

Community Mapping of Sand Dune Ecosystems of the Panaiyur Coast, Kanchipuram District, Tamil Nadu



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The background:

The Government of India has identified Cheyyur in Kanchipuram district, Tamil Nadu, as one of the sites for a 4000 MW Ultra Mega Power Plant (UMPP) using imported coal and super-critical technology. The coal would be brought in through a captive jetty located between the fishing villages of Panaiyur Periakuppam and Panaiyur Chinnakuppam, Kanchipuram district.

The Ministry of Power, Government of India, aims to develop the UMPPs through Build Own Operate (BOO) basis. It has delegated the responsibility of developing these projects to the Power Finance Corporation Ltd (PFC), a public sector unit. PFC has set up a Special Purpose Vehicle (SPV) called the Coastal Tamil Nadu Power Limited (CTNPL), based in New Delhi, for preparing the Cheyyur project. The SPV is meant to acquire the land, perform the EIAs, conduct the public hearings, obtain the various clearances and hand over the project to a private party who wins the bid for the project, thus saving the private party the trouble of land acquisition, impact assessment, public consultation and environmental clearances. Land for the power plant, ash dyke and related infrastructure is set to come up inland – between 5 and 8 km from the coast.

According to CTNPL's project documents, the port will require a 650 m long shorefront. The jetty will be capable of accommodating two cape-size containers capable of carrying 155,000 tonnes of coal each. On shore, a port containing a coal-stocking yard will be set up to store up to 310,000 tonnes of coal. These facilities will come up on 83 acres of coastal land, all of which falls within the Coastal Regulation Zone of 500 metres from the High Tide Line.

The Environmental Impact Assessment report, the submissions of CTNPL, and the CRZ clearance that has been obtained by CTNPL for the marine terminal and coal stacking yard, declare that the project area is devoid of sand dunes. In fact, the Executive Summary of the EIA for the Marine Terminal states that:

*“The identified project land area has no sand dunes and is fairly flat.”*¹

The Form 1 submission to the Tamil Nadu Pollution Control Board seeking clearance from the State Coastal Zone Management Authority states that there are no eco-sensitive areas within 15 km of the project area.

Section 7(i)(A)(c) of the CRZ Notification, 2011, classifies sand dunes as “ecologically sensitive” and accords them a high degree of protection by identifying them as CRZ 1.

Residents of Panaiyur Periakuppam said that many averments in various project documents are contrary to facts. They specifically identified the claims of CTNPL about the absence of sand dunes as an example of the misstatements.

¹ Source: "Executive Summary of Comprehensive Environmental Impact Assessment of proposed captive marine terminal and coal conveyor off Panaiyur Chinnakuppam for Cheyyur UMPP." Coastal Tamil Nadu Power Ltd. Undated.

Despite an intimate knowledge of coastal ecology and dynamics, artisanal fisherfolk are not considered to be experts by the Government because of their lack of formal education qualifications. So, aided by Community Environmental Monitoring, a program of New Delhi-based NGO The Other Media, residents of the fishing villages in the vicinity of the project area approached the principal author and marine biologist Dr. Naveen Namboothri,² to verify the claim of CTNPL regarding the presence or absence of coastal sand dunes in the project area.

The principal author trained the members of Community Environmental Monitoring, and nominees from the fishing villages of Panaiyur Periakuppam and Chinnakuppam in mapping and creating profiles of coastal sand dunes and beaches.

Subsequently, a comprehensive sand dune profiling exercise was carried out and the results interpreted by the co-authors guided by the principal author.

The views expressed in this paper are of the authors and may not necessarily reflect the positions of their organisations.

² Naveen Namboothri. 2004. Ph.D in Marine Biology – Centre for Advanced Study in Marine Biology, Annamalai University, Tamil Nadu. Thesis title – Coral associated fauna of the Indian waters. Founder member, Dakshin Foundation. Post-doctoral fellow at Centre for Ecological Sciences, Indian Institute of Science, Bangalore.

