

Best Practice Guidelines for the Establishment of a Coastal Greenbelt

March 2007



Sri Lanka Country Office

Green Coast
For **nature** and **people**
after the tsunami



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கரையோரம் பேணல் திணைக்களம்
COAST CONSERVATION DEPARTMENT

Best Practice Guidelines for the Establishment of a Coastal Greenbelt

March 2007

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Best Practice Guidelines for the Establishment of a Coastal Greenbelt

Objectives of the best practice guidelines

The overall objective of these Guidelines is to evolve a systematically designed common approach to restore, rehabilitate and/or recreate a vegetational barrier/buffer (Greenbelt) that may be resilient and stable enough to prevent or mitigate the devastating effects of natural disasters such as cyclones, storm surges and tsunamis. A greenbelt will ideally represent a multipurpose investment, in terms of stabilizing a fragile and unconsolidated beach front in the coastal belt, while at the same time functioning as a wind barrier where necessary, providing shade and protection, enhancing the landscape for recreation and tourism, and providing opportunities for economic returns to traditional coastal communities.

The enthusiasm and wide acceptance of the need to rehabilitate or establish afresh, a coastal belt of vegetational cover following the post-tsunami scenario, has in recent times led to unregulated and disoriented rehabilitation work that are likely to have serious negative consequences. There is therefore an urgent need to set out specially designed guidelines to ensure that well integrated greenbelts will emerge in conformity with basic standards and policies on coast conservation.

Broad Classification of Landscapes for the Coastal Belt

For the purposes of creating or restoring coastal vegetation belts, it is useful to select plant species on the visible division of the landscape from a land use perspective, into three major landscape types – NATURAL, RURAL and URBAN. It must nevertheless be noted that there are areas of transition and overlap among them, e.g. urban fringe, suburban, rural-natural. These types are found in varying extents, in the three climatic zones of the wet zone, the dry zone and the arid zone. However, for the purpose of these guidelines, the transitional landforms and the arid climatic region would not be considered as separate entities.

Areas considered as NATURAL encompass all areas which are relatively unaffected by human activity,

especially those which are already designated as national parks and other categories of reserves, e.g. the coastal edges of Yala, Wilpattu and Bundala National Parks, and also areas which, though not yet designated, are potentially suitable for designation as nature conservation/preservation areas.

Natural landscape areas will therefore comprise estuarine areas, lagoons, mud or sand flats, beaches, dunes, sand bars, spits, bays, rocky headlands and cliffs (the two latter sometimes with sandy beaches at their bases), in various combinations, where the natural landform and vegetation is still preserved or, at least, predominant.

The immediate hinterland of the coastline could be deemed RURAL in areas where, despite a similar variation in landform to that in natural areas, the natural vegetation has been largely replaced by non-indigenous agricultural species such as coconut palms and palmyrah palms. In some cases, there might be crops such as cashewnut, further inland, and even patches of grassland used for grazing. In certain areas, such as Mundel, Waikkal, and Hambantota, aqua-culture (especially prawn farms) and salt-pans have replaced the original mangroves or salt marshes. Groups or strips of Casuarina (Kasa), which is also an introduced species, although it may be considered as being naturalized in Sri Lanka, have been planted in many locations along both the wet zone and dry zone beaches for wind shelter or beach stabilization. Nevertheless, remnant pockets, patches and strips of natural plant communities still exist, albeit dispersed and fragmented.

It is appropriate to categorize as URBAN those coastal strips within or bordering urban settlements, usually including seaside parks, playgrounds, esplanades and marine drives, sometimes with seaside retaining walls and often bordered by artificial coastal protection structures such as rock revetments.

It is essential firstly, to study the area and identify whether it is (or should be) urban, rural, or natural in character. Wherever natural maritime vegetation communities exist, even as small remnants, the basic principle should be to conserve them and integrate them into the design.

The local government authority, and the Divisional Secretary, should be consulted at the outset, as well as relevant central government authorities such as the Coast Conservation Department, the Urban Development Authority and the Fisheries Department, and in some cases, the Security Forces, the Department of Wildlife Conservation, the Sri Lanka Tourist Board, the Forest Department, and the Department of Agriculture.

