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RESTORATION OF SAND DUNE VEGETATION FROM CUDDALORE AREA, SOUTHEAST COAST OF INDIA

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ABSTRACT

Coastal sand dunes (CSD) floras were under constant anthropogenic and natural pressure due to rapid elimination of sand dunes and its associated vegetation; as a result, its associated indigenous knowledge with them is also gradually disappearing. Such biodiversity rich and useful ecosystems need immediate restoration and conservation actions. Cuddalore coastal area is prone to both anthropogenic and natural disaster. Cyclone Thane hit Cuddalore coast on 29th and 30th of December 2011 with wind speeds of up to 135 kmph (83 mph) and tidal surges reaching 1.5 metres (5 feet), is worth mentioning apart from the tsunami hit during December 2004. Industrialization has occupied nearly 500 acres of Coastal land which causes pollution and destruction of sand dune vegetation. Restoration of degraded area by propagation of plants (Ipomoea pescaprae and Spinifex littoralis (which are natural sand binders) by plucking a portion of the creeper from the denser area and planting it in pits dug at a depth of 30 to40 cm. The planting of creepers was made at an interval of 2 m distance each in 6 pits. The restoration work was started from October 2012, 90 % survival was found during the restoration study. The best season for this program in this area was between October to January. After three months, 30cm of growth was observed in the plants. As that of mangroves restoration programmes this sand dune vegetation flora should also be encouraged by all the countries in the world.

KEY WORDS

Coastal Sand dunes, cuddalore, pollution, southeast coast.

INTRODUCTION

Coastal sand dunes are natural structures which protect the coastal environment by absorbing energy from wind, tide and wave action. Despite geographical differences, sand dunes have been considered as a specific ecosystem due to several common environmental features. CSD constitute a variety of microenvironments due to substrate mobility and physical processes. Plants establishing mobility and physical processes. Plants establishing on coastal sand dunes are subjected to several environmental fluctuations which affect their growth, survival and community structure. CSDs dynamic but fragile buffer zones of sand and vegetation where the following three characteristics can be found: large quantities of sand; persistent wind capable of moving the sand; persistent wind capable of moving the sand; suitable locations for sand to accumulate.

CSD formulations ultimately depend on embayment size and prevailing wind energy (Kumar et *al*.1993). Their heights differ in response to adequate sand supply, climate and local topographic features (Barbour et *al*. 1985). Plants on coastal dunes are specially adapted to withstand various environmental stresses which allow them to grow, establish and to trap sand in such harsh conditions of coastal zones, so they are mostly represented by herbs, shrubs, creepers or runners (Sridhar et *al*. 2007)

The role of vegetation in dune formation is critical and is that of a wind trap, sand binder and dune stabilizer (Wagner 1964; Dahm et *al*. 2005). The foliage of dune plants breaks wind activity leading to less erosive activity on the lee side (Chapman 1976). Pioneer zone, intermediate zone and back/ forests zone were recognized earlier in coastal dunes and later several workers found shore, foredune, main dune width wind ward and lee ward slopes, wet dune slacks and back dunes with plateaus, holes that supporting grasslands scrub forests, thus portraying complex ecosystem diversity (Wood house 1978; Hesp 2004). Temperate coastal dunes are well studied and documented (Koske and gemma 1997; Sridhar and Bhagya 2007) as compared to studies on tropical coastal dunes (Kulkarni et al. 1997; Sridhar and Bhagya 2007).

The Ecological roles and functions of coastal dunes include: essential store of sediments, protecting the land behind them from storm erosion and potential sea level rise; filter for rainwater and groundwater and in some situations, provided aquatic habitats such as dune lakes; protection of islands from storm surges, hurricanes and erosion; trapping of the windblown sand and prevention of sand being blown further inland by the vegetation; habitats for specially adapted plants, birds, and animals - several of which are now rare or endangered; a range of unique landforms and processes which have intrinsic value and are of scientific interest; and nesting sites for sea turtles and birds.

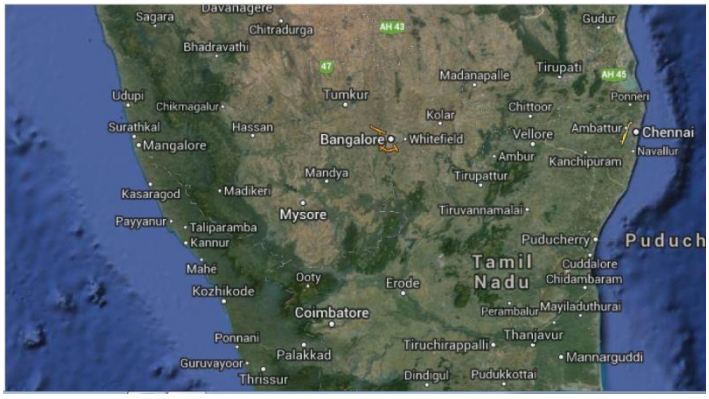
This paper aims to generate a restoration of *Ipomoea pescaprae* and *Spinifex littoralis* on coastal sand dune in the coramendal coast, with special reference to Cuddalore coastline. Apparently, this is the first sand dune restoration work carried out in Cuddalore coast.