Methodology

Various methodologies have been developed to measure beach profiles and their changes over time. This study used the Emery method (see Emery 1961 for details) which is a low-cost, low-tech, rapid survey method that can be used for sufficiently accurate monthly surveys. The simple "stake and horizon" technique is used extensively for long-term beach/dune profiling surveys in many parts of the world including countries of the Europe, South America, Australia and Asia.

The leveling rods used were graduated to the nearest centimeter. The coordinates of the starting point of each transect were recorded on a GPS and the entire transect was tracked using the "track" option in the GPS. The starting points were marked permanently on trees or on walls for precise location of the sites for future surveys.

The fishing village of Panaiyur Periyakuppam was visited on June 15, 2013 for the training and Phase 1 of the sand dune survey. Transect 1 (see Fig. 1) was surveyed between 10.30 am and 12.30 am. Volunteers from the fishing villages of Panaiyur Periyakuppam and Chinnakuppam and members of the Community Environmental Monitoring team were trained to employ the beach profiling technique (see Appendix 1). Repeated exercises were carried out to ensure that errors and observer biases were reduced substantially. Phase 2 of the sand dune profiling survey was carried out on July 4 and 5, 2013 and four additional transects (Fig 1) were profiled by the villagers to the north of the Transect 1, under the supervision of trained members of the Community Environmental Monitoring team.

Field data was standardised and plotted on graphs using Microsoft Excel.

Project documents, particularly the contour map of the port site provided by the project proponent for obtaining environmental clearance, were also analysed. A copy of the Contour Map is in Fig. 3

Results

Observations by the author

- The entire stretch of Panaiyur coast (including Periyakuppam and Chinnakuppam villages) is fringed by extensive sand dune systems that were at least half a kilometer in width and stretched for approximately 1.5 kilometres on either side of the village.
- Coastal sand dunes began from the Buckingham Canal and stretched all the way to the beach berm. The leeward side of the dunes had substantial vegetation fringing the Buckingham canal. However, in transect 5 it was noticed that the Buckingham canal splits the sand dunes into two, shortly before emptying into the Mudaliarkuppam estuary.
- The entire Panaiyur Periyakuppam village was situated on a raised dune and the houses were built on the dunes in a way that they synchronized with its topography. This suggests that the dunes could have offered the village protection from the December 2004 tsunami induced inundation and during other storm induced surges. This was later confirmed by the villagers.
- The Contour Map furnished by the project proponent, reproduced in Fig. 3 confirms this observation. Zone A of the map is located on a steeper slope of the dune complex, while Zone B, which will house the coal stockyard, is located on a gentler slope of the dune complex. The heights of the dune range from 7 metres to 3.5 metres within the project area.

The contour map also marks the presence of a settling pond along the eastern boundary. Ground truthing revealed that this location corresponds to a natural depression and drainage that is already present

- The proposed site for the coal stocking yard is situated on the top and along the slopes of a large and established sand dune.
- Ground water (fresh water) levels in the area seemed to be substantially high as indicated by the availability of abundant fresh water in the dug-out wells in the village.
- A large portion of the frontal dunes, including in project area, were used for numerous fisheries related activities such as boat docking, net mending, and fish drying by fishers from both Panaiyur Periakuppam and Chinnakuppam. A community livelihood map generated by residents of Panaiyur Periakuppam identifies the beachfront proposed to be occupied by the project as including exclusive and shared beach space used by fisherfolk of Periakuppam and Chinnakuppam. [See Fig 2: Livelihood map of Panaiyur Periakuppam]
- During phase 1 and phase 2 of the sand dune survey, boats were docked on the beachfront that falls within the project area, and fishermen were observed removing fish from their nets.
- Mango orchards were observed on the west of the survey area within private lands. Sand dunes provide protection from salt-laden winds and salt water, and it is common along the east coast to observe agriculture and horticulture on the leeward side of sand dunes.

