

# Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

Sugaseelan Akash<sup>1</sup>, Kathavarayan Manikandan<sup>1</sup>, Seetharaman Radhakrishnan<sup>2</sup>,  
Ramachandran Rajaselvam<sup>1</sup>, Authinarayanan Rajesh<sup>1&3\*</sup>

<sup>1</sup>Department of Botany, Annamalai University, Chidambaram, Cuddalore, Tamil Nadu, India.

<sup>2</sup>Department of Botany, Government College for Women's, Kumbakonam, Tamil Nadu, India.

<sup>3</sup>Department of Medicinal Botany, Government Siddha Medical College, Palayamkottai, Tirunelveli, Tamil Nadu, India. Email: [tselvarajes@gmail.com](mailto:tselvarajes@gmail.com) (Corresponding Author)

\*Corresponding author: Authinarayanan Rajesh, Department of Medicinal Botany, Government Siddha Medical College, Palayamkottai, Tirunelveli, Tamil Nadu, India

Email: [tselvarajes@gmail.com](mailto:tselvarajes@gmail.com)

Received: 30th May, 2026; Revised: 10th June, 2026; Accepted: 15th June, 2026; Available Online: 18th June, 2026

## ABSTRACT

A qualitative field survey was conducted to document vegetation in sand dune and coastal areas of Viluppuram District, situated along the Coromandel Coast of Tamil Nadu, which represent ecologically significant ecosystems that support diverse plant communities adapted to harsh environmental conditions. A comprehensive floristic survey was conducted between January 2025 and March 2026. A total of 268 angiosperm species distributed among 219 genera and 75 families were documented. Fabaceae emerged as the most species-rich family with 35 species, followed by Malvaceae (15 species), Convolvulaceae and Poaceae (12 species each), Apocynaceae (11 species), and Acanthaceae, Amaranthaceae, and Euphorbiaceae (10 species each). Life-form analysis showed a predominance of herbs (106 species), followed by trees (70 species), shrubs (45 species), climbers (32 species), and creepers (15 species). Assessment of plant functional types revealed phanerophytes as the dominant group (158 species), while therophytes (51 species), graminoids (22 species), legumes (15 species), succulents (12 species), geophytes (6 species), parasites (3 species), and carnivorous plants accounted for 1 species. The study further recorded six endemic taxa, namely *Mussaenda tomentosa*, *Chloris wightiana*, *Lepidagathis pungens*, *Commiphora berryi*, *Euphorbia glaucescens*, and *Hardwickia binata*, highlighting the conservation value of the region. The conservation status revealed two Vulnerable species, one Near Threatened species, 116 species of Least Concern, and five Data Deficient species. The floristic richness observed in the present study exceeds that reported from several other coastal dune ecosystems of Tamil Nadu, underscoring the importance of Viluppuram as a reservoir of coastal biodiversity. However, increasing anthropogenic disturbances, including fuelwood collection, waste disposal, and habitat degradation, pose substantial threats to these ecosystems. The findings emphasise the urgent need for conservation planning, habitat protection, and long-term ecological studies to safeguard the biological integrity and ecological functions of the coastal dune landscapes of Viluppuram District.

**Keywords:** Flora, Coromandel Coast, threatened species, Plant functional types.

**How to cite this article:** Akash S, Manikandan K, Radhakrishnan S, Rajaselvam R, Rajesh A. Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India. *Int J Drug Deliv Technol.* 2026;16(61s):807-823. DOI: 10.25258/ijddt.16.61s.89

**Source of support:** Nil.

**Conflict of interest:** None

## Introduction

The coastal dunes of Viluppuram District, along the Coromandel Coast of Tamil Nadu, support a distinctive assemblage of plant species that have evolved to thrive in the harsh conditions of coastal ecosystems. Characterised by shifting sands, saline conditions, strong winds, and nutrient-deficient soils, these habitats present significant challenges for plant establishment and survival. Nevertheless, the dunes harbour a rich diversity of native, endemic, and threatened flora that exhibit

specialised adaptations to withstand salinity, water scarcity, and intense solar radiation. The vegetation is predominantly composed of halophytic and xerophytic species, which are well suited to the prevailing environmental stresses (Hashem and Mohamed, 2020). In addition to these specialised plants, the dune ecosystem supports a variety of coastal grasses, shrubs, and herbaceous species that contribute to sand stabilisation and provide essential habitats and food resources for wildlife, including migratory birds (Akash *et al.*, 2025). The vegetation

cover plays a critical ecological role by acting as a natural barrier against coastal hazards such as sea-level rise, storm surges, and erosion, thereby enhancing shoreline resilience and reducing the impacts of climate change (Akash *et al.*, 2026). The composition and distribution of dune vegetation are strongly influenced by regional climatic conditions (Jackson *et al.*, 2019). Despite their ecological significance, coastal dune ecosystems are increasingly threatened by anthropogenic activities that accelerate soil erosion and habitat degradation, leading to biodiversity loss and local species decline. These pressures underscore the importance of establishing protected areas and implementing long-term ecological monitoring programs to ensure the conservation of this fragile ecosystem (Borges *et al.*, 2020). Effective conservation measures are essential not only because dune habitats are highly vulnerable to disturbance but also because they play a fundamental role in maintaining regional biodiversity and ecological stability (Rodrigues *et al.*, 2011). Dune vegetation further contributes to ecosystem integrity by reducing erosion caused by wind and wave action while providing refuge for numerous plant and animal species (Feagin *et al.*, 2015). Many of the plant species occurring in these habitats possess medicinal potential that remains insufficiently explored, highlighting the need for their preservation (Narayanan *et al.*, 2025). Moreover, the conservation of dune ecosystems has important socio-economic dimensions, as local communities depend on these landscapes for their livelihoods, traditional knowledge systems, and overall well-being (Padmavathy and Anbarashan, 2011).

Although research on the dune flora of Villupuram remains limited, available studies emphasise the importance of these plant communities in sustaining coastal ecosystem functions. As developmental activities continue to expand along the coastline, a comprehensive understanding and protection of dune vegetation have become increasingly important for ensuring the long-term conservation and sustainable management of these ecologically sensitive environments.

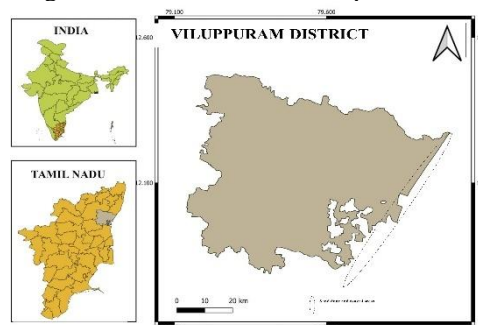
#### Materials and methods

The study was conducted in the Viluppuram District, located in the northern part of Tamil Nadu, India (Figure 1). This coastal district lies along the Bay of Bengal and is part of the Coromandel Coast. Viluppuram is characterised by a diverse range of ecosystems, ranging from semi-arid to tropical. Major rivers in the district include the Ponnaiyar, Gadilam, Malattar, and Sankaraparani. The area features a variety of habitats, such as forests, grasslands, wetlands, and agricultural lands. The vegetation is influenced by both climatic and human activities, making it an ideal location for studying plant diversity. The climate is typically tropical, with a distinct dry season. The region receives

rainfall from the southwest monsoon (June to September) and the northeast monsoon (October to December), which significantly affect its rainfall patterns.