Site Selection and Appraisal

It is encouraged that the Green Belt be established within the coastal set back limits, where the land is available for planting. The coastal setback is a geographical strip of land within the coastal zone bordering the shoreline, within which certain development activities are prohibited or significantly restricted for management reasons, except for regeneration of vegetation. The land mass lying between the Seaward Reference Line and the Landward Reference Line of the particular coastal segment is considered as the coastal set back. The width of the coastal set back varies according to the vulnerability of the particular coastal segment to erosion. Set back limits applied to the area of concern can be verified from the Planning Officer of the CCD posted in coastal District Secretariats.

After selecting a suitable stretch of land in the coastal set back with the permission of the District or Divisional Secretaries (if the land belongs to the state) or the private land owners, an appraisal and design should be done with the aid of relevant professionals, always getting at least basic advice from a coastal planner. Even for urban locations, landscape architects should obtain advice from other specialists. For rural locations, landscape architects and sometimes, other specialists also are needed besides agriculturists. For natural locations, landscape architects, ecologists and often other specialists such as geologists are needed. Whatever the location, it would be necessary to prepare detailed survey sketches of the existing vegetation and landscape. In general, apart from ecological and aesthetic factors, social and socio-economic issues must also be addressed.

Based on this appraisal, a landscape design should be drawn up. It is recommended that the principles laid out by the Coastal Zone Management Plan (CZMP) be adhered to when designing the physical layout, for

example, providing accessibility to the beach for traditional users. There should be layout plans giving measurements and planting plans including spacing showing how the planting should be set out. There should preferably be section elevation drawings to clearly illustrate how the work should be done and what its outcome would be. It is vitally important to design appropriate temporary protective fencing for areas to be planted and to have realistic work programmes. A management plan should be prepared including for maintenance with cost estimates.

Planting Design Principles

The following basic principles of establishing greenbelts should be applied when designing to conditions laid down by the Coast Conservation Department (CCD)

In Natural locations

- Existing natural ecosystems should be preserved. In other locations, the natural terrain and vegetation should be restored as far as possible, keeping visual effects also in mind. The natural littoral woodland species will be the most used species, because sandy shores border most of the island. Wherever mangroves have been damaged or depleted, they should be rehabilitated and enhanced and wherever they have been destroyed, they should be restored.
- Introduced/exotic species should be excluded.
- Structures such as shelters, toilets, camp sites etc. should be as few as possible. (Functionality and the management aspects of those structures should be well defined)
- Footpaths through mangrove forests and over sand dunes should preferably be raised board walks, to ensure minimum disturbance to the mangroves or the dune stabilizing vegetation.
- Access to vehicles including bicycles should be limited or even prohibited, and parking areas should be at the edges of such sites
- Materials, finishes, shapes, facades, styles and locations of structures should be chosen carefully to be in harmony with the natural habitat.
- A preservation/conservation management plan should be prepared.
- Unless debris can be recycled or re-used in keeping with the principles above, it should be taken out of the site completely.

In Rural locations

- At least a 15 to 20m wide strip of natural littoral woodland and strand plants should be planted seaward of agricultural crops. Imitation of the typical plant species mix and distribution in the natural community would be the best, while natural vegetation should not be removed but integrated.
- Agricultural crops, not confined to native and endemic species, should be selected to suit the specific location.
- Identification of the most suitable beach-front ground cover for soil stabilization in the specific landscape, and the successive vegetation cover for erosion resistance as well as for mellowing strong winds, should be carefully selected and designed
- Structures, vehicle access, footpaths and cycle paths should be minimal and harmoniously integrated.
- In general, materials and finishes should reflect the rusticity of the location.
- A management plan should be prepared.
- Debris may be buried, recycled or used for ground shaping: the terrain should be made suitable for the natural vegetation belt and agricultural crops chosen.

In Urban locations

- Patches of natural vegetation should be integrated as far as possible with whatever is the most suitable concept for a particular area.
- There could be open grass/sandy/paved parks or playgrounds or sports grounds of various sizes, provided there is a good belt of trees on the seaward side.
- There could be many alternative styles, materials, finishes and colours for structures and surfaces and they should be strong enough to tolerate intensive use.
- Vegetation could be either irregular and naturalistic or regular and geometric in form, but formal geometrical layouts and regular planting will often be desirable.
- There should be sufficiently wide beach stabilizing vegetation strips between seaside retaining walls and the open beach.
- Vehicle access and parking should be minimized.
- Sea walls, piers, quays, street furniture, kiosks, picnic/rest shelters, infrastructure facilities and other minimal permitted structures should be located and detailed with care.

