

## Distribution and Diversity of Coastal Sand Dunes (CSD) of Marakkanam Coastal Belts, Southeast Coast of India

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### ABSTRACT

Coastal sand dunes (CSD) are sensitive and fragile ecosystems with variety of specific floral species. A study of sand dune flora along coastal sand dune areas was done from January 2014 to June 2014. A total of 39 species belonging to 33 genera and 28 families were identified at three different sites. The CSD systems are rich and diverse in their floral composition, even over the small areas of Alamparai, Thazankadu and Muttukkadu kuppam coastal belts. CSD constitutes a variety of habitats and has vital ecological and economic importance. These CSD flora were under constant anthropogenic pressure due to rapid elimination of sand 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.

**Keywords:** Coastal sand dunes; Marakkanam; diversity; anthropogenic pressure

### 1. INTRODUCTION

Coastal dune ecosystems are unique habitats because of their ecological diversity and the occurrence of many rare and endemic species. Dune plant communities and associated fauna are threatened by disturbance from increasing human activities, natural erosion processes, and sea-level changes (Carboni *et al.*, 2009; Feagin *et al.*, 2005).

Vegetation and floristic composition are very important for conservation of biodiversity by providing habitat for wildlife and contributing to the ecologically sustainable management of natural resources. Documenting floristic composition and vegetation types are valuable for continuing

ecological research, management and conservation of plants and wildlife. Any disturbance or changes in the native vegetation may affect wildlife sustainable use of natural resources and conservation of biological diversity (Ejtehadi *et al.*, 2005).

Coastal dune formation ultimately depends on size and prevailing wind energy (Hesp, 2000; Kumar *et al.*, 1993). Their heights differ in response to adequate sand supply, climate and local topographic features (Barbour, 1985; Brid, 1972; Ranwell, 1972). CSD constitute a variety of habitats of vital ecological and economic importance (Sridhar *et al.*, 2007; Varsha *et al.*, 2001; Martinez *et al.*, 1996). Soil is the ultimate reservoir of plant nutrients and their availability decide the diversity, distribution and abundance of the native vegetation (Kurtbo *et al.*, 2007; Zuo *et al.*, 2007; Wilson, 1989).

The rapid increase of a wide range of human activities (urbanization, agriculture, forestry, industry, transport and tourism, etc.) has led to a progressive deterioration and loss of biodiversity, causing fragmentation and a dramatic decline in the distribution and quality of dune habitats (Hansen *et al.*, 2004; Reidsma *et al.*, 2006 and Reger *et al.*, 2007). Coupled with direct anthropogenic impacts on beaches are the effects of predicted climate change, which could have dramatic, widespread and long-lasting consequences for coastal environments in the near future (Stanisci *et al.*, 2004; Feagin *et al.*, 2005 and Harley *et al.*, 2006). Thus, coastal dune management and conservation have become critical issues, representing a priority for many European countries (Schlacher *et al.*, 2005).

While several studies are scattered on coastal sand dunes (CSD) vegetation, restoration and stabilization in temperate regions (Koske *et al.*, 1997; Sylvia, 1989; Sylvia and Will, 1988), the tropical coastal dunes in general and Indian coastal dunes in particular are poorly studied (Sridhar *et al.*, 2007; Padmavathi *et al.*, 2010; Muthukumar and Samuel, 2011). The main objective of the present study was quantify diversity, abundance, richness of CSD floral community, to understand the ecological and economic importance of local community of in and around Marakkanam coastal belts.

## 2. MATERIALS AND METHODS

### A. Study Area

Marakkanam coastal belts located in southeast coast of India ( $12^{\circ}12'$ -  $12^{\circ}15'$  N and  $70^{\circ}56'$  -  $80^{\circ}0'$  E). Alamparai, Thazankadu and Muttukkadu kuppam villages with sand dune coverage about 5 KM<sup>2</sup> extents respectively. The coastal area is flat, sandy and luxury mangrove vegetation. The study area experiences a mean annual temperature of 32°C and mean annual rainfall of 1300 mm and humidity 85%. The mean monthly average temperature ranged from 29-39°C. The climate is tropical and dissymmetric with the bulk of the rainfall occurring during the northeast monsoon October–December (Tharamani - Meterological data). CSD formations depend on accumulating size and prevailing wind energy (Kumar *et al.*, 1993). Their height differs in response to the availability of sand supply, climate and local topographic features (Barbour *et al.*, 1985).