Results of the dune profiling exercise

The dune profiling exercise found the following:

- The Panaiyur dunes are part of a continuous stretch of a well-established dune system stretching to the North and South of the Panaiyur Periyakuppam village.
- The foredune begins at the beach berm and on an average extends 570 metres towards the landward side. Averaging the maximum heights observed at the five transects, the dune system is seen to have an average maximum height of 9.774 metres with a maximum of 11.62 metres (see table 1 for details).
- The dune system surveyed stretches continuously for at least 2 kilometres north of the Panaiyur Periyakuppam village, with the Buckingham canal splitting the dune into two approximately at a kilometer away from transect 1.
- The coordinates of the proposed coal stocking yard place it on top of this substantially large sand dune that stretches for a considerable distance to its north and south (see Fig. 1)
- The unhindered flow of sand from the beach to the dune heights, and the ability of the sea to reclaim sand from the dunes during storm surges and cyclones are essential to maintaining the integrity of the beach and the stability of the coastline. Any interference in the form of construction or barriers, including say a 10 metre coal yard with a higher ceilinged bubbletop structure, would interfere with the sand flow. This would have implications on the health of the sand dune and the profile of the coastline.
- The sampled stretch of sand dunes appear to be an extension of the large dune system that are reported from the Kadapakkam coast thereby extending the sand dune stretch all the way to the South East of the Odiyur lake. (see Namboothri et al. 2008 for details)

Fig 1: Map indicating the precise locations of the transects (red lines) and the location of the proposed coal storage yard (borders marked in blue)