MATERIALS AND METHODS

Study area

Cuddalore is located on the Coramandal coast in 11°44'39" N and 79°47'00" E, lies 25km (16mi) south of Pondicherry and coast of the bay of bengal . *Devanampattinam, Thazhanguda, Singarathoppu, Pudupettai, Annangkovil* are the coastal village with sand dune coverage of about 30 km^2 extent, present at a distance of about 48 km towards south on the way to Parangipettai from the Cuddalore main town (***Map*:1**).

The coastal border has a length of 30 km and a breadth ranging from four to six hundred meters. Superficially, the coast is flat and sandy. The coastal zone of Cuddalore comprises newer and older dunes including saline areas of clayey texture. The study area experiences mean annual temperature of 30.0 °C and mean annual rainfall about 1,311-1,172 mm. The mean number of annual rainy days is 55, the mean monthly temperature ranges from 21.3°- 30.2°C. The climate is tropical dissymmetric with the bulk of the rainfall during northeast monsoon October-December (Indian Meteorological Department - Chennai).



Map: 1: Showing Cuddalore coastal area

Preliminary survey

A preliminary survey was carried out in *Devanampattinam, thazhanguda, Singarathoppu, Pudupettai, Annangkovil* coastal villages in Cuddalore. Due to high industrial development, construction of thermal power plant in Puthupettai and harbor

construction in annangkovil affects the coastal sand dunes and destroys the sand dune plants (*Ipomoea pescaprae* and *Spinifex littoralis*) in high rate. In my survey 30-40% of sand dunes in Cuddalore coast are disturbed by the development activities carried out in the coastal areas and industrialation.

Devanampattinam

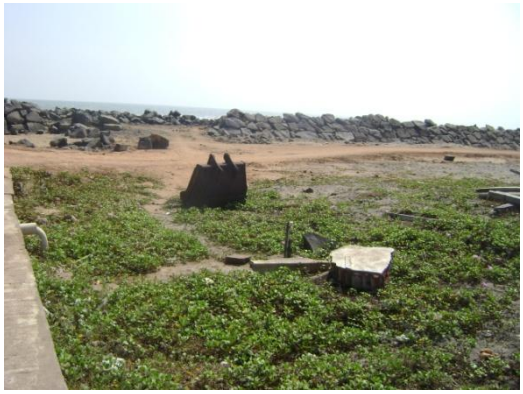


Fig:1 **Sand dune with *ipomea pescaprae* affected by the artificial shield build by humans**

