M. D. & Fosberg, F. R. (eds.) (1980 - 2004) A revised Handbook to the Flora of Ceylon (vol 1-9 edited by Dassanayake M.D., Fosberg F.R. and Clayton W.D.; Vol. 10-15 edited by Dassanayake M.D., and Clayton W.D.) 15 Vols. Oxford and IBH Publishing Co., New Delhi.

Harrison, J. and Worfolk, T. (1999). *A Field Guide to the Birds of Sri Lanka*, Oxford University Press Inc, New York, USA.

Kotagama, S. (2004). *Mammals in Sri Lanka. Pictorial Pocket Guide – 3*. Field Ornithology Group of Sri Lanka. Colombo.80pp.

Latief, H. and Hadi, S., 2006. The role of forests and trees in protecting coastal areas against tsunamis, Coastal protection in the aftermath of the Indian Ocean tsunami: What role for forests and trees? FAO/RAPO, Khao Lak, Thailand. Food and Agriculture Organization of the United Nations, Bangkok.

Manamendra-Arachchi, K. and Pethiyagoda, R. (2006). *Amphibians of Sri Lanka*. (text in Sinhala). Wildlife Heritage Trust of Sri Lanka.

Perera W.P.N.and Bambaradeniya C.N.B. (2006)., Status of Butterfly Fauna of Sri Lanka. . *In* Bambaradeniya C.N.B. (eds) *The fauna of Sri Lanka: Status of Taxonomy, research and conservation*. IUCN Sri Lanka.

Pethiyagoda R. (1991), *Freshwater Fishes of Sri Lanka*. Wildlife Heritage Trust, Colombo, Sri Lanka. 362pp.

Pethiyagoda R. (2006).Conservation of Sri Lankan Freshwater Fishes, *In* Bambaradeniya C.N.B. (eds) *The fauna of Sri Lanka: Status of Taxonomy, research and conservation*. IUCN Sri Lanka.

Phillips, W.W.A. (1935). *Manual of the Mammals of Ceylon*. Ceylon Journal of Science, Dulau and Company, London. 371pp.

Weerakoon, D. K. and W. L. D. P. T. S. de A. Goonatilake, W. L. D. P. T. S. (2006). Taxonomic Status of the Mammals of Sri Lanka. *In* Bambaradeniya C.N.B. (eds) *The fauna of Sri Lanka: Status of Taxonomy, research and conservation*. IUCN Sri Lanka.

Wijesinghe, Y. (1994). Checklist of woody perennial plants of Sri Lanka. National Science Foundation Published by the Sri Lanka Forest Department, 1- 201.



International Union for Conservation
of Nature

Ecosystems & Livelihoods Group, Asia
No. 4/1, Adames Avenue
Colombo 04
Sri Lanka

Tel: +94 112559634/35
Fax: +94 112559637

www.iucn.org