#### Field survey

The study aims to document the plants growing within a 200-meter width from the shoreline of the dunes in the Viluppuram District. The survey began at Kottakuppam Beach and extended to Muttukadu, covering two taluks. The qualitative field survey was conducted from January 2025 to March 2026, with regular surveys throughout the year to document the emergence of seasonal plants. During each survey, plant specimens were collected for identification using references such as the Flora of the Gulf of Mannar (Daniel and Umamaheswari, 2001). The family nomenclature and author citations adhered to the standards set by the Plants of the World Online (POWO 2026). The recorded plants were classified by life form and functional type. The conservation status of the species in the study area was assessed according to the International Union for Conservation of Nature (IUCN 2026), which provides a globally recognised standard for evaluating the conservation status of species.



**Figure 1.** The study area map illustrates the dune and coastal regions of Viluppuram District where the present study was conducted.

#### Result and discussion

The floristic survey recorded 268 species belonging to 219 genera and 75 families. Fabaceae is the dominant family in the study area (35 species) followed by Malvaceae (15 species), Convolvulaceae and Poaceae (12 species each), Apocynaceae (11 species), Acanthaceae, Amaranthaceae and Euphorbiaceae (10 species each), Asteraceae and Rubiaceae (9 species each), Lamiaceae (8 species), Solanaceae (7 species), Phyllanthaceae (6 species), Arecaceae and Moraceae (5 species each). Were 33 families that represent just a single species each, while 15 families have just 2 species each, seven families represent 3 species each, and five families have just four species each. (Table 3)

Previous studies in Viluppuram, Silambarasan and Senthilkumar (2015) recorded 39 species belonging to 33 genera and 28 families in the Marakkanam coastal belt. Other studies near the Viluppuram

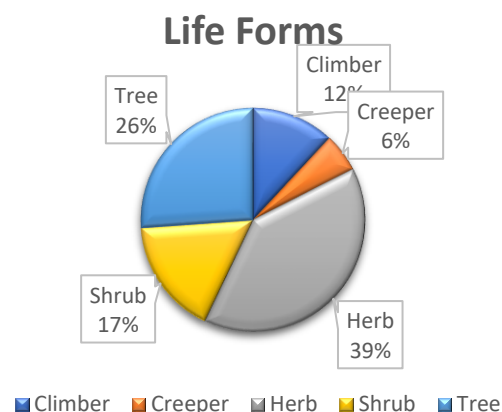
district, Padmavathy *et al.* (2010) documented 41 species belonging to 35 genera and 20 families in Nallavadu village, Puducherry. Additionally, Padmavathy and Anbarashan (2011) listed 52 species belonging to 34 families in a phytomedicinal study of coastal dune flora in Puducherry. In the Cuddalore district, Anbarashan *et al.* (2024) found 105 species belonging to 85 genera and 39 families in the dune ecosystem. In the Cuddalore district, Arulmoorthy and Srinivasan (2017) recorded 32 species belonging to 20 families. In the Thoothukudi district, Muthukumar and Samuel (2011) documented 42 species belonging to 38 genera representing 26 families, while in the nearest district, Tirunelveli, Ramarajan and Murugesan (2014) listed 55 species belonging to 46 genera and 26 families, but recently, Akash *et al.* (2026) resurveyed and documented 253 plant species from 182 genera and 61 families. In recent studies in Kanniyakumari district, Akash *et al.* (2025) recorded 311 species from 233 genera and 75 families. The study area has a greater number of species than most previous studies, but fewer than in the Kanyakumari district, likely due to the larger extent of coastal dunes there.

**Life forms & Plant functional types**

Herbs are the dominant life form in the study area (106 species), followed by trees (70 species), shrubs (45 species), Climbers (32 species), and Creepers (15 species). Figure 2, Tables 2 and 3). According to and stems to conserve water, as noted by Ehleringer *et al.* (1997). Additionally, there are 6 legumes, which are root nodule-producing plants that can tolerate unfavourable conditions due to their improved root systems (Dutta *et al.*, 2022). Furthermore, 4 geophytes store nutrients in underground structures like bulbs, corms, tubers, and rhizomes (Tribble *et al.*, 2021), and 1 carnivorous plant (*Drosera burmanni* Vahl) can

the plant functional types, Phanerophytes dominate the study area (156 species), Therophytes (51 species), Graminoids (22 species), Legumes (15 species), Succulents (12 species), Geophytes (6 species), Parasites (3 species), Cryptophytes (2 species), and Carnivores (1 species). (Table 1,2,3).

Herbs dominate the study area primarily because most are perennial. The area features 34 phanerophytes with woody stems, 15 graminoids (monocots that fold their leaves to reduce evaporation), and 7 succulents (such as *Euphorbia* and *Portulaca species*), which have modified leaves thrive in nutrient-poor ecosystems by supplementing their nutrients through insect capture and digestion (Hochuli, 1996). These adaptations enable plants to survive and tolerate drought and unfavourable conditions in nutrient-poor ecosystems. Moreover, 39 therophytes (annual plants) can grow during favourable seasons and complete their life cycles from germination to seed production.



**Figure 2: Life forms of plants recorded from the study area**

**Table 1: Plant functional types, species, genus, and family**

Si NO	Plant functional types	Species	Genus	Family
1	Carnivores	1	1	1
2	Geophytes	6	6	6
3	Graminoids	22	19	6
4	Legumes	15	15	1
5	Parasites	3	3	3
6	Phanerophytes	158	134	49
7	Succulents	12	8	7
8	Therophytes	51	44	26



Figure 3. Selected plants of sand dune and coastal areas from Viluppuram District. (Photo credit: Kathavarayan Manikandan)



Figure 4. Selected plants from the study area. (Photo credit: Sugaseelan Akash)

Trees are the second-dominant life form in the study area, with sixty-six woody species (phanerophytes) and four monocot trees (graminoids): *Borassus flabellifer* L., *Cocos nucifera* L., *Phoenix pusilla* Gaertn., and *Phoenix sylvestris* (L.) Roxb. Deep root systems of the woody species help them tolerate and escape unfavourable conditions. (Pierret et al., 2016).