### B. Data collection

Belt transect is the most common standard method, used for vegetation surveys on systems with less proportion of flora such as sand dunes and grasslands (Espejel, 1987). The plants along the belt transect and about 1 m on either sides of the line was surveyed. Belt transects were made on both horizontal and vertical directions (with reference to the shoreline) on coastal sand dunes. Each transect measured about 100 m (three sites). Each site covered by 2 × 100 m (horizontal and vertical). Vegetation was sub-sampled for abundance and density by square quadrates of about 1 m<sup>2</sup>.

## 3. RESULTS AND DISCUSSION

A total of 39 species belonging to 33 genera and 28 families were registered during this survey. Malvaceae was the most common and dominant family with 03 species followed by Amaranthaceae, Euphorbiaceae, Aizoaceae, Poaceae, Rhizophoraceae 02 species and twenty two families were represented only by single species and overall 17 were medicinal plants (Table-1 and II and Figure- 1). Out of the total Indian CSD plants listed so far (154), nearly one third (39) species of them were reported in the study area. Indian CSDs consists of 154 species belonging to 108 genera and 41 families (Arun *et al.*, 1999; Rao and Sheriff, 2002).

While several studies have pointed out in various parts of the world, many dune ecosystems support high plant richness and diversity values (Padmavathi *et al.*, 2009 Musila *et al.*, 2001; Fontana, 2005; Celsi and Monserrat, 2008). During the present study Lamiaceae, Amaranthaceae, Euphorbiaceae, Aizoaceae, Poaceae and Rhizophoraceae were the most common families. Cyperaceae, Convolvulaceae found to be a common family to all the three study sites. We also compared the floristic comparison of the three coastal areas Alamparai has 34 species followed by Thazankadu and Muttukkadu kuppam. Temperate CSDs comprises mainly the members of Poaceae, while tropics with Astraceae, Cyperaceae and Fabaceae (Srihar *et al.*, 2007).

In the present survey indicates the study area preserves a rich floral diversity. Moreover, the different vegetation formation together with the dune field geomorphologic heterogeneity provide a wide variety of environmental conditions and habitat types that support a diverse native fauna like beetles, butterflies, garden lizards and crabs etc., the conservation of the native vegetation of the CSD is a priority to conserve the integrity of the natural communities in coastal belts.

**Table 1**

Silambarasan and Senthilkumaar,  
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<http://www.discovery.org.in/s.htm>

The list of Coastal sand dune flora in Marakkanam coastal belt

Plant name	Family	Common name	Habit
<i>Achyranthus aspera</i>	Amaraniaceae	Nayuruvi	Herb
<i>Acalyph indica</i>	Euphorbiaceae	Kuppaimeni	Herb
<i>Alternachera sessilis</i>	Amaraniaceae	Poonanganni	Herb
<i>Asparagus racemosus</i>	Liliaceae	Satavari	Climber
<i>Avicennia officinalis</i>	Acanthaceae	Alaiyathi	Tree
<i>Borassus flabellifer</i>	Palmaceae	Panaimaram	Tree
<i>Calotropis gigantea</i>	Asclepiadaceae	Erukku	Shrub
<i>Cissus quadraangularis</i>	Vitaceae	Pirandai	Climber
<i>Azadirachia indica</i>	Euphorbiaceae	Neem	Tree
<i>Leucas aspera</i>	Lamiaceae	Tumbai	Herb
<i>Sida cardifolia</i>	Malvaceae	Palampasi	Herb
<i>Abutilon indicum</i>	Malvaceae	Thuthi	Shrub
<i>Carcia papaya</i>	Cariaceae	Pappali	Tree
<i>Casuarina litorea</i>	Causariniaceae	Chavukku	Tree
<i>Caiharanthus voseus</i>	Apocynaceae	Nithyakalyani	Shrub
<i>Cocos nucifera</i>	Areceaceae	Thennaiaram	Tree
<i>Datura matai</i>	Solanaceae	Oomathai	Shrub
<i>Euphorbia hista</i>	Euphorbiaceae	Amampatcharisi	Herb
<i>Euphorbia tortilis</i>	Euphorbiaceae	Tirukukalli	Shrub
<i>Gisekia pharaceoides</i>	Aizoaceae	Manalkeerai	Herb
<i>Hibiscus tiliaceus</i>	Malvaceae	Neerparuthi	Shrub
<i>Opunita stricta</i>	Cactaceae	Sappathikalli	Shrub
<i>Pedaliium murex</i>	Pedaliaceae	Perunerurgil	Herb
<i>Thespesia populnea</i>	Malvaceae	Poovarasu	Tree
<i>Tribuls terrestris</i>	Zygophyllaceae	Nerinji	Shrub
<i>Vernonia cinera</i>	Astraceae	Mukkuttipundu	Herb
<i>Bulbostyllis barbata</i>	Cyperaceae	Hairsedges	Herb
<i>Citrullus colocynthes</i>	Cucurbitaceae	Bitter apple	Herb
<i>Gisekia pharnaceoides</i>	Aizoaceae	Sand herbage	Herb
<i>Lantana camara</i>	Verbenaceae	Big sage	Shrub
<i>Glinus oppositifolius</i>	Molluginaceae	Perun tirai	Herb
<i>Croton bonplandianus</i>	Euphorbiaceae	Boaplandis croton	Herb
<i>Ipomeapes caprae</i>	Convolvulaceae	Ataparkolai	Herb
<i>Canavalia cathartica</i>	Fabaceae	Maunaloa	Shrub
<i>Spinifex littoreus</i>	Poaceae	Ravans moustache	Herb
<i>Mimosa pudica</i>	Mimosaccae	Thotalsiningi	Herb
<i>Cyanodon dactylon</i>	Poaceae	Arugampul	Herb
<i>Rhizophora apiculata</i>	Rhizophoraceae	Surapunnai	Herb
<i>Rhizophora mucoranta</i>	Rhizophoraceae	Surapunnai	Herb

