

## **PLANT DIVERSITY ON COASTAL SAND DUNE FLORA, TIRUNELVELI DISTRICT, TAMIL NADU**

**S. Ramarajan and \*A.G. Murugesan**

*Manonmaniam Sundaranar University,*

*Sri Paramakalyani Centre of Excellence in Environmental Sciences, Alwarkurichi - 627 412, Tamil Nadu, India*

*\*Author for Correspondence*

### **ABSTRACT**

The sand dunes in coastal regions of Tirunelveli are important ecosystems because of their small size, the rare species found in this habitat, and the beautiful landscapes they create. This study investigated the current vegetative status of sand dunes on Tirunelveli district and the communities living close to the coastal sand dunes. A study of sand dune flora along coastal sand dune areas was done from June 2011 to December 2012. 55 species belonging to 46 genera and 26 families were identified at different distances from the shoreline. Coastal dune constitutes a variety of habitats wide varieties of diverse habitats and ecosystems are essential for the maintenance of food webs, migration routes and increase productivity. Such unique sensitive systems have to be protected from habitat exploitation in order to protect their native biodiversity and ecological functions.

**Keywords:** *Coastal, Exploitation, Ecological Functions, Biodiversity, Ecosystems, Food Web, Landscapes, Sand Dunes*

### **INTRODUCTION**

Coastal ecosystems, found along continental margins, are regions of remarkable biological productivity and high accessibility. This has made them centre of human activity for millennia. Coastal ecosystems provide a wide array of goods and services: they host the world's primary ports of commerce; they are the primary producers of fish, shellfish, and seaweed for both human and animal consumption; and they are also a considerable source of fertilizer, pharmaceuticals, cosmetics, household products, and construction materials.

In a world where biodiversity is in steady decline, it is important not only to study why this decline is taking place and how best to halt it, but also how to reverse it. Since habitat fragmentation and degradation have been pointed out as two of the main reasons for the world-wide biodiversity loss (Fischer & Lindenmayer 2007).

Coastal zone is a dynamic natural environment area with many cyclic processes owing to a variety of resources and habitats. Coastal plains are the most taxonomically rich and productive ecosystems on the earth. Although occupying only 8% of the total surface, ecologically important areas account for 20-25% of global plant growth.

The coastlines of the world represent both a dynamic natural environment and an important context in which a diverse range of human activities, as well as geomorphologic and biological processes, interact. Much of the forest land is being converted into agricultural land. Thus, in recent years, overexploitations as well as other factors such as over inhabitation, overgrazing, socioeconomic issues and political issues have disturbed the entire ecosystem. The disturbance caused to the forests has threatened the existence of various rare species of flora and fauna due to habitat destruction.

Sand dune vegetation comprises vital components of coastal sand dune habitats owing to their bioengineering role in sediment accumulation, sand binding and land building processes. Beach ecosystems in India have been studied for their physical, geological and restoration aspects (Ahmad 1972 and Mascarenhas, Jayakumar 2008), CSD ecosystems are categorized as ecologically sensitive (MoEF).

Indian subcontinent has a coastline of about 7516 km long with 2.1 million km<sup>2</sup> exclusive economic zone and 0.13 million km<sup>2</sup> continental shelf (Khoshoo 1996) and spread over 9 states and the coastline of

### Research Article

Tamilnadu has a length of about 1076kms, constitutes about a 15% of the total coastal length of India. The coastal zone is one among the 10 biogeographically important habitats of the Indian subcontinent (Rodgers and Panwar 1988). Tirunelveli district is part of the Gulf of Mannar Biosphere Reserve and the types of vegetation on the sand dune vegetation.

This paper aims to generate a baseline data on coastal sand dune vegetation in the Gulf of Mannar Biosphere Reserve, with special reference to Tirunelveli coastline. Apparently, very some publications are available on the Angiosperm floral diversity of Indian sand dunes (Sridhar and Bhagya 2007).