Fig 2: Livelihood map of Panaiyur Periyakuppam village

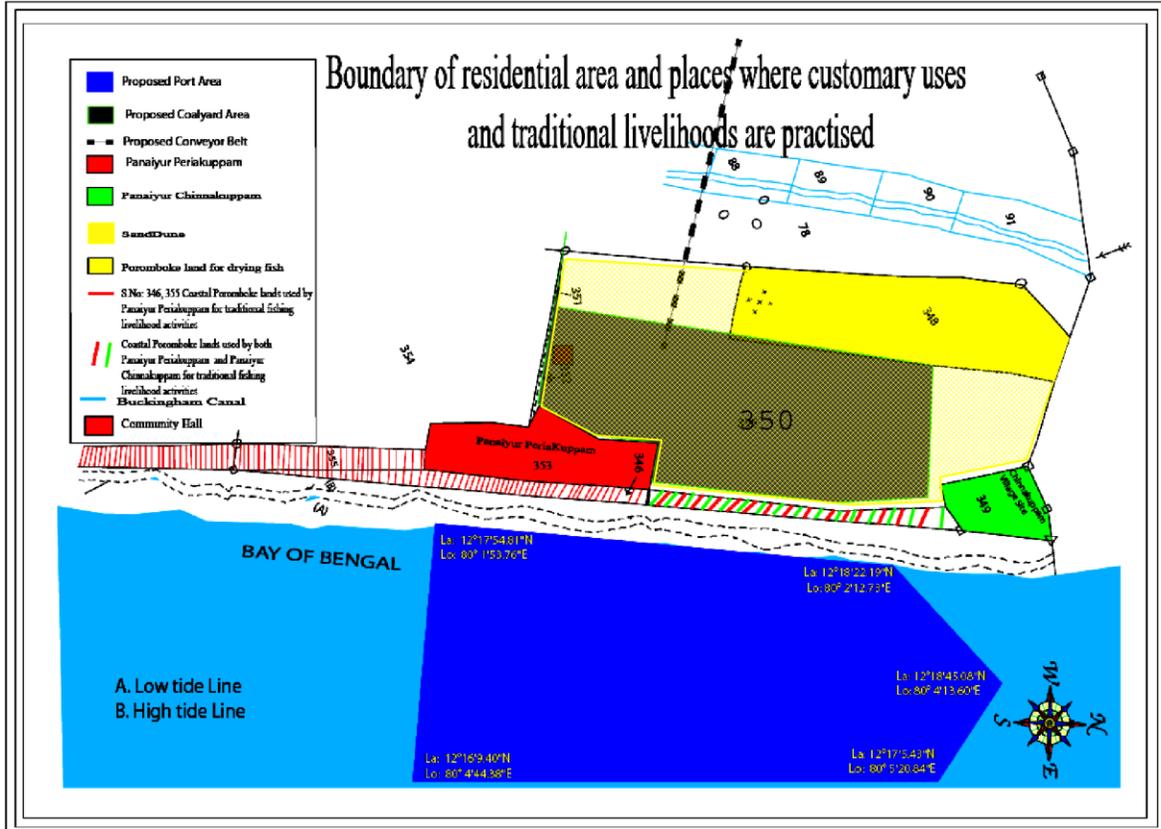


Table 1. Details of sand dune transect surveys

Transect no.	GPS coordinates	Date sampled	Maximum height in metres	Maximum width in metres
1	N 12°18'15.30" E 80° 1'40.73"	15/06/2013	11.62	674
2	N 12°18.337' E 80°01.741'	04/07/2013	8.84	500
3	N12°18.441' E 80°01.818'	04/07/2013	11.04	590
4	N 12°18.560 ' E 80°01.903'	05/07/2013	8.51	620
5	N 12°18.815' E 80°02.182'	05/07/2013	8.86	465
			9.774 m (AMH)	569.8 (AMW)