Fig:2 spinifex littoralis **destruction due to human impact**

Thazhanguda

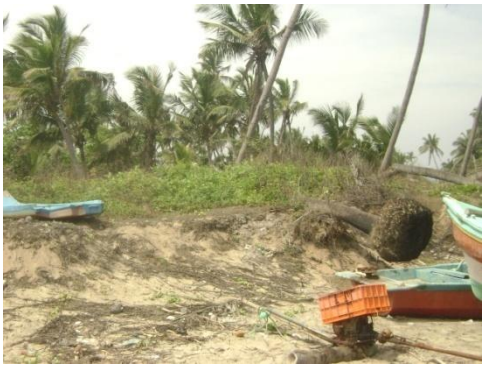


Fig:3 **Sand dune destroyed by the cyclone "*thane*"**

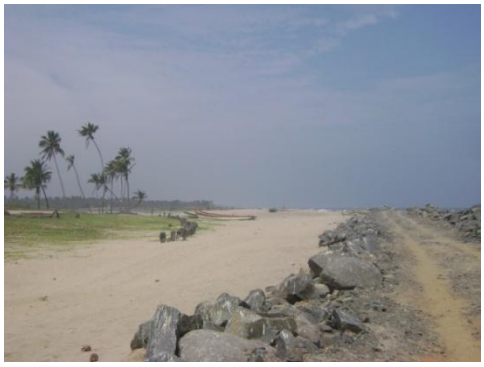


Fig:4 **sand dune destructed by human impact**

Singarathoppu

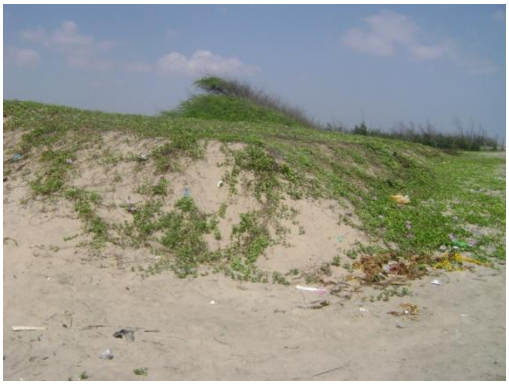


Fig:5 **Sand dune with *ipomea pescaprae***

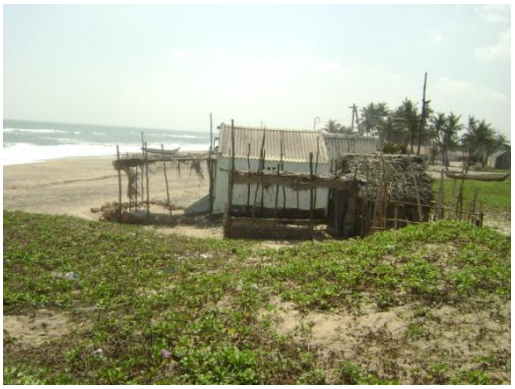


Fig:6 **sand dune with temple**

Pudupettai

Fig:7 **Grazing of *ipomea pescaprae* in sand dune**

Fig:8 **sand dune with *cashewrina* and *ipomea***

Annangkovil

Fig:9 **Grazing of *ipomea pescaprae* by the cattles in sand dunes**

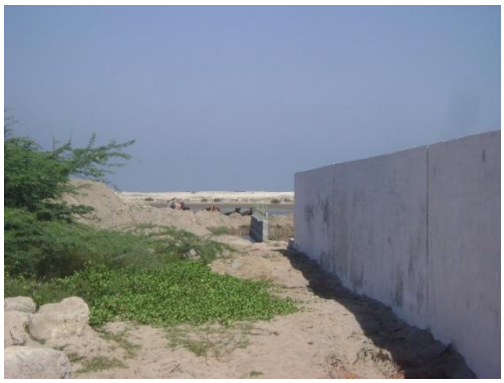


Fig:10 **Destruction of sand dunes by harbor construction**

Restoration

Restoration work was carried out in Devanampattinam, Thazhanguda, Singarathoppu, Pudupettai and Annangkovil coastal villages in Cuddalore coast from the month of October 2012. In each villages two to three sand dunes were selected for *ipomea pescaprae* and *spinifex* restoration. Restoration of degraded area by propagation of plants by plucking a portion of plant from the denser area i.e., two to three meter length of ipomea pescaprae were plucked and cut into small plants by giving two to three internodes and planting it in pits dug at a depth of 30 to40 cm. The planting of creepers was made at an interval of 2 m distance each in 6 pits. For one site an area of 16 m X 16 m was covered with fence. Watering the plants and fencing were followed after the planting.