## MATERIALS AND METHODS

### Study Area:

Tirunelveli is located on the North Eastern- south western coast of Tamil Nadu. Geographically it is located between  $78^{\circ} 7' 30''$  E –  $77^{\circ} 35' 30''$  E longitude and  $8^{\circ} 27' 30''$  S -  $8^{\circ} 2' 30''$  S latitude. The coast of Tirunelveli district extends from Kayamozhi on the North and ends at South East of Karungulam coast (Figure 1). The coast line runs NE- SW direction. Superficially, the coast is flat and sandy. The study area experiences a mean annual temperature of  $32^{\circ}\text{C}$  and a mean annual rainfall of 655mm and humidity 87%. The mean monthly temperature ranges from  $29\text{--}35^{\circ}\text{C}$ . The climate is tropical and dissymmetric with the bulk of the rainfall occurring during the northeast monsoon October–December (Coastal Regulation Zone of Tirunelveli District website).



Figure 1: Coastal sand dune map of Tirunelveli

### Data collection:

A line transects of about 10000m were laid randomly (wherever the vegetation cover was predominantly found) in 10 different locations at different distance gradients from the shoreline in each area. Every plant species found along the 10 transects are recorded by observation while walking. Species are identified then and there. Species were identified by using published flora (Daniel & Umamaheswari 2001; Banerjee *et al.*, 2002). All recorded plant species were divided into annual versus perennial groups.

**Research Article**

**RESULTS AND DISCUSSION**

55 species belonging to 46 genera and 26 families were registered during this survey. Poaceae was the most common and dominant family with 13 species followed by and Cyperaceae (6) Fabaceae (5), Molluginaceae (4), Euphorbiaceae (3), Amaranthaceae, Asclepiadeaceae, Asteraceae, Malvaceae, (2) and sixteen families were represented only by one single species (Table 1 and 2, Figures 2 and 6). Temperate Coastal Sand Dunes comprise mainly the members of Poaceae, while tropics with Asteraceae, Cyperaceae and Fabaceae and Poaceae (Arun *et al.*, 1999; Rao and Sherieff 2002; Sridhar and Bhagya 2007). As several authors have pointed out in various parts of the Tamil Nadu region and world, coastal dune flora (Muthukumar and Samuel 2011; Padmavathy *et al.*, 2010; Musila *et al.*, 2001; Kim K. D. 2004; Fontana 2005; Celsi and Monserrat 2008).

**Table 1: List coastal sand dune flora in Tirunelveli district**

Botanical Name	Family	Habit
<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	S
<i>Acalypha indica</i> L.	Euphorbiaceae	H
<i>Acanthospermum hispidum</i> DC.	Asteraceae	H
<i>Acrachne henrardiana</i> (Bor) S.M. Phillips	Poaceae	H
<i>Aerva lanata</i> (L.) Juss.	Amaranthaceae	H
<i>Aerva persica</i> (Burm.f.) Merr.	Amaranthaceae	S
<i>Aeschynomene indica</i> L.	Fabaceae	H
<i>Aloe vera</i> (L.) Burm.f.	Liliaceae	H
<i>Alysicarpus monilifer</i> (L.) DC.	Fabaceae	H
<i>Argemone maxicana</i> L.	Papaveraceae	H
<i>Barleria noctiflora</i> L. f.	Acanthaceae	H
<i>Boerhavia diffusa</i> L.	Nyctaginaceae	H
<i>Borassus flabellifer</i> L.	Arecaceae	T
<i>Brachiaria ramosa</i> (L.) Stapf	Poaceae	H
<i>Brachiaria reptans</i> (L.) C.A. Gardner & C.E Hubb.	Poaceae	H
<i>Bulbostylis barbata</i> (Rottb.) Kunth ex C.B. Clarke	Cyperaceae	H
<i>Bulbostylis puberula</i> C.B. Clarke	Cyperaceae	H
<i>Calotropis gigantea</i> (L.) R. Br.	Asclepiadaceae	S
<i>Canavalia cathartica</i> Thouars	Fabaceae	C
<i>Canavalia rosea</i> (Sw.) Dc.	Fabaceae	C
<i>Casuarina equisetifolia</i> L.	Casuarineaceae	T
<i>Catharanthus roseus</i> G. Don	Apocyanaceae	H
<i>Chloris barbata</i> Sw.	Poaceae	H
<i>Chrysopogon fulvus</i> (Spreng.) Chiov.	Poaceae	H
<i>Cissus vitiginea</i> L.	Vitaceae	C
<i>Citrullus colocynthes</i> (L.) Sch.	Cucurbitaceae	C
<i>Cyperus rotundus</i> L.	Cyperaceae	H
<i>Dactyloctenium aegyptium</i> (L.) Willd.	Poaceae	H
<i>Enicostema axillare</i> (Lam.) J. Raynal	Gentianaceae	H
<i>Eragrostiella bifaria</i> (Vahl) Bor	Poaceae	H
<i>Eragrostis amabilis</i> (L.) Wight & Arn. var. <i>insularis</i> (C.E. Hubb.) Umamahesw. & P. Daniel	Poaceae	H
<i>Eragrostis amabilis</i> (L.) Wight & Arn. Var. <i>Amabilis</i>	Poaceae	H
<i>Gisekia pharnaceoids</i> L.	Molluginaceae	H
<i>Glinus oppositifolius</i> L.	Molluginaceae	H
<i>Halopyrum mucronatum</i> (L.) Stapf	Poaceae	H
<i>Jatropha maheswarii</i> Subram. & Nayar	Euphorbiaceae	S