- A management plan should be prepared.
- Debris could be recycled or re-used as landscape material if suitable.

Selection of Plant Species and Planting Designs

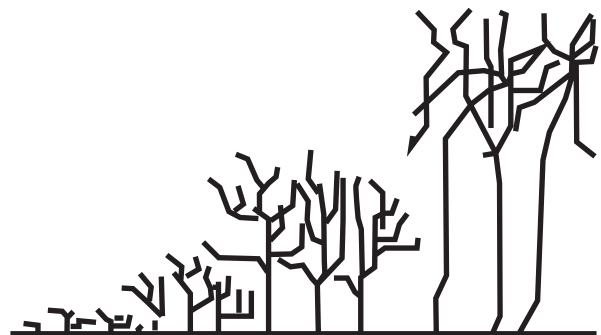
The choice of plant species in greenbelt rehabilitation has to be primarily based on the growth potential and adaptability of plants to a given situation. Hence the initial consideration has to be a careful assessment of the geo-physical and agro-ecological conditions, the land use values and community needs, and more importantly the existing ground situation of the selected rehabilitation site in relation to the level of disturbance and the existing residual vegetation. It is thus clear that a number of technical as well as non-technical considerations are pre-requisites for the choice of plant species and planting designs.

After site selection the next step therefore has to be a consultation with knowledgeable persons in fields of agronomy, ecology and landscape architecture, as well as a cross section of the local community and representatives of relevant Community Based Organizations. In brief, to ensure establishment of a successful greenbelt, the prospective project proponent must have a perfect understanding of the ground situation before embarking on developing the landscape proposal.

A fairly broad selection of plants for the Wet Zone and the Dry/Arid Zones are summarized in the Annex I.

Arrangement of the Tree Belt

Method of Planting



While the material for field planting is being prepared, the planned area for the establishment of the greenbelt should also be organized simultaneously, either for

sowing, or for transplanting of the pre-arranged plant species that are being nursed in the plant nursery.

Designing and field planting of plant species, again requires proper advice and guidance of an agronomist, and preferably also of a landscape architect. The field transplants will necessarily need, a) some shade initially, which has to be progressively reduced with plant growth and establishment, b) adequate watering and mulching, c) protective barriers against stray animals, pests and diseases, and d) wind breaks.

In the Wet Zone, planting has to be timed for the period when the first heavy rains of the dominant monsoon for the zone have begun to taper off. This is important because planting during heavy rains can do much damage to the young transplants. Practice in the east is at the onset of the rains.

Spacing and field lining of the site is the first important step to be undertaken before transplanting tree and shrub species of plants. This is a job that has to be done by a farm or agriculture school - trained field



assistant. This step is not necessary where a ground cover is to be established with a creeper or a grass-type of plant species. In such instances, depending on the appropriate plant propagation technique to be used, field planting could be done through either sowing of pre-treated seed material, or by the vegetative propagation method of digging in cuttings at regular intervals. Where the vegetative technique of field planting has to be done, the field must remain well moistened and shaded for several weeks after planting until the cuttings are well established. The alternative approach is to plant the cuttings in poly-bags in the nursery and transplant when the plants are well established.

Protection and After-Care

Newly planted species should be protected against strong winds, animals, pests and diseases, wilting, and nutrient deficiencies. Temporary fencing with jungle timber posts and barbed wire, combined with wind-shields of brush wood, cadjan (thatched coconut fronds) or such other material on the windward side, could protect the plants from wind and animal damage. Plants should also be regularly checked for pests and diseases, and nutrient deficiencies, for the treatment of which the advice of an agriculturist should be sought, and promptly treated.

Even though cloudy weather is likely to prevail for several days during the mid-monsoon planting period, some shading will be required, which could be provided with used coir netting or by sticking short lengths of dried coconut fronds. During intermittent dry spells it would be necessary to water the young plants to prevent wilting.