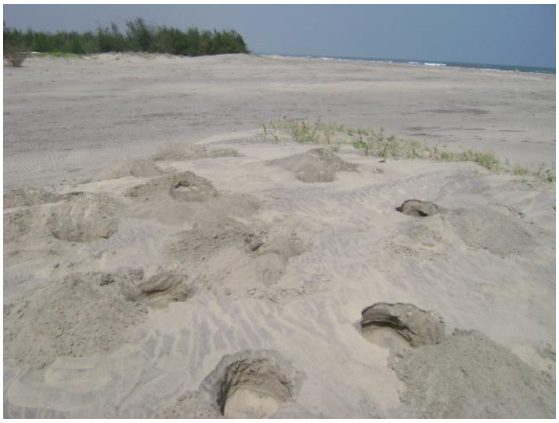


***Fig:*11 Dugging of pits**

***Fig*:12 Planting ipomea pescaprae**

***Fig:*13 Twenty days growth**

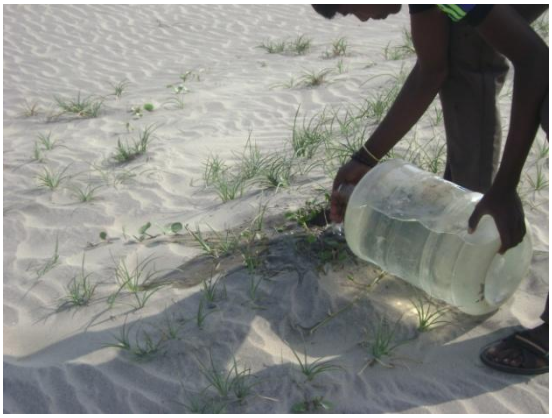


***Fig:*14 Watering to ipomea and spinifex**

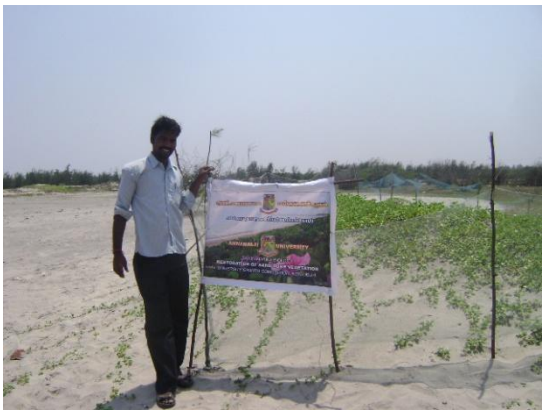


***Fig:* 15, 16 Fencing of ipomea vegetated sand dunes in pudupettai and singarathoppu villages**

RESULTS AND CONCLUSION

Field investigation and the preliminary assessment in the Cuddalore coastal villages indicate the sand dunes were in the immense pressure. In *Devanampattinam (*11°44'39" N and 79°47'00" E) totally 12 sand dunes were surveyed, in this 6 to 7 dunes are without any sand dune plants and are in the stage of extinct(***Fig* :1,2**). In *thazhanguda* (11°46'02" N and 79°47'27" E) totally 5 dunes were surveyed, in this all Sand dunes are without any vegetation (***Fig*:3, 4**). In *singarathoppu* (11°43'26" N and 79°46'57" E) and *pudupettai* (11°30'59" N and 79°46'09" E) 12 sand dunes were surveyed in this mostly all sand dunes in *singarathoppu* with high vegetation of ipomea and spinifex (***Fig*: 5, 6**) and in pudupettai due to the thermal power plant construction all sand dunes are destructed and polluted by the humans (***Fig*: 7, 8**). *Annangkovil* (11°30'08" N and 79°46'19" E) nearly all

sand dunes are disturbed by harbor construction with poor vegetation (***Fig*: 9, 10**).

Restoration works were carried out in five coastal villages in Cuddalore from the month October 2012(**Fig: 11, 12, 13, and 14**). *Ipomea pescaprae* and *Spinifex littoralis* are the plant species restored in these villages by plucking a portion of the creeper from the denser area and planting it in pits dug at a depth of 30 to40 cm. The planting of creepers was made at an interval of 2 m distance each in 6 pits. 90% of growth was recorded in my study from the month of October 2012 to January 2013. *Ipomea pescaprae* growth was reached nearly 30cm from three months but *Spinifex littoralis* was not showing any level of growth. After two months, fencing of the vegetated sand dunes were made particularly in pudupettai and singarathoppu villages (***Fig:* 15, 16**). The table (***Table*: 1, 2**) shows the growth rate of *Ipomea pescaprae* and *Spinifex littoralis* for the three months in the five villages.

In my study, sand dunes in Cuddalore coastal area is under pressure due to the development activities carried out in this area. Sand dune vegetation is the good way for protecting sand dunes in Cuddalore coastal areas. Ipomea pescaprae is a dune plant has great ability to grow in the Cuddalore area. Turtle nesting activity is carried out in high level in Cuddalore coastal area. For to conserve the coastal living organisms and protecting coastal villages from natural hazards, the sand dunes should be conserve and manage by routine monitoring and restoration activity.

***Table: 1: Ipomea pescaprae* plant growth in five villages from October 2012 to January 2013**

PLANT SPECIES	VILLAGES	MONTH	GROWTH RATE(cm)
Ipomea pescaprae	Devanampattinum	October 2102	5-10
		November2012	10-17
		December2012	17-23
		January 2013	23-30
	Thazhanguda	October 2102	5-9
		November2012	10-19
		December 2012	19-23
		January 2013	23-30
	Singarathoppu	October 2102	5-10
		November2012	10-15
		December2012	17-21
		January 2013	21-28
	Pudupettai	October 2102	5-8
		November2012	10-16
		December2012	17-24
		January 2013	24-27
	Annangkovil	October 2102	5-7
		November2012	8-17
		December2012	17-24
		January 2013	24-27

Table: 2: *Spinifex littoralis* plant growth in five villages from October 2012 to January 2013

PLANT SPECIES	VILLAGES	MONTH	GROWTH RATE(cm)
		October 2102	-
	Devanampattinam	November2012	-
		December2012	-
		January 2013	0.5-1.5
		October 2102	1.5-2.0
	Thazhanguda	November2012	-
Spinifex littoralis		December 2012	-
		January 2013	-
		October 2102	-
	Singarathoppu	November2012	-
		December2012	-
		January 2013	-
		October 2102	-
	Pudupettai	November2012	-
		December2012	-
		January 2013	1.0-2.3
		October 2102	-
	Annangkovil	November2012	-
		December2012	-
		January 2013	-

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