### Endemic species

The study area is a haven for unique biodiversity, hosting six endemic species that are found nowhere else in the world: *Mussaenda tomentosa* Wall. ex G.Don, which is exclusive to Tamil Nadu; *Chloris wightiana* Nees ex Steud., a species endemic to the Gulf of Mannar; and four other notable species, including *Lepidagathis pungens* Nees, *Commiphora berryi* (Arn.) Engl., *Euphorbia glaucescens* Willd. and *Hardwickia binata* Roxb., the latter being endemic to the broader region of Peninsular India. Previous research conducted by Narayanasamy and Natesan (2020) documented the presence of several endemic species, including *Mussaenda tomentosa* Wall. Ex G.Don, *Lepidagathis pungens* Nees, *Hardwickia binata* Roxb., and *Euphorbia glaucescens* Willd., along the Coromandel Coast.

### IUCN status

A comprehensive survey of the study area yielded a total of 268 species, which were subsequently assessed for their conservation status, revealing a

diverse range of categories: two species, namely *Cayratia pedata* (Lam.) Juss. Ex Gagnep. and *Conocarpus lancifolius* Engl., were classified as Vulnerable, indicating a high risk of endangerment; one species, *Aegle marmelos* (L.) Corrêa was categorised as Near Threatened, suggesting a potential risk of decline; 116 species were deemed to be of Least Concern, indicating a relatively stable population; five species were classified as Data Deficient, highlighting the need for further research; and the remaining 144 species had not been evaluated, underscoring the importance of continued conservation assessments.



**Figure 5. Field documentation of sand dune vegetation carried out by the first author, Sugaseelan Akash.**

**Table 2: Correlation between life form and plant functional type.**

Plant functional types	Herbs	Shrubs	Trees	Creepers	Climbers	Total
Carnivores	1	-	-	-	-	1
Geophytes	4	-	-	-	2	6
Graminoids	15	2	4	-	1	22
Legumes	6	2	-	3	4	15
Parasites	-	1	-	-	2	3
Phanerophytes	34	28	66	8	22	158
Succulents	7	5	-	-	-	12
Therophytes	39	7	-	4	1	51
<b>Total</b>	<b>106</b>	<b>45</b>	<b>70</b>	<b>15</b>	<b>32</b>	<b>268</b>

**Table 3: Binomial name, Family, Life forms, Plant functional types, and IUCN status of the study area.**

Si no	Binomial name	Family	Life forms	Plant functional types	IUCN
1	<i>Abrus precatorius</i> L.	Fabaceae	Climber	Legumes	Not evaluated
2	<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	Shrub	Phanerophytes	Not evaluated
3	<i>Acacia auriculiformis</i> A.Cunn. Ex Benth.	Fabaceae	Tree	Phanerophytes	Least concern
4	<i>Acalypha indica</i> L.	Euphorbiaceae	Herb	Phanerophytes	Not evaluated
5	<i>Achyranthes aspera</i> L.	Amaranthaceae	Herb	Phanerophytes	Not evaluated
6	<i>Adenium obesum</i> (Forssk.) Roem. & Schult.	Apocynaceae	Shrub	Succulents	Least concern
7	<i>Aegle marmelos</i> (L.) Corrêa	Rutaceae	Tree	Phanerophytes	Near threatened
8	<i>Aeluropus lagopoides</i> (L.) Thwaites	Poaceae	Herb	Graminoids	Least concern
9	<i>Aeschynomene indica</i> L.	Fabaceae	Herb	Legumes	Least concern
10	<i>Agave americana</i> L.	Asparagaceae	Shrub	Graminoid	Least concern
11	<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	Tree	Phanerophytes	Data deficient
12	<i>Alangium salviifolium</i> (L.f.) Wangerin	Cornaceae	Tree	Phanerophytes	Least concern
13	<i>Albizia amara</i> (Roxb.) Boivin	Fabaceae	Tree	Phanerophytes	Least concern
14	<i>Allmania nodiflora</i> (L.) R.Br. ex-Wight	Amaranthaceae	Herb	Therophytes	Not evaluated
15	<i>Alternanthera paronychioides</i> A.St.-Hil.	Amaranthaceae	Herb	Therophytes	Not evaluated
16	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Amaranthaceae	Herb	Phanerophytes	Not evaluated
17	<i>Alysicarpus vaginalis</i> (L.) DC.	Fabaceae	Herb	Legumes	Not evaluated
18	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Shrub	Therophytes	Not evaluated
19	<i>Amaranthus viridis</i> L.	Amaranthaceae	Shrub	Therophytes	Not evaluated
20	<i>Ammannia baccifera</i> L.	Lythraceae	Herb	Therophytes	Least concern
21	<i>Anacardium occidentale</i> L.	Anacardiaceae	Tree	Phanerophytes	Least concern
22	<i>Andrographis echioides</i> (L.) Nees	Acanthaceae	Herb	Therophytes	Not evaluated
23	<i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees	Acanthaceae	Herb	Phanerophytes	Not evaluated
24	<i>Annona reticulata</i> L.	Annonaceae	Tree	Phanerophytes	Least concern
25	<i>Annona squamosa</i> L.	Annonaceae	Tree	Phanerophytes	Least concern
26	<i>Aphyllodium biarticulatum</i> (L.) Gagnep.	Fabaceae	Shrub	Legumes	Not evaluated
27	<i>Argemone mexicana</i> L.	Papaveraceae	Herb	Therophytes	Not evaluated
28	<i>Aristida setacea</i> Retz.	Poaceae	Herb	Graminoids	Not evaluated

Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

29	<i>Asparagus racemosus</i> Willd.	Asparagaceae	Herb	Geophytes	Not evaluated
30	<i>Asystasia gangetica</i> (L.) T.Anderson	Acanthaceae	Creeper	Phanerophytes	Not evaluated
31	<i>Avicennia marina</i> (Forssk.) Vierh.	Acanthaceae	Tree	Phanerophytes	Least concern
32	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Tree	Phanerophytes	Least concern
33	<i>Azima tetracantha</i> Lam.	Salvadoraceae	Shrub	Phanerophytes	Least concern
34	<i>Bacopa floribunda</i> (R.Br.) Wettst.	Plantaginaceae	Herb	Therophytes	Least concern
35	<i>Bacopa monnieri</i> (L.) Wettst.	Plantaginaceae	Herb	Phanerophytes	Least concern
36	<i>Barleria prionitis</i> L.	Acanthaceae	Shrub	Phanerophytes	Least concern
37	<i>Bauhinia racemosa</i> Lam.	Fabaceae	Tree	Phanerophytes	Least concern
38	<i>Bergera koenigii</i> L.	Rutaceae	Shrub	Phanerophytes	Least concern
39	<i>Blastania garcinii</i> (Burm.f.) Cogn.	Cucurbitaceae	Climber	Phanerophytes	Not evaluated
40	<i>Blumea lacera</i> (Burm.f.) DC.	Asteraceae	Herb	Therophytes	Not evaluated
41	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Herb	Therophytes	Not evaluated
42	<i>Boerhavia erecta</i> L.	Nyctaginaceae	Herb	Therophytes	Not evaluated
43	<i>Bonnaya antipoda</i> (L.) Druce	Linderniaceae	Herb	Phanerophytes	Least concern
44	<i>Bonnaya ciliata</i> (Colsm.) Spreng.	Linderniaceae	Herb	Therophytes	Least concern
45	<i>Borassus flabellifer</i> L.	Arecaceae	Tree	Graminoids	Least concern
46	<i>Bulbostylis barbata</i> (Rottb.) C.B.Clarke	Cyperaceae	Herb	Graminoids	Least concern
47	<i>Butea monosperma</i> (Lam.) Kuntze	Fabaceae	Tree	Phanerophytes	Least concern
48	<i>Cadaba fruticosa</i> (L.) Druce	Capparaceae	Shrub	Phanerophytes	Not evaluated
49	<i>Cajanus scarabaeoides</i> (L.) Thouars	Fabaceae	Climber	Legumes	Least concern
50	<i>Calamus rotang</i> L.	Arecaceae	Climber	Graminoids	Not evaluated
51	<i>Calophyllum inophyllum</i> L.	Calophyllaceae	Tree	Phanerophytes	Least concern
52	<i>Calotropis gigantea</i> (L.) W.T.Aiton	Apocynaceae	Shrub	Phanerophytes	Not evaluated
53	<i>Canavalia rosea</i> (Sw.) DC.	Fabaceae	Creeper	Legumes	Least concern
54	<i>Canthium coromandelicum</i> (Burm.f.) Alston	Rubiaceae	Shrub	Phanerophytes	Not evaluated
55	<i>Capparis sepiaria</i> L.	Capparaceae	Shrub	Phanerophytes	Least concern
56	<i>Capparis zeylanica</i> L.	Capparaceae	Climber	Phanerophytes	Not evaluated
57	<i>Cardiospermum halicacabum</i> L.	Sapindaceae	Climber	Phanerophytes	Least concern
58	<i>Carica papaya</i> L.	Caricaceae	Tree	Phanerophytes	Data deficient
59	<i>Carissa spinarum</i> L.	Apocynaceae	Shrub	Phanerophytes	Data Deficient
60	<i>Cassytha filiformis</i> L.	Lauraceae	Climber	Hemiparasites	Not evaluated
61	<i>Casuarina equisetifolia</i> L.	Casuarinaceae	Tree	Phanerophytes	Least concern
62	<i>Catharanthus roseus</i> var. <i>angustus</i> (Steenis)	Apocynaceae	Herb	Phanerophytes	Not evaluated

Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

	<i>Bakh.</i>				
63	<i>Cayratia pedata</i> (Lam.) Juss. Ex Gagnep.	Vitaceae	Climber	Phanerophytes	Vulnerable
64	<i>Ceiba pentandra</i> (L.) Gaertn.	Malvaceae	Tree	Phanerophytes	Least concern
65	<i>Celosia argentea</i> L.	Amaranthaceae	Herb	Phanerophytes	Least concern
66	<i>Cereus pterogonus</i> Lem.	Cactaceae	Shrub	Succulents	Not evaluated
67	<i>Chloris barbata</i> Sw.	Poaceae	Herb	Graminoids	Not evaluated
68	<i>Chloris wightiana</i> Nees ex Steud.	Poaceae	Herb	Graminoids	Not evaluated
69	<i>Citrullus colocynthis</i> (L.) Schrad.	Cucurbitaceae	Creeping	Phanerophytes	Not evaluated
70	<i>Cleome ruidosperma</i> DC.	Cleomaceae	Herb	Therophytes	Not evaluated
71	<i>Cleome viscosa</i> L.	Cleomaceae	Herb	Therophytes	Not evaluated
72	<i>Clitoria ternatea</i> L.	Fabaceae	Climber	Legumes	Not evaluated
73	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Climber	Geophytes	Not evaluated
74	<i>Coccoloba uvifera</i> (L.) L.	Polygonaceae	Tree	Phanerophytes	Least concern
75	<i>Cocculus hirsutus</i> (L.) W.Theob.	Menispermaceae	Climber	Phanerophytes	Not evaluated
76	<i>Cocos nucifera</i> L.	Arecaceae	Tree	Graminoids	Not evaluated
77	<i>Colubrina asiatica</i> (L.) Brongn.	Rhamnaceae	Tree	Phanerophytes	Least concern
78	<i>Combretum albidum</i> G.Don	Combretaceae	Climber	Phanerophytes	Not evaluated
79	<i>Commelina benghalensis</i> L.	Commelinaceae	Herb	Graminoids	Least concern
80	<i>Commiphora berryi</i> (Arn.) Engl.	Burseraceae	Shrub	Phanerophytes	Least concern
81	<i>Conocarpus lancifolius</i> Engl.	Combretaceae	Tree	Phanerophytes	Vulnerable
82	<i>Corchorus aestuans</i> var. <i>aestuans</i>	Malvaceae	Herb	Therophytes	Not evaluated
83	<i>Corchorus tridens</i> L.	Malvaceae	Herb	Therophytes	Not evaluated
84	<i>Corchorus trilocularis</i> L.	Malvaceae	Herb	Therophytes	Not evaluated
85	<i>Cressa cretica</i> L.	Convolvulaceae	Herb	Phanerophytes	Least concern
86	<i>Crinum asiaticum</i> L.	Amaryllidaceae	Herb	Geophytes	Not evaluated
87	<i>Croton bonplandianus</i> Baill.	Euphorbiaceae	Herb	Phanerophytes	Not evaluated
88	<i>Croton hirtus</i> L'Hér.	Euphorbiaceae	Herb	Phanerophytes	Not evaluated
89	<i>Cucumis maderaspatanus</i> L.	Cucurbitaceae	Climber	Therophytes	Not evaluated
90	<i>Cuscuta campestris</i> Yunck.	Convolvulaceae	Climber	Hemiparasites	Not evaluated
91	<i>Cyanthillium cinereum</i> (L.) H.Rob.	Asteraceae	Herb	Therophytes	Not evaluated
92	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Herb	Graminoids	Not evaluated
93	<i>Cyperus rotundus</i> L.	Cyperaceae	Herb	Graminoids	Least concern
94	<i>Dactyloctenium aegyptium</i> (L.) Wild.	Poaceae	Herb	Graminoids	Not evaluated
95	<i>Dalbergia sissoo</i> Roxb. ex DC.	Fabaceae	Tree	Phanerophytes	Least concern

Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

96	<i>Datura metel</i> L.	Solanaceae	Shrub	Phanerophytes	Not evaluated
97	<i>Delonix elata</i> (L.) Gamble	Fabaceae	Tree	Phanerophytes	Least concern
98	<i>Dendrophthoe falcata</i> (L.f.) Ettingsh.	Loranthaceae	Shrub	Hemiparasites	Not evaluated
99	<i>Diospyros ferrea</i> (Willd.) Bakh.	Ebenaceae	Tree	Phanerophytes	Least concern
100	<i>Drosera burmanni</i> Vahl	Droseraceae	Herb	Carnivores	Least concern
101	<i>Eclipta prostrata</i> (L.) L.	Asteraceae	Herb	Therophytes	Least concern
102	<i>Emilia sonchifolia</i> (L.) DC.	Asteraceae	Herb	Therophytes	Not evaluated
103	<i>Enicostema axillare</i> (Poir. ex Lam.) A.Raynal	Gentianaceae	Herb	Phanerophytes	Least concern
104	<i>Epaltes divaricata</i> (L.) Cass.	Asteraceae	Herb	Phanerophytes	Least concern
105	<i>Erythrina variegata</i> L.	Fabaceae	Tree	Phanerophytes	Least concern
106	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Tree	Phanerophytes	Least concern
107	<i>Euphorbia glaucescens</i> Willd.	Euphorbiaceae	Herb	Succulents	Not evaluated
108	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Herb	Phanerophytes	Not evaluated
109	<i>Euphorbia thymifolia</i> L.	Euphorbiaceae	Herb	Succulents	Not evaluated
110	<i>Euphorbia tirucalli</i> L.	Euphorbiaceae	Shrub	Succulents	Least concern
111	<i>Evolvulus alsinoides</i> (L.) L.	Convolvulaceae	Herb	Therophytes	Not evaluated
112	<i>Ficus benghalensis</i> L.	Moraceae	Tree	Phanerophytes	Not evaluated
113	<i>Ficus hispida</i> L.f.	Moraceae	Tree	Phanerophytes	Least concern
114	<i>Ficus racemosa</i> L.	Moraceae	Tree	Phanerophytes	Least concern
115	<i>Ficus religiosa</i> L.	Moraceae	Tree	Phanerophytes	Least concern
116	<i>Flacourtia indica</i> (Burm.f.) Merr.	Salicaceae	Shrub	Phanerophytes	Least concern
117	<i>Flueggea leucopyrus</i> Willd.	Phyllanthaceae	Shrub	Phanerophytes	Least concern
118	<i>Gisekia pharnaceoides</i> L.	Gisekiaceae	Herb	Therophytes	Not evaluated
119	<i>Gloriosa superba</i> L.	Colchicaceae	Climber	Geophytes	Least concern
120	<i>Gomphrena celosioides</i> Mart.	Amaranthaceae	Herb	Phanerophytes	Not evaluated
121	<i>Guettarda speciosa</i> L.	Rubiaceae	Tree	Phanerophytes	Least concern
122	<i>Guilandina bonduc</i> L.	Fabaceae	Climber	Phanerophytes	Least concern
123	<i>Halopyrum mucronatum</i> (L.) Stapf	Poaceae	Herb	Graminoids	Not evaluated
124	<i>Hardwickia binata</i> Roxb.	Fabaceae	Tree	Phanerophytes	Least concern
125	<i>Heliotropium indicum</i> L.	Boraginaceae	Herb	Therophytes	Not evaluated
126	<i>Hemidesmus indicus</i> (L.) R.Br.	Apocynaceae	Climber	Phanerophytes	Not evaluated
127	<i>Hibiscus surattensis</i> L.	Malvaceae	Climber	Phanerophytes	Not evaluated
128	<i>Hibiscus tiliaceus</i> L.	Malvaceae	Tree	Phanerophytes	Least concern

Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

129	<i>Hibiscus vitifolius</i> L.	Malvaceae	Shrub	Phanerophytes	Not evaluated
130	<i>Hydrophylax maritima</i> L.f.	Rubiaceae	Herb	Phanerophytes	Not evaluated
131	<i>Indigofera tsiangiana</i> Metcalf	Fabaceae	Herb	Phanerophytes	Not evaluated
132	<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	Creeper	Phanerophytes	Least concern
133	<i>Ipomoea carnea</i> subsp. <i>carnea</i>	Convolvulaceae	Shrub	Phanerophytes	Not evaluated
134	<i>Ipomoea obscura</i> (L.) Ker Gawl.	Convolvulaceae	Climber	Phanerophytes	Not evaluated
135	<i>Ipomoea pes-caprae</i> (L.) R.Br.	Convolvulaceae	Creeper	Phanerophytes	Least concern
136	<i>Ipomoea pes-tigridis</i> L.	Convolvulaceae	Creeper	Therophytes	Not evaluated
137	<i>Ipomoea sagittifolia</i> Burm.f.	Convolvulaceae	Creeper	Phanerophytes	Not evaluated
138	<i>Ipomoea violacea</i> L.	Convolvulaceae	Creeper	Phanerophytes	Not evaluated
139	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Shrub	Phanerophytes	Least concern
140	<i>Kohautia attenuata</i> (Willd.) I.M.Turner	Rubiaceae	Herb	Therophytes	Not evaluated
141	<i>Lansea coromandelica</i> (Houtt.) Merr.	Anacardiaceae	Tree	Phanerophytes	Least concern
142	<i>Lantana camara</i> L.	Verbenaceae	Shrub	Phanerophytes	Not evaluated
143	<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal	Asteraceae	Creeper	Therophytes	Not evaluated
144	<i>Launaea sarmentosa</i> (Willd.) Kuntze	Asteraceae	Herb	Phanerophytes	Not evaluated
145	<i>Leonotis nepetifolia</i> (L.) R.Br.	Lamiaceae	Shrub	Therophytes	Not evaluated
146	<i>Lepidagathis cristata</i> Willd.	Acanthaceae	Herb	Phanerophytes	Not evaluated
147	<i>Lepidagathis pungens</i> Nees	Acanthaceae	Herb	Phanerophytes	Not evaluated
148	<i>Leucaena leucocephala</i> (Lam.) de Wit	Fabaceae	Tree	Phanerophytes	Not evaluated
149	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	Herb	Therophytes	Not evaluated
150	<i>Limnophila repens</i> (Benth.) Benth.	Plantaginaceae	Herb	Phanerophytes	Least concern
151	<i>Ludwigia adscendens</i> subsp. <i>diffusa</i> (Forssk.)	Onagraceae	Creeper	Phanerophytes	Least concern
152	<i>Ludwigia octovalvis</i> (Jacq.) P.H.Raven	Onagraceae	Shrub	Phanerophytes	Least concern
153	<i>Madhuca longifolia</i> (L.) J.F.Macbr.	Sapotaceae	Tree	Phanerophytes	Least concern
154	<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	Shrub	Therophytes	Not evaluated
155	<i>Manilkara hexandra</i> (Roxb.) Dubard	Sapotaceae	Tree	Phanerophytes	Least concern
156	<i>Melia azedarach</i> L.	Meliaceae	Tree	Phanerophytes	Least concern
157	<i>Melochia corchorifolia</i> L.	Malvaceae	Herb	Therophytes	Least concern
158	<i>Memecylon umbellatum</i> Burm.f.	Melastomataceae	Tree	Phanerophytes	Least concern
159	<i>Merremia emarginata</i> (Burm.f.) Hallier f.	Convolvulaceae	Creeper	Phanerophytes	Not evaluated
160	<i>Mesosphaerum suaveolens</i> (L.) Kuntze	Lamiaceae	Herb	Therophytes	Not evaluated

Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

161	<i>Micrococca mercurialis</i> (L.) Benth.	Euphorbiaceae	Herb	Phanerophytes	Not evaluated
162	<i>Miliusa indica</i> Lesch. Ex A.DC.	Annonaceae	Tree	Phanerophytes	Least concern
163	<i>Millingtonia hortensis</i> L.f.	Bignoniaceae	Tree	Phanerophytes	Least concern
164	<i>Mimosa pudica</i> L.	Fabaceae	Herb	Legumes	Least concern
165	<i>Mimusops elengi</i> L.	Sapotaceae	Tree	Phanerophytes	Least concern
166	<i>Mollugo disticha</i> (L.) Ser.	Molluginaceae	Herb	Therophytes	Not evaluated
167	<i>Morinda citrifolia</i> L.	Rubiaceae	Tree	Phanerophytes	Least concern
168	<i>Morinda coreia</i> Buch.-Ham.	Rubiaceae	Tree	Phanerophytes	Least concern
169	<i>Muntingia calabura</i> L.	Muntingiaceae	Tree	Phanerophytes	Least concern
170	<i>Mussaenda tomentosa</i> Wall. ex G.Don	Rubiaceae	Shrub	Phanerophytes	Not evaluated
171	<i>Naregamia alata</i> Wight & Arn.	Meliaceae	Herb	Phanerophytes	Not evaluated
172	<i>Neltuma juliflora</i> (Sw.) Raf.	Fabaceae	Tree	Phanerophytes	Least concern
173	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Herb	Phanerophytes	Not evaluated
174	<i>Opuntia monacanthos</i> (Willd.) Haw.	Cactaceae	Shrub	Succulents	Not evaluated
175	<i>Ouret lanata</i> (L.) Kuntze	Amaranthaceae	Herb	Phanerophytes	Not evaluated
176	<i>Oxystelma esculentum</i> (L.f.) Sm.	Apocynaceae	Climber	Phanerophytes	Least concern
177	<i>Pandanus tectorius</i> Parkinson	Pandanaceae	Shrub	Graminoids	Least concern
178	<i>Passiflora foetida</i> L.	Passifloraceae	Climber	Phanerophytes	Not evaluated
179	<i>Pavonia zeylonica</i> (L.) Cav.	Malvaceae	Herb	Phanerophytes	Not evaluated
180	<i>Pedaliium murex</i> L.	Pedaliaceae	Herb	Therophytes	Not evaluated
181	<i>Peltophorum pterocarpum</i> (DC.) Backer ex K.Heyne	Fabaceae	Tree	Phanerophytes	Least concern
182	<i>Pentatropis capensis</i> (L.f.) Bullock	Apocynaceae	Climber	Phanerophytes	Not evaluated
183	<i>Pergularia daemia</i> (Forssk.) Chiov.	Apocynaceae	Climber	Phanerophytes	Least concern
184	<i>Phoenix pusilla</i> Gaertn.	Arecaceae	Tree	Graminoids	Not evaluated
185	<i>Phoenix sylvestris</i> (L.) Roxb.	Arecaceae	Tree	Graminoids	Not evaluated
186	<i>Phyllanthus acidus</i> (L.) Skeels	Phyllanthaceae	Tree	Phanerophytes	Not evaluated
187	<i>Phyllanthus niruri</i> L.	Phyllanthaceae	Herb	Therophytes	Not evaluated
188	<i>Phyllanthus reticulatus</i> Poir.	Phyllanthaceae	Shrub	Phanerophytes	Least concern
189	<i>Phyllanthus rotundifolius</i> J.G.Klein ex Willd.	Phyllanthaceae	Herb	Therophytes	Not evaluated
190	<i>Physalis angulata</i> L.	Solanaceae	Herb	Therophytes	Least concern
191	<i>Pigea enneasperma</i> (L.) P.I.Forst.	Violaceae	Herb	Therophytes	Not evaluated
192	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Fabaceae	Tree	Phanerophytes	Least concern
193	<i>Platostoma menthoides</i> (L.) A.J.Paton	Lamiaceae	Herb	Therophytes	Not evaluated

Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

194	<i>Polygala chinensis</i> L.	Polygalaceae	Herb	Therophytes	Not evaluated
195	<i>Polygala javana</i> DC.	Polygalaceae	Herb	Phanerophytes	Not evaluated
196	<i>Portulaca oleracea</i> L.	Portulacaceae	Herb	Succulents	Least concern
197	<i>Portulaca pilosa</i> L.	Portulacaceae	Herb	Succulents	Not evaluated
198	<i>Portulaca quadrifida</i> L.	Portulacaceae	Herb	Succulents	Not evaluated
199	<i>Portulaca tuberosa</i> Roxb.	Portulacaceae	Herb	Geophytes	Not evaluated
200	<i>Pouzolzia zeylanica</i> (L.) Benn.	Urticaceae	Herb	Therophytes	Not evaluated
201	<i>Premna tomentosa</i> Willd.	Lamiaceae	Tree	Phanerophytes	Least concern
202	<i>Pterolobium hexapetalum</i> (Roth) Santapau & Wagh	Fabaceae	Climber	Legumes	Not evaluated
203	<i>Pterospermum suberifolium</i> (L.) Raeusch.	Malvaceae	Tree	Phanerophytes	Least concern
204	<i>Rhinacanthus nasutus</i> (L.) Kurz	Acanthaceae	Shrub	Therophytes	Not evaluated
205	<i>Rhizophora apiculata</i> Blume	Rhizophoraceae	Tree	Phanerophytes	Least concern
206	<i>Rhynchosia aurea</i> (Willd.) DC.	Fabaceae	Climber	Legumes	Not evaluated
207	<i>Richardia tricocca</i> (Torr. & A.Gray) Standl.	Rubiaceae	Herb	Phanerophytes	Not evaluated
208	<i>Ricinus communis</i> L.	Euphorbiaceae	Shrub	Phanerophytes	Not evaluated
209	<i>Rivea hypocrateriformis</i> (Desr.) Choisy	Convolvulaceae	Climber	Phanerophytes	Least concern
210	<i>Ruellia patula</i> Jacq.	Acanthaceae	Shrub	Phanerophytes	Not evaluated
211	<i>Ruellia tuberosa</i> L.	Acanthaceae	Herb	Geophytes	Not evaluated
212	<i>Salicornia brachiata</i> Roxb.	Amaranthaceae	Herb	Succulents	Not evaluated
213	<i>Salvadora persica</i> L.	Salvadoraceae	Tree	Phanerophytes	Least concern
214	<i>Samanea saman</i> (Jacq.) Merr.	Fabaceae	Tree	Phanerophytes	Least concern
215	<i>Sapindus emarginatus</i> Vahl	Sapindaceae	Tree	Phanerophytes	Not evaluated
216	<i>Scaevola taccada</i> (Gaertn.) Roxb.	Goodeniaceae	Tree	Phanerophytes	Not evaluated
217	<i>Scoparia dulcis</i> L.	Plantaginaceae	Herb	Phanerophytes	Not evaluated
218	<i>Senegalia senegal</i> (L.) Britton	Fabaceae	Tree	Phanerophytes	Least concern
219	<i>Senna auriculata</i> (L.) Roxb.	Fabaceae	Shrub	Legumes	Least concern
220	<i>Senna occidentalis</i> (L.) Link	Fabaceae	Shrub	Phanerophytes	Least concern
221	<i>Senna siamea</i> (Lam.) H.S.Irwin & Barneby	Fabaceae	Tree	Phanerophytes	Least concern
222	<i>Sesamum prostratum</i> Retz.	Pedaliaceae	Creeper	Therophytes	Not evaluated
223	<i>Sesuvium portulacastrum</i> (L.) L.	Aizoaceae	Herb	Succulents	Least concern
224	<i>Solanum nigrum</i> L.	Solanaceae	Shrub	Therophytes	Not evaluated
225	<i>Solanum torvum</i> Sw.	Solanaceae	Shrub	Phanerophytes	Not evaluated
226	<i>Solanum trilobatum</i> L.	Solanaceae	Climber	Phanerophytes	Not evaluated

Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

227	<i>Solanum viarum</i> Dunal	Solanaceae	Herb	Phanerophytes	Least concern
228	<i>Solanum virginianum</i> L.	Solanaceae	Herb	Therophytes	Not evaluated
229	<i>Spermacoce hispida</i> L.	Rubiaceae	Herb	Phanerophytes	Not evaluated
230	<i>Sphaeranthus indicus</i> L.	Asteraceae	Herb	Therophytes	Least concern
231	<i>Spinifex littoreus</i> (Burm.f.) Merr.	Poaceae	Herb	Graminoids	Not evaluated
232	<i>Sporobolus spicatus</i> (Vahl) Kunth	Poaceae	Herb	Graminoids	Not evaluated
233	<i>Sporobolus virginicus</i> (L.) Kunth	Poaceae	Herb	Graminoids	Least concern
234	<i>Stephanotis volubilis</i> (L.f.) S.Reuss, Liede & Meve	Apocynaceae	Climber	Phanerophytes	Not evaluated
235	<i>Streblus asper</i> Lour.	Moraceae	Tree	Phanerophytes	Least concern
236	<i>Strychnos nux-vomica</i> L.	Loganiaceae	Tree	Phanerophytes	Least concern
237	<i>Stylosanthes fruticosa</i> (Retz.) Alston	Fabaceae	Herb	Legumes	Not evaluated
238	<i>Suriana maritima</i> L.	Surianaceae	Shrub	Succulents	Least concern
239	<i>Synostemon bacciformis</i> (L.) G.L.Webster	Phyllanthaceae	Herb	Phanerophytes	Not evaluated
240	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Tree	Phanerophytes	Least concern
241	<i>Tabebuia heterophylla</i> (DC.) Britton	Bignoniaceae	Tree	Phanerophytes	Least concern
242	<i>Tamarindus indica</i> L.	Fabaceae	Tree	Phanerophytes	Least concern
243	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	Herb	Legumes	Not evaluated
244	<i>Tephrosia villosa</i> (L.) Pers.	Fabaceae	Herb	Legumes	Least concern
245	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Combretaceae	Tree	Phanerophytes	Least concern
246	<i>Terminalia catappa</i> L.	Combretaceae	Tree	Phanerophytes	Least concern
247	<i>Tiliacora acuminata</i> (Lam.) Miers	Menispermaceae	Climber	Phanerophytes	Not evaluated
248	<i>Tinospora cordifolia</i> (Willd.) Hook.f. & Thomson	Menispermaceae	Climber	Phanerophytes	Not evaluated
249	<i>Torenia crustacea</i> (L.) Cham. & Schldl.	Linderniaceae	Herb	Phanerophytes	Not evaluated
250	<i>Trachys muricata</i> (L.) Pers. ex Trin.	Poaceae	Herb	Graminoids	Not evaluated
251	<i>Trachyspermum ammi</i> (L.) Sprague	Apiaceae	Herb	Therophytes	Not evaluated
252	<i>Trianthema portulacastrum</i> L.	Aizoaceae	Herb	Therophytes	Not evaluated
253	<i>Tribulus terrestris</i> L.	Zygophyllaceae	Shrub	Therophytes	Least concern
254	<i>Trichodesma indicum</i> (L.) Sm.	Boraginaceae	Herb	Therophytes	Not evaluated
255	<i>Tridax procumbens</i> L.	Asteraceae	Creeper	Therophytes	Not evaluated
256	<i>Triumfetta rhomboidea</i> Jacq.	Malvaceae	Shrub	Phanerophytes	Not evaluated
257	<i>Urena lobata</i> L.	Malvaceae	Shrub	Phanerophytes	Least concern

Floristic Diversity of Angiosperms in Sand Dunes and Coastal Areas of Viluppuram District, Tamil Nadu, India

258	<i>Urochloa mutica</i> (Forssk.) T.Q.Nguyen	Poaceae	Herb	Graminoids	Least concern
259	<i>Vigna aconitifolia</i> (Jacq.) Maréchal	Fabaceae	Creeper	Legumes	Data deficient
260	<i>Vigna radiata</i> (L.) R.Wilczek	Fabaceae	Creeper	Legumes	Least concern
261	<i>Vincetoxicum indicum</i> (Burm.f.) Mabb.	Apocynaceae	Climber	Phanerophytes	Not evaluated
262	<i>Vitex agnus-castus</i> L.	Lamiaceae	Tree	Phanerophytes	Data deficient
263	<i>Volkameria inermis</i> L.	Lamiaceae	Shrub	Phanerophytes	Not evaluated
264	<i>Walsura trifoliolata</i> (A.Juss.) Harms	Meliaceae	Tree	Phanerophytes	Not evaluated
265	<i>Waltheria indica</i> L.	Malvaceae	Herb	Phanerophytes	Least concern
266	<i>Wrightia tinctoria</i> (Roxb.) R.Br.	Apocynaceae	Tree	Phanerophytes	Least concern
267	<i>Zanthoxylum asiaticum</i> (L.) Appelhans, Grosso & J.Wen	Rutaceae	Shrub	Phanerophytes	Not evaluated
268	<i>Ziziphus oenopolia</i> (L.) Mill.	Rhamnaceae	Climber	Phanerophytes	Least concern



Figure 6. Field documentation of dune slack vegetation carried out by Kathavarayan Manikandan.