*AMH – Average Maximum Height | *AMW – Average Maximum Width

Fig 3: Contour map of proposed site for captive port and Panaiyur village

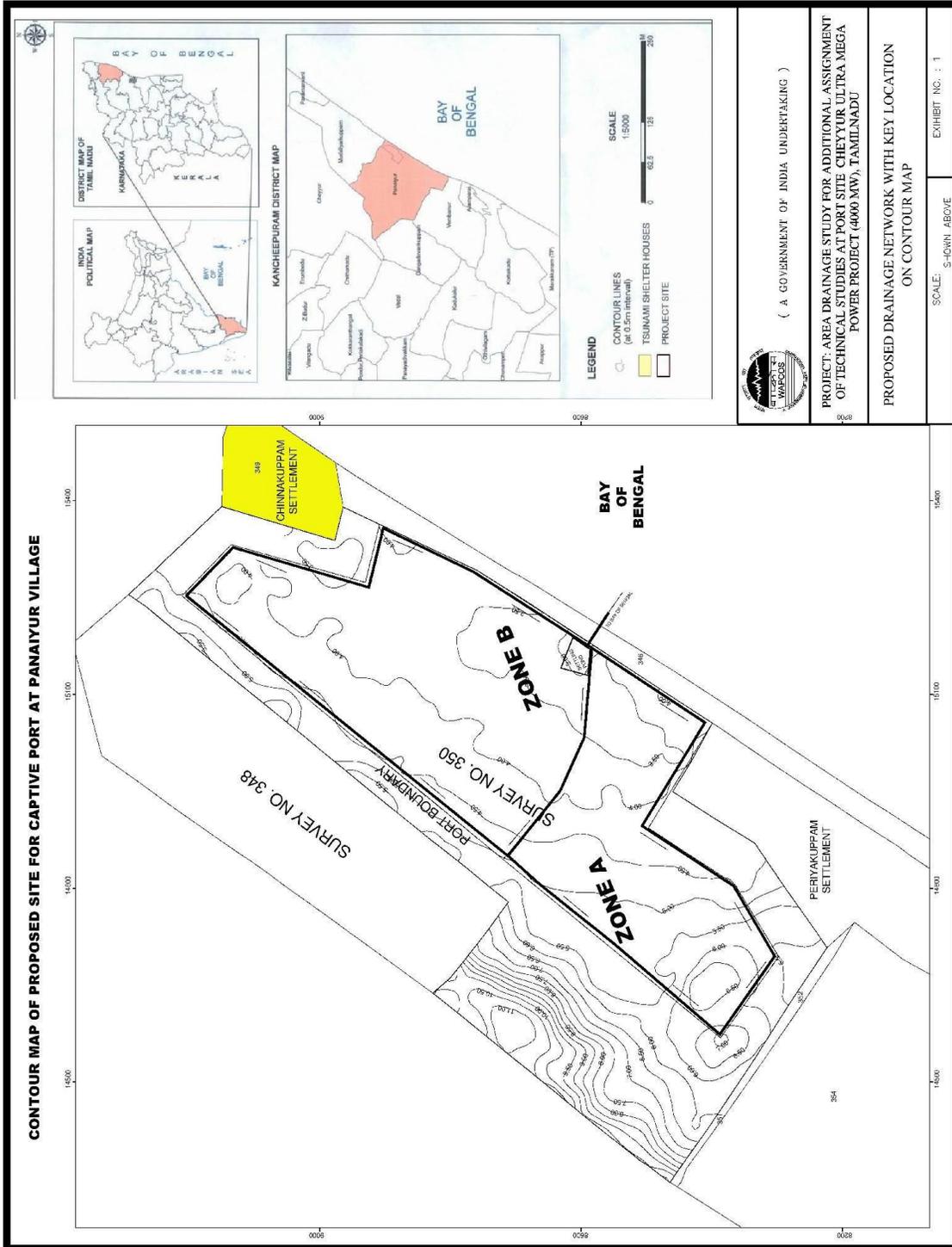
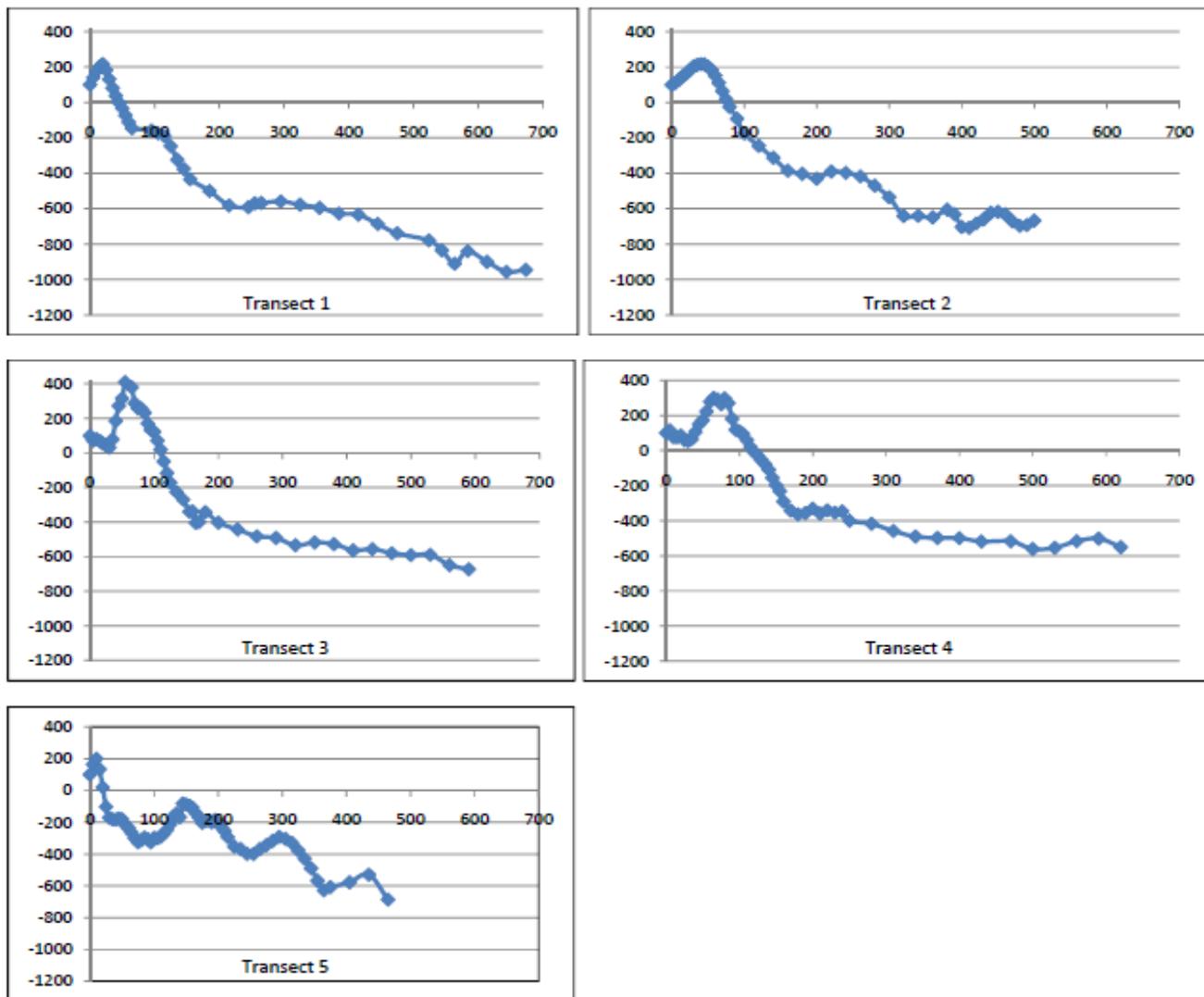


Fig 4: Graphs showing the profiles of each transect. The start points are the permanently marked points on the landward side and the end points indicate the water level.