Monitoring Progress

Keeping track of the health and growth of the young plants is very important, especially during the first 3 months after field planting. For successful management of the newly established vegetational belt, the active cooperation of the local community is absolutely necessary, and for this purpose a committed senior member of the local community should be co-opted as a member of the monitoring team.

During the first 2 weeks after planting, visual observations of the growth progress must be carefully recorded on a daily basis by the community member, with one staff member of the implementation organization joining the community member every other day. During this initial monitoring mission plants subjected to damping-off, and any diseased or weak looking plants should be replaced with healthier plants.

At the end of 3 months, tree species could be tagged with numbers and subjected to growth (height) measurements. At the end of 6 months, the second set of height measurements should be taken, and at that stage any weak plants could be removed or replaced according to the spacing needs of the tree species. Weak plants are judged by visual observations and the rate of growth in height, calculated from the height measurements taken at the third and sixth month stages. This process could be continued for a period of about one year, by which time a reasonably stable greenbelt would have been installed.

Annex I

Woody plants for site rehabilitation in Tsunami affected areas.

No.	Botanical name	Family	Local name	Climatic preference			Site preference		Remarks
				Dry/Arid zone	Wet zone	Behind beach	More interior		
1	<i>Acacia auriculiformis</i>	Fabaceae		x	x		x	on site suitability	
2	<i>Adina cordifolia</i>	Rubiaceae	Kolon	x			x		
3	<i>Aegle marmelos</i>	Rutaceae	Beli	x			x	Homegardens	
4	<i>Albizia lebbeck</i>	Fabaceae	Kabalmara	x			x		
5	<i>Alostonia scholaris</i>	Apocynaceae	Rukattana	x	x		x		
6	<i>Anacardium occidentale</i>	Anacardiaceae	Kaju	x			x	Homegardens	
7	<i>Artocarpus heterophyllus</i>	Moraceae	Kos		x		x	Homegardens	
8	<i>Azadirachta indica</i>	Meliaceae	Kohomba	x		x	x		
9	<i>Azima tetraeanthe</i>	Salvadoraceae		x		x	x		
10	<i>Bambusa vulgaris</i>	Bambusaceae	Una		x		x	Homegardens	
11	<i>Berringtonia asiatica</i>	Lecythidaceae	Mudilla		x	x			
12	<i>Berya cordifolia</i>	Tiliaceae	Halmilla	x			x		
13	<i>Borassus flabblifer</i>	Palmae	Thal	x		x	x		
14	<i>Bridelia retusa</i>	Euphorbiaceae	Ketakela	x			x		
15	<i>Calophyllum inophyllum</i>	Clusiaceae	Domba		x	x	x		
16	<i>Cassia auriculata</i>	Fabaceae	Ranawara	x		x	x		
17	<i>Cassia fistula</i>	Fabaceae	Ehala	x		x	x		
18	<i>Cassia roxburghii</i>	Fabaceae	Ratu-wa	x		x	x		
19	<i>Casuarina equisetifolia</i>	Casuarinaceae	Kasa	x	x	x			
20	<i>Ceiba pentandra</i>	Bombacaceae	Pulungas		x		x	Homegardens	

No.	Botanical name	Family	Local name	Climatic preference		Site preference		Remarks
				Dry/Arid zone	Wet zone	Behind beach	More interior	
21	<i>Chloroxylon swietenia</i>	Rutaceae	Burutha	x			x	on site suitability
22	<i>Clerodendrum inerme</i>	Verbenaceae	Burenda		x	x		
23	<i>Cocos nucifera</i>	Palmae	Pol	x	x	x		
24	<i>Cordia dichotoma</i>	Boraginaceae	Lolu	x			x	
25	<i>Diloxylon regia</i>	Fabaceae	Mal mara	x	x		x	Avenue plant
26	<i>Diospyros malabarica</i>	Ebenaceae	Thimbiri	x			x	Riverine
27	<i>Erythrina spp.</i>	Fabaceae	Erabadu	x	x	x		
28	<i>Eugenia jambolana</i>	Myrtaceae	Jambu		x		x	Homegardens
29	<i>Filicium decipiens</i>	Sapindaceae	Pihimbiya		x		x	
30	<i>Gliricidia sepium</i>	Fabaceae	Wetahira	x	x		x	Homegardens
31	<i>Hibiscus tiliaceus</i>	Malvaceae	Belipatta		x	x		
32	<i>Holoptelea integrifolia</i>	Ulmaceae	Godakirilla	x			x	
33	<i>Hydnocarpus venenata</i>	Flacourtiaceae	Makulu	x	x		x	Riverine
34	<i>Limonia acidissima</i>	Rutaceae	Divul	x		x		
35	<i>Madhuca longifolia</i>	Sapotaceae	Mee	x	x		x	Riverine
36	<i>Mangifera indica</i>	Anacardiaceae	Amba	x	x		x	Homegardens
37	<i>Manilkara hexandra</i>	Sapotaceae	Palu	x		x		
38	<i>Melia dubia</i>	Meliaceae	Lunumidella		x			Homegardens
39	<i>Mesua ferrea</i>	Clusiaceae	Na		x		x	Avenue plant
40	<i>Moringa oleifera</i>	Moringaceae	Murrunga	x	x		x	Homegardens