## Conclusion

The study recorded 268 species belonging to 219 genera and 75 families. Additionally, the study area is home to six endemic species. According to the IUCN Red List, two species are classified as Vulnerable, one as Near Threatened, 116 as Least Concern, five as Data Deficient, and the remaining 144 species as Not Evaluated. The study area boasts rich biodiversity and serves as a habitat for diverse flora and fauna, with undisturbed dunes. However, anthropogenic activities such as illegal poaching of fuelwood for charcoal production, dumping, and burning of solid waste pose a threat to this vulnerable ecosystem.

## References

- Akash, S., Venkadeshraja, V., & Udayakumar, M.** (2025). Flowering plant wealth of sand dunes and coastal areas of Kanniyakumari District, Tamil Nadu, India. *Environment Conservation Journal*, 26(2), 328–339.
- Akash, S., Venkadeshraja, V., & Udayakumar, M.** (2026). Floristic diversity and ecological structure of coastal sand dunes of Tirunelveli District, Tamil Nadu, India. *Journal of Biology and Nature*, 18(1), 191–203.
- Anbarashan, M., Balachandran, N., Mathevet, R., Barathan, N., & Uma Maheswari, P.** (2024). An evaluation of coastal dune flora of Cuddalore District, Tamil Nadu, India: Perspectives for conservation and management. *Geology, Ecology, and Landscapes*, 8(2), 208–221.
- Arulmoorthy, M. P., & Srinivasan, M.** (2017). Coastal sand dune floral diversity in Cuddalore coastal areas, southeast coast of India. *International Journal of Current Research and Academic Review*, 7(3), 60–64.
- Borges, P. A. V., Gabriel, R., & Fattorini, S.** (2020). Biodiversity erosion: Causes and consequences. In W. Leal Filho, A. Azul, L. Brandli, A. Lange Salvia, & T. Wall (Eds.), *Life on land* (pp. 81–90). Springer. <https://doi.org/10.1007/978-3-319-95981-8>
- Daniel, P., & Umamaheswari, P.** (2001). *The flora of the Gulf of Mannar: Southern India*. Botanical Survey of India, Ministry of Environment and Forests.
- Dutta, A., Trivedi, A., Nath, C. P., Sen, D., & Krishna, K.** (2022). A comprehensive review on grain legumes as climate-smart crops: Challenges and prospects. *Environmental Challenges*, 7, 100479. <https://doi.org/10.1016/j.envc.2022.100479>
- Ehleringer, J. R., Cerling, T. E., & Helliker, B. R.** (1997). C4 photosynthesis, atmospheric CO<sub>2</sub>, and climate. *Oecologia*, 112(3), 285–299. <https://doi.org/10.1007/s004420050311>
- Feagin, R. A., Figlus, J., Zinnert, J. C., Sigren, J., Martínez, M. L., Silva, R., & Carter, G.** (2015). Going with the flow or against the grain? The promise of vegetation for protecting beaches, dunes, and barrier islands from erosion. *Frontiers in Ecology and the Environment*, 13(4), 203–210. <https://doi.org/10.1890/140218>
- Hashem, H. A., & Mohamed, A. H.** (2020). Strategies for drought tolerance in xerophytes. In M. Hasanuzzaman (Ed.), *Plant ecophysiology and adaptation under climate change: Mechanisms and perspectives I: General consequences and plant responses* (pp. 269–293). Springer. <https://doi.org/10.1007/978-981-15-2156-0>
- Hochuli, D. F.** (1996). The ecology of plant/insect interactions: Implications of digestive strategy for feeding by phytophagous insects. *Oikos*, 75(1), 133–141. <https://doi.org/10.2307/3546331>
- IUCN** (2025) Guidelines for Using the IUCN Red List Categories and Criteria. Version 16. Prepared by the Standards and Petitions Committee. Available from <https://www.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed 11 February 2026)
- Jackson, D. W. T., Costas, S., González-Villanueva, R., & Cooper, A.** (2019). A global ‘greening’ of coastal dunes: An integrated consequence of climate change? *Global and Planetary Change*, 182, 103026. <https://doi.org/10.1016/j.gloplacha.2019.103026>
- Kumar, A.** (2022). Environment Conservation Journal. *Environment Conservation Journal*, 13(1–2), 17–21.
- Muthukumar, K., & Samuel, A. S.** (2011). Coastal dune flora in the Thoothukudi District, Tamil Nadu, southern India. *Journal of Threatened Taxa*, 3(11), 2211–2216. <https://doi.org/10.11609/jott.o2634.2211-6>
- Narayanan, M., Gnanasekaran, C., Palanisamy, B., Govindan, R., Chelliah, C. K., Govindhan, R., & Natesan, M.** (2025). Coastal sand dune plants as a valuable resource of

bioactive metabolites in the pharmaceutical field. In *Plant specialized metabolites: Phytochemistry, ecology and biotechnology* (pp. 815–837). Springer Nature Switzerland.

**Narayanasamy, D., & Natesan, B.** (2020). Endemic vascular plants from the Coromandel Coast of Tamil Nadu, southern India. In *Endangered plants*. IntechOpen. <https://doi.org/10.5772/intechopen>

**Padmavathy, A., & Anbarashan, M.** (2011). Phytomedicinal study of coastal dune floras in Puducherry. *Journal of Medicinal Plants Research*, 5(12), 2566–2571.

**Padmavathy, K., Poyyamoli, G., & Balachandran, N.** (2010). Coastal dune flora, Nallavadu Village, Puducherry, India. *Check List*, 6(2), 198–200. <https://doi.org/10.15560/6.2.198>

**Pierret, A., Maeght, J. L., Clément, C., Montoroi, J. P., Hartmann, C., & Gonkhamdee, S.** (2016). Understanding deep roots and their functions in ecosystems: An advocacy for more unconventional research. *Annals of Botany*, 118(4), 621–635. <https://doi.org/10.1093/aob/mcw130>

**POWO** (2026). "Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; <https://powo.science.kew.org/> Retrieved 01 June 2026."

**Ramarajan, S., & Murugesan, A. G.** (2014). Plant diversity on coastal dune flora, Tirunelveli District, Tamil Nadu. *Indian Journal of Plant Sciences*, 3(2), 42–48.

**Rodrigues, R. S., Mascarenhas, A., & Jagtap, T. G.** (2011). An evaluation of flora from coastal dunes of India: Rationale for conservation and management. *Ocean & Coastal Management*, 54(2), 181–188. <https://doi.org/10.1016/j.ocecoaman.2010.11.005>

**Silambarasan, K., & Senthilkumar, P.** (2015). Distribution and diversity of coastal sand dunes (CSD) of Marakkanam coastal belts, southeast coast of India. *International Journal of Scientific Research*, 12(35), 101–105.

**Tribble, C. M., Martínez-Gómez, J., Howard, C. C., Males, J., Sosa, V., Sessa, E. B., et al.** (2021). Get the shovel: Morphological and evolutionary complexities of belowground organs in geophytes. *American Journal of Botany*, 108(3), 372–387. <https://doi.org/10.1002/ajb2.1617>