**Table 2**

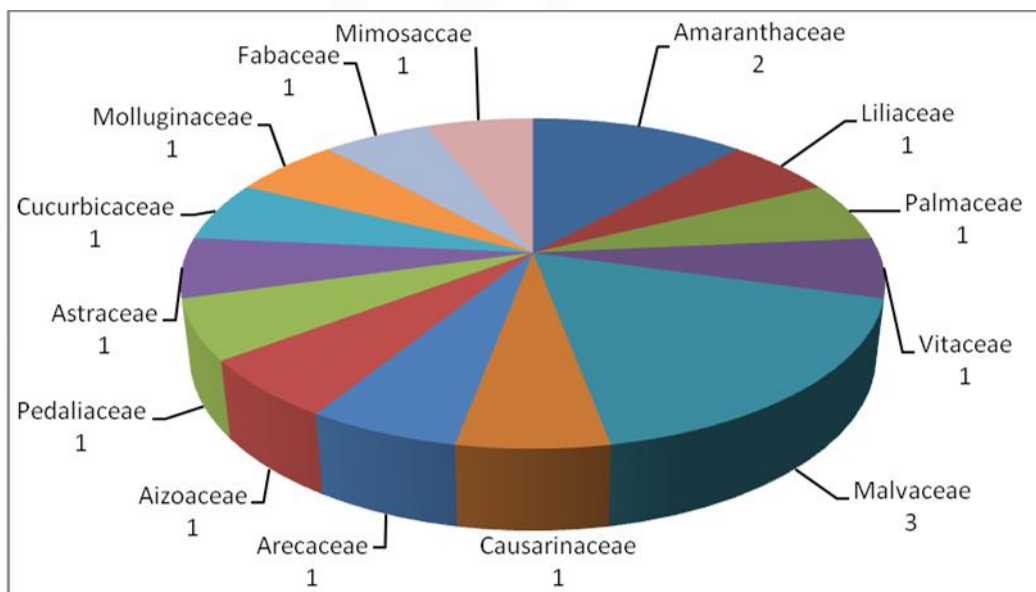
List of families with number of genera and species of coastal sand dune flora of Marakkanam coastal belts

S. No	FAMILY	GENERA	SPECIES
1.	Amaranthaceae	2	2
2.	Euphorbiaceae	2	2
3.	Liliaceae	1	1
4.	Acanthaceae	1	1
5.	Palmaceae	1	1
6.	Asclepidaceae	1	1

7.	Vitaceae	1	1
8.	Lamiaceae	1	1
9.	Malvaceae	3	3
10.	Cariaceae	1	1
11.	Causarinaceae	1	1
12.	Apocynaceae	1	1
13.	Arecaceae	1	1
14.	Solanaceae	1	1
15.	Aizoaceae	1	2
16.	Cactaceae	1	1
17.	Pedaliaceae	1	1
18.	Zygophyllaceae	1	1
19.	Astraceae	1	1
20.	Cyperaceae	1	1
21.	Cucurbitaceae	1	1
22.	Verberaceae	1	1
23.	Molluginaceae	1	1
24.	Convolvulaceae	1	1
25.	Fabaceae	1	1
26.	Poaceae	1	2
27.	Mimosaccae	1	1
28.	Rhizophorceae	1	2

**Figure 1**

Percentage contribution to abundance by major sand dune families



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