**Research Article**

<i>Kyllinga bulbosa</i> P.Beauv.	Cyperaceae	H
<i>Kyllinga hyalina</i> (Vahl) T. Koyama	Cyperaceae	H
<i>Kyllinga nemoralis</i> (J.R.Forst. & G.Forst.) Dandy ex Hutch. & Dalziel	Cyperaceae	H
<i>Launaea sarmentosa</i> (Willd.) Sch.Bip. ex Kuntze	Asteraceae	H
<i>Lopholepis orithocephala</i> (Hook.) Steud.	Poaceae	H
<i>Mimosa pudica</i> L.	Mimosaceae	H
<i>Mollugo cerviana</i> (L.) Ser.	Molluginaceae	H
<i>Mollugo pentaphylla</i> L.	Molluginaceae	H
<i>Ocimum tenuiflorum</i> L.	Lamiaceae	H
<i>Passiflora foetida</i> L.	Possifloraceae	C
<i>Pedaliium murax</i> L.	Pedaliaceae	H
<i>Perularia daemia</i> (Forssk.) Chiov.	Asclepiadaceae	C
<i>Prosopis juliflora</i> (Sw.)DC.	Fabaceae	T
<i>Ricinus communis</i> L.	Euphorbiaceae	S
<i>Salvadora persica</i> L.	Salvadoraceae	T
<i>Senna tora</i> (L.) Roxb.	Caesalpiaceae	H
<i>Spinifex littoreus</i> (Burm.f.) Merr.	Poaceae	H
<i>Thespesia populnea</i> (L.) Sol.ex Correa	Malvaceae	T
<i>Trachys muricata</i> (L.) Pers.	Poaceae	H



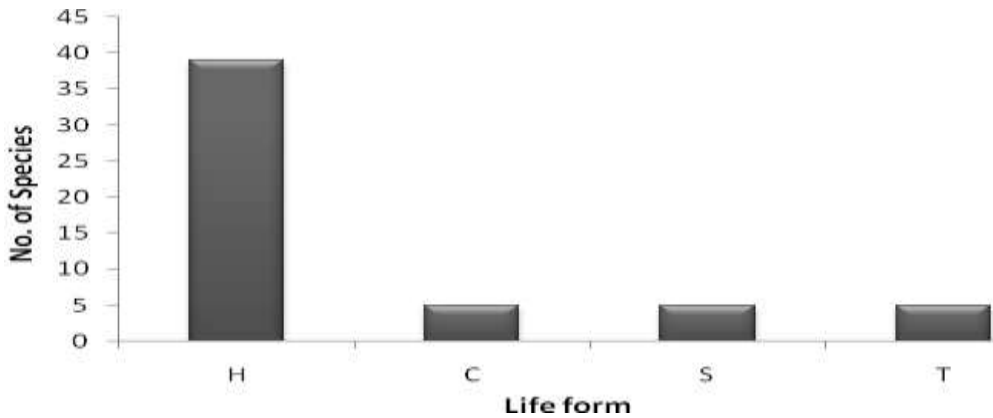
**Figure 2: Selected Coastal dune flora**