No.	Botanical name	Family	Local name	Climatic preference		Site preference		Remarks
				Dry/Arid zone	Wet zone	Behind beach	More interior	
41	<i>Nauclea orientalis</i>	Rubiaceae	Bakmee	x			x	on site suitability Riverine
42	<i>Pandanus odoratissimus</i>	Pandanaceae	Wetake		x		x	
43	<i>Pisonia grandis</i>	Nyctaginaceae	Wathabanga	x	x	x	x	
44	<i>Plumeria rubra</i>	Apocynaceae	Araliya		x	x	x	Homegardens
45	<i>Pongamia pinnata</i>	Fabaceae	Karanda	x	x	x	x	
46	<i>Psidium guajava</i>	Myrtaceae	Peera		x		x	Homegardens
47	<i>Punica granatum</i>	Punicaceae	Delum	x			x	Homegardens
48	<i>Salvadora persica</i>	Salvadoraceae	Malittan	x		x	x	
49	<i>Samanea saman</i>	Fabaceae	Mara	x	x		x	Avenue plant
50	<i>Schleichera oleosa</i>	Sapindaceae	Koon	x			x	
51	<i>Sesbania grandiflora</i>	Fabaceae	Kathurumurunga	x	x		x	Homegardens
52	<i>Strychnos nux-vomica</i>	Loganiaceae	Ingini	x			x	
53	<i>Sweitwnia mahogoni</i>	Meliaceae	Mahogani		x		x	Homegardens
54	<i>Syzygium cumini</i>	Myrtaceae	Madan	x		x	x	
55	<i>Tamarindus indica</i>	Fabaceae	Siyambala	x	x		x	
56	<i>Tectona grandis</i>	Verbenaceae	Teak	x	x		x	
57	<i>Terminalia arjuna</i>	Combretaceae	Kumbuk	x	x		x	Riverine
58	<i>Terminalia catappa</i>	Combretaceae	Kottamba	x	x	x	x	
59	<i>Thespesia populnea</i>	Malvaceae	Gansooriya	x	x	x	x	
60	<i>Vitex altissima</i>	Verbenaceae	Milla	x			x	

The World Conservation Union (IUCN) was founded in 1948 and brings together nearly 1,100 members (States, government agencies, NGOs and affiliates) and some 10,000 scientists and experts from 181 countries in a unique worldwide partnership. Its mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. Within the framework of global conventions IUCN has helped over 75 countries to prepare and implement national conservation and biodiversity strategies. IUCN has approximately 1,000 staff, most of whom are located in its regional and country offices while some 150 work at its Headquarters in Gland, Switzerland.

In the context of IUCN's mission, the role of the IUCN programme in Sri Lanka is to be a facilitator of conservation action. It plays a catalytic role, and offers effective platforms to promote dialogue and discussion among the various partners engaged in conservation work. The emphasis of the Programme is to support sustainable natural resource initiatives of the Union's members and partners in Sri Lanka, in biodiversity conservation, conservation and management of critical habitats, environmental policy support, institutional support and environmental education and awareness. It also provides opportunities for the practical application of methodologies developed through the Union's scientific networks to support the conservation initiatives of members and partners of IUCN in Sri Lanka.

The in-country operations of IUCN in Sri Lanka commenced in 1988. In addition to the country office in Colombo, the programme has now expanded with four regional offices operating from the southern, eastern and central parts of the country.

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