

APPENDIX K

GUIDELINES ON PLANTING ON COASTAL SAND DUNES

K.1. Planting conditions

Planting on sand dunes has the effect of: stabilizing the coastal sand dunes; shielding the inland areas against wind and storm; obstructing landward sand movement, which can invade the soil used for agricultural production and traffic routes; improving the ecological conditions and nearshore environment; reducing the evaporation and retaining the water in the soil, supplementing the soil with more organic matters etc.

Depending on local conditions, plants can be combined with the sand-obstructing fences in order to stabilize the coastal sand dune within a range of 500m from the coastline to inland area.

a) Favourable areas: Plants can grow well in the areas where: the sand ratio is less than 90%; irrigation sources can be exploited in situ; there are some species of plants grow naturally on sand.

b) Hardly favourable areas: The growth of plants will become slower in the areas where: sand ratio in soil is greater than 90%; no or limited in situ exploited irrigation source. Therefore, in these areas, the following solutions must be adopted before planting:

- To build a system for collecting and storing surface and ground water, which can be used for watering;

- To improve the planting holes locally (the hole depth depends on the thickness of sand layers and specific species of plants) in order to place the alluvial soil into the hols before planting, in combination with the mixing of fertilizers in order to spread before planting.

- To build fences to obstruct the blown sand and stabilize the sand dunes.

c) Unfavourable areas: Plants cannot grow on the sand dunes which are still in the forming stage with greatly high rate of deposit and movement

K.2. Planting design for the purpose of stabilizing coastal sand dunes

K.2.1. Selecting types of plants

Each type of plant can adapt to specific natural and ecological conditions. Therefore, appropriate types are selected on the basis of local conditions.

Table 1 – Some appropriate species for planting on coastal sand dunes

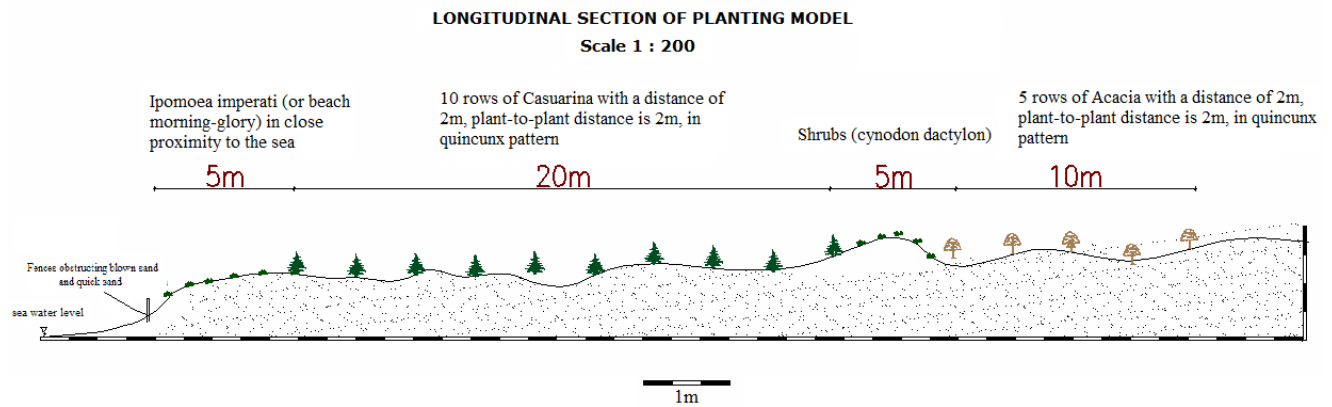
No.	Types of sandy soils	Type of plants
1	Yellowish white dune sand: thick soil layers (>100 cm), soil composition: coarse loose sand with poor organic substances, relatively high degree of mineral, low ability in water retaining. Nutrient content is from low to very low.	<i>Casuarina</i> , <i>Acacia auriculiformis</i> , <i>Eucalyptus teriticornis</i> , <i>Ipomoea imperati</i> (or beach morning-glory), cactus.
2	Light marine sandy soil: relatively even ground; light soil composition: fine sand accounts for 71 - 94%, limon and clay account for less than 30%, with clear stratification.	<i>Casuarina</i> , <i>Acacia</i> , <i>Eucalyptus teriticornis</i> , <i>Ipomoea imperati</i> (or beach morning-glory), <i>Azadirachta indica</i> (or local Neem), cactus, <i>Pandanus tectorius</i> Sol. (or thatch screwpine)
3	Red dune sand: Thickness of the top (surface) layer is less than 10 cm, light soil composition, in which sand are dominant, especially fine and medium sand (usually account for 84-92%), with small separated lumps, but highly unstable in water.	<i>Casuarina</i> , drought-proof <i>Melia azedarach</i> , <i>Azadirachta indica</i> (or local Neem), <i>Ipomoea imperati</i> (or beach morning-glory), cactus.
4	Coastal submerged areas + coastal sandy beaches	<i>Rhizophora apiculata</i> , <i>Aegiceras corniculatum</i> , <i>Bruguiera</i> , <i>Casuarina</i> , <i>Ipomoea imperati</i> (or beach morning-glory)

K.2.2. Natural ecological succession and growth of plants

In order to ensure the efficiency in the stabilization of coastal sand dunes, the design plants should be located along the coastline. The design landward planting order is as follows: primary plants in close proximity to the sea, the following plants are grown heterogeneously. The combination of rapidly-grown and slowly-grown plants; of high and low foliage; of sparse, thin and thick

foliage has the effect in shielding the inland areas against wind and blown sand. Shrubs and herbaceous plants are grown on downhill slopes in order to prevent the quick sand.

Casuarina is a rapidly-grown plants in terms of height. These plants have great ability to withstand drought and harsh conditions, and usually used as primary seaward plants. *Acacia auriculiformis* and *Melia azedarach* are greatly drought-proof plants, with large foliage, especially the root nodules fixing nitrogen, which can improve the properties of the soil following the primary strip.



Ipomoea imperati (or beach morning-glory), *Pluchea indica* (L.) Less and shrubs with spreading growth on the ground are planted on the downhill slopes. These plants have the effect of covering the surface, maintaining the humidity, lowering the temperature in soil and stabilizing the sand.

K.2.3. Planting density

Depending on each specific type of plants, appropriate planting densities can be determined, normally on the basis of root characteristics, diameter of grown foliage etc., which can improve the stability of sand dunes, limit the blown sand and minimal impacts on the growth of plants.

Table 2 - Required densities of some plants on sandy soil

No.	Types of plants	Density (plants/ha)
1	<i>Casuarina</i>	2.200 - 3000
2	<i>Acacia auriculiformis</i>	2.200 - 2800
3	Drought-proof <i>Melia azedarach</i>	800 - 1.300