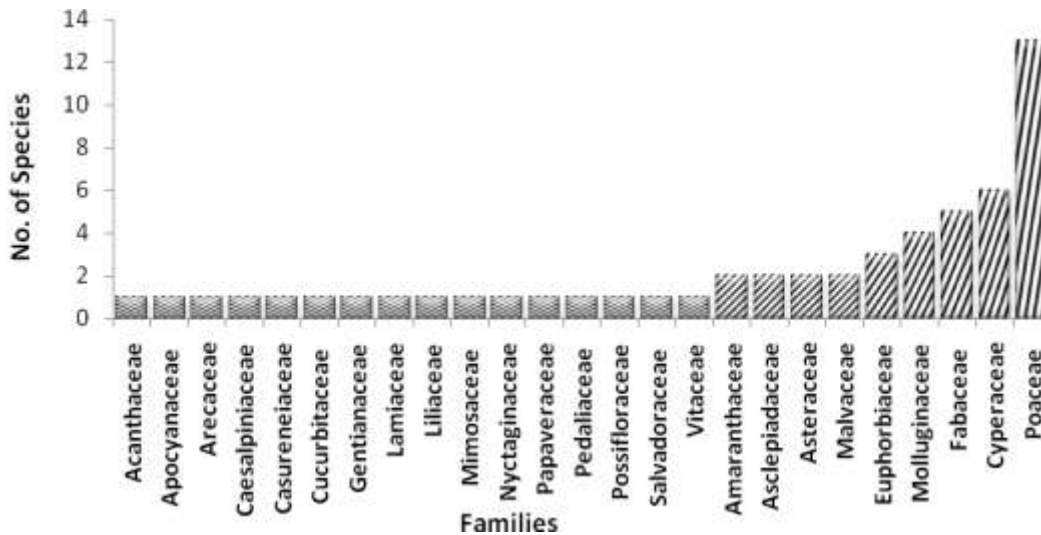
**Figure 3: Selected Coastal dune grasses**



**Figure 4: Part of the study area**



**Figure 5: Life form wise distribution of plant species in the study area**



**Figure 5: List of families with number of genera and species of coastal dune flora**

In this present work also indicates that the study area preserves a rich flora with high number of native dune plants. Moreover, the different vegetation formations together with the dune field geomorphologic heterogeneity provide a wide variety of environmental conditions and habitat types that support a diverse native fauna like Crabs, Dune Lizards etc. The conservation of the native vegetation of the CSD is a priority to conserve the integrity of the natural communities in coastal regions. This area was composed of herbaceous species like *Leucas aspera*, *Gisekia pharnaceoides*, *Tephrosia purpurea*, coastal tree species like *Borassus flabellifer* and the introduced *Casuarina litorea*.

**Conclusions**

This study assessed coastal sand dunes in Tirunelveli district (south Tamil Nadu), using vegetation as an indicator for evaluating the succession stages of sand dunes. Once known as very natural and inaccessible, the majority of the sand dunes in Tirunelveli have been destroyed. Today, these dunes remain as fragmented strips lying parallel to the coastline in an east-west direction and are largely occupied by Mining, Fishing, Tourism and agriculture. Indiscriminant grazing an overall increase in visitors have also damaged typical vegetation on sand dunes (Lee and Chon, 1983; Lee *et al.*, 2000). Mining patches make up 75% of the total sand dune area in the district. In particular place during religious celebrations floral diversity and environmental conditions were affected as human waste, polythene bags, and other solid wastes were deposited on the sand dunes. Coastal sand dunes are susceptible to various direct (e.g. sand extraction) and/or indirect (e.g. cattle grazing) anthropogenic

impacts that result in drastic changes in plant species diversity. These studies may vary from vegetation studies, as deep-rooted in this paper; to detailed surveys for use in identify coastal dune floras.