*y axis in centimeters

Discussion

This brief survey of the coastal areas of the Panaiyur reveals that the entire coastline north of the village is fringed by extensive and well-formed dune systems. Dunes are found extensively on the open and high energy coastline of the Coromandel. Sanjeevi (1996) did an extensive study of the coastal sand dunes of the Coromandel Coast using satellite data. He recorded extensive dune systems south of Madras city, although not providing specific sites. He also points out that the Buckingham Canal seems to act as a demarcating line between the dunes on the eastward side and the hinterland on the west. This was also clearly observed in the present case. Some of the heights he mentions for other dune systems of the Coromandel are 3 metres for the dunes North of Chennai and South of Pulicat and 10 metres for dunes found along the Pondicherry and Porto Novo (currently Parangipettai) regions.

A post-tsunami study conducted for United Nations Development Programme carried out a preliminary survey in 38 coastal villages all along Tamil Nadu coast where sand dunes are reported. Two of the three locations in Cheyyur Taluk of Kanchipuram district are Panaiyur Chinnakuppam and Panaiyur Periakuppam.³

Considering CTNPL's port project proposal for CRZ recommendation, the Tamil Nadu Coastal Zone Management Authority noted that "the said area lies on the coast and surrounded all (*sic*) the three sides by sand dunes."⁴

The current height of the dunes recorded (9.774 metres average of maximum height of dunes at sampled transects with a maximum of 11.62 m) indicates that they are as well-established, if not better than dunes from other sites of the Coromandel Coast. The vertical and horizontal profile of the dunes suggests that they are very old. The dune systems of the Panaiyur Coast are therefore an important component of the larger dune systems of the Coromandel Coast and need protection.

In addition, coastal sand dunes are also known to provide a suite of services (see Namboothri et al. 2008 for details). Some important ones are:-

- a. acting as a buffer to reduce the impacts of coastal storms, surges and hurricanes
- b. acting as a barrier to saltwater intrusion
- c. acting as a sink for rainwater, thereby increasing the ground water level and freshwater availability
- d. preventing movement of salt laden winds and sand to the hinterland
- e. supporting unique fauna and flora that are specially adapted to life in these harsh conditions.

The healthy dune systems of the Panaiyur coast seem to be providing all of these and perhaps more services to the fishing and farming communities living on the coast.

They have to be treated with care.

³ Bhalla, R.S., Ram. S., and V. Srinivas, eds. 2008 "Studies on vulnerability and habitat restoration along the Coromandel Coast." 1st ed. Pondicherry, India: FERAL, UNDP-UNTRS (See Annexure E. Page 227)

⁴ Tamil Nadu State Coastal Zone Management Authority. Agenda Notes. 54Th Meeting. 28.10.2009

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Namboothri, N., D. Subramanian, B. Muthuraman, A. Sridhar, S. Rodriguez and K. Shanker. (2008). *Beyond the Tsunami: Coastal Sand Dunes of Tamil Nadu, India- An Overview*. UNDP/UNTRS, Chennai and ATREE, Bangalore, India. p 56.

Sanjeevi, S. (1996). Morphology of dunes of the Coromandel coast of Tamil Nadu: A satellite data based approach for coastal landuse planning, *Landscape and Urban Planning* 34 (3): 189-195.

Appendix 1



A. The team of volunteers carrying out the dune profiling exercise.



B. An image showing the large raised portion of a dune in the background.



C. The team carrying out the dune profiling exercise on a dune slope. Typical dune vegetation is visible along with shallow inundated areas (swales) on the top-right corner



D. A view of the Panaiyur dune system showing Palmyra palm trees – a typical representative of dune fauna.