#### **ACKNOWLEDGMENTS**

Financial assistance from the DAE-BRNS in the form of a major research project to Prof. Dr. A.G Murugesan is gratefully acknowledged. The author is also thankful to the local communities whose support was impressive during the collection period of flora. A. Saravana Gandhi, Head & Professor, Department of Botany, Rani Anna Govt. College for Women Tirunelveli, for his constant encouragement in throughout of our study and for her help in making photo plates is gratefully acknowledged.

#### **REFERENCE**

- Ahmad E (1972).** *Coastal geomorphology of India* (Orient Longman Limited., Asaf Ali Road, New Delhi) 222.
- Arun AB, Beena KR, Raviraja NS and Sridhar KR (1999).** Coastal sand dunes - a neglected ecosystem. *Current Science* **77** 19–21.
- Banerjee LK, Rao TA, Sastry ARK and Ghosh D (2002).** Diversity of Coastal Plant Communities in India, *Botanical Survey of India*, Kolkata 233–320.
- Celsi CE and Monserrat AL (2008).** Vascular plants, coastal dunes between Pehuen-có and Monte Hermoso, Buenos Aires, Argentina. *Check List* **4**(1) 37–46.
- Daniel P and Umamaheswari P (2001).** The Flora of Gulf of Mannar. Southern India, *Botanical Survey of India* 605.
- Fischer J and Lindenmayer DB (2007).** Landscape modification and habitat fragmentation: a synthesis, *Global Ecology and Biogeography* **16** 265-280.
- Fontana SL (2005).** Coastal dune vegetation and pollen representation in south Buenos Aires Province, Argentina. *Journal of Biogeography* **32** 719-735.
- Khoshoo TN (1996).** Vesicular-arbuscular mycorrhizae of Hawaiian dune plants. *Current Science* **71** 506-513.
- Kim KD (2004).** Invasive plants on disturbed Korean sand dunes. *Estuarine, Coastal and Shelf Science* **62** 353–364.
- Lee and Chon SK (1983).** Ecological studies on the coastal plants in Korea. *Korean Journal of Ecology* **6** 177–186.
- Lee JK, Lee KS, Ihm BS, Kim HS and Lee SH (2000).** Studies on the vegetation distribution and standing biomass at the coastal sand dune of Uido. *Basic Science Research* **15** 53–60.
- Mascarenhas A and Jayakumar S (2008).** An environmental perspective of the post-tsunami scenario along the coast of Tamil Nadu, India: Role of sand dunes and forests. *Journal of Environmental Management* **89** 24-34.
- Mo EF (1991).** Declaration of Coastal Stretches as Coastal Regulation Zone (CRZ), Notification, S.O. no. 114(E), 19 February. *New Delhi: Ministry of Environment and Forests*; 14.
- Musila WM, Kimyamario JI and Jungerius PD (2001).** Vegetation dynamics of coastal sand dunes near Malindi, Kenya. *African Journal of Ecology* **39** 170-177.
- Muthukumar and Samuel AS (2011).** Coastal sand dune flora in the Thoothukudi District, Tamil Nadu, southern India. *Journal of Threatened Taxa* **3**(11) 2211–2216.
- Padmavathy K, Poyyamoli G and Balachandran N (2010).** Coastal Dune Flora, Nallavadu Village, Puducherry, India. *Check List* **6**(2) 198–200.
- Rodgers WA and Panwar HS (1998).** Planning a Wildlife Protected Area Network in India, *Wildlife Institute of India, Dehra Dun, India* 1(2).
- Rao TA and Sherieff AN (2002).** Coastal Ecosystem of the Karnataka State, India II - Beaches. Bangalore: *Karnataka Association for the Advancement of Science* 250.  
<http://www.lrrd.org/lrrd19/6/srid19084.htm>.