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## A floral wealth and diversity: An outstanding status in Puducherry Union Territory – A review

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### ABSTRACT

The Puducherry Union Territory has greater floral cover percentiles (0.43%) at different locations in both aquatic and terrestrial regions. Octa Floral Diversity Region (OFDR) is the collective name for the eight distinct floral diversity regions that were examined for this review from the union territory of Puducherry. Review on previous studies around 2278 species, 1523 genera, 561 families, and 25 endangered species have been found in Puducherry's diverse ecosystems (Bahour Lake, Ousteri wetland and restoration, Pondicherry University campus, estuary, terrestrial grassland, Sacred grooves, and coastal flora). Sacred grooves had the greatest percentage of significant vegetative status across species, genera, and families when compared to the floral diversity status on OFDR. The estuarine floral exploration had the lowest percentage compared with TDEF of the Pondicherry University campus (PU), Sacred Groves, Ousteri wetland, Restoration, and terrestrial flora, which are arranged in descending order of percentage. The country-level analysis of floral diversity (%) revealed a descending order in which India, China, Africa, Russia, the Arctic, the OFDR, Europe, and Antarctica were included. Different results were obtained from quantitative research conducted at the national, state, and union territory levels on species and diversity strata in terrestrial and aquatic biomes. Quantitative floral data will help manage and conserve wetland forests. The findings indicate that the floral status of OFDR across a range of ecosystems falls into a significantly rich diversity and wealth category. Hence, the author reviewed OFDR's floral status under the outstanding status. There are a few recommendations that could be proposed to protect Puducherry's wealth: 1. Stop indiscriminate logging, 2. An in-depth analysis of the multi-decade inventory is required for the OFDR regions in Puducherry, 3. Both terrestrial and aquatic environments reported threatened flora, and actions can be conducted to save them.

**Keywords:** Puducherry flora, south India, diverse ecosystems, Union territory

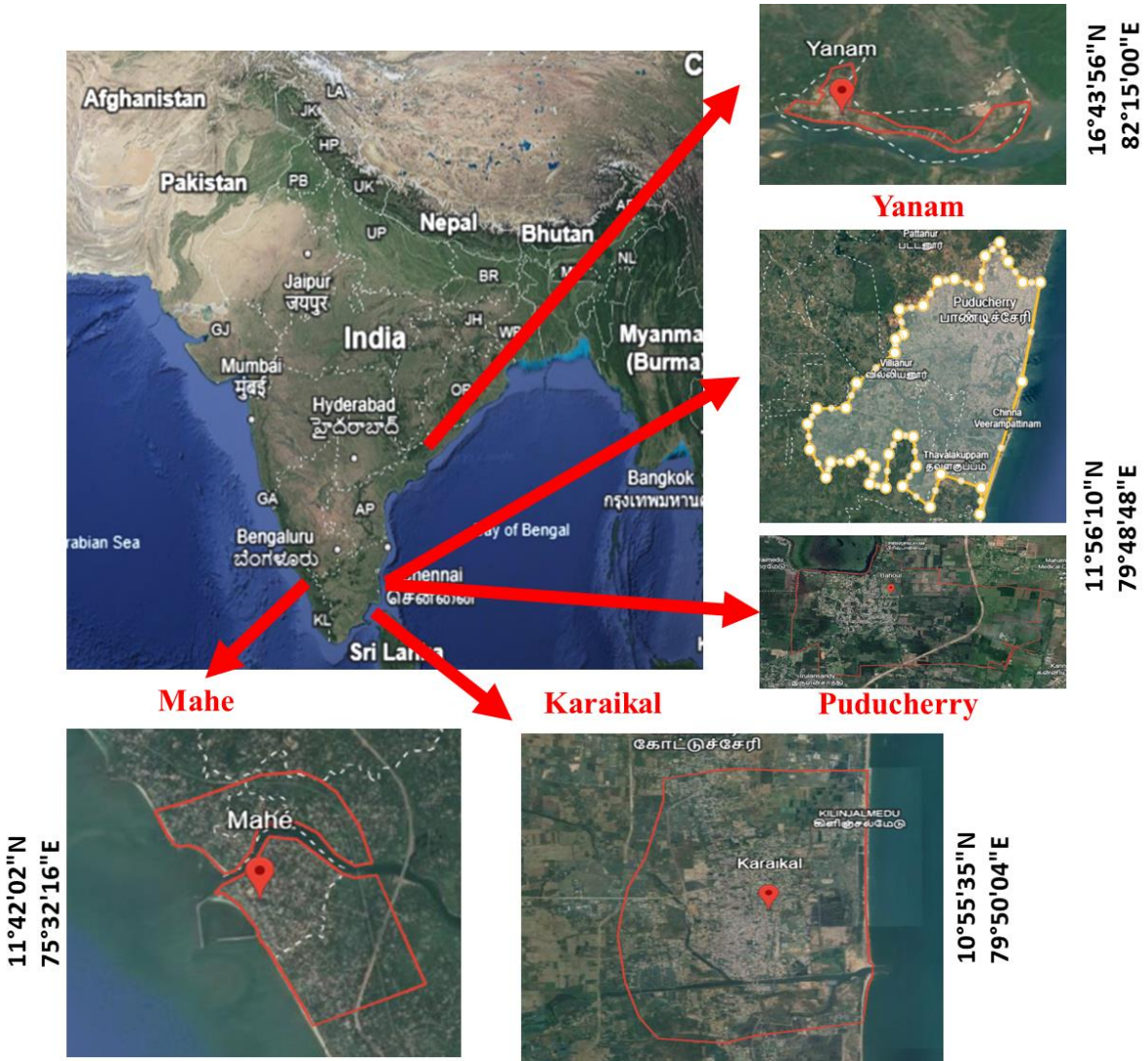
## 1. INTRODUCTION

A Union Territory, Puducherry has a rich cultural history that encompasses the bio-physical, socio-economic, and biological environments [18]. Puducherry (U.T) comprises four interspersed geographical regions Puducherry, Karaikal, Mahe, and Yanam. According to the annual reports of Census 2011, the population of U.T. Puducherry stands at 12.47 lakh, with a decadal population growth rate of 28.1%. From 769 people per square kilometer in 1961 to 2547 people per square kilometer in 2011, there has been an increase in population density. The percentage of literate people increased from 37.43% to 85.8% between 1961 and 2011. Based on current prices, the U.T. of Puducherry's Quick Estimate recorded GSDP for 2021–2022 is around ~ 38,285.03 crores. Quick estimates that the per capita income for 2021–2022 will be around \$2,16,495 (QE), based on NSDP. As to the GSVA sectoral composition for 2021–2022, the percentage shares of the primary, secondary, and tertiary sectors are 6.63%, 48.63%, and 6.63%, respectively. A wide range of plant species, including fence plants, hydrophytes, halophytes, woody plant groupings, and ornamental plants, make up Pondicherry's vegetation. There are no cliffs or forests in the plain topography of Pondicherry's Karaikal area. The domestic gardens of Pondicherry are home to a diverse array of flowers, including dahlias, petunias, impatiens, hibiscus, jasmines, lilies, roses, and chrysanthemums.

In Puducherry, The forest resource was measured at 0.43% (480 km<sup>2</sup>). The floral components of flowering plants occupy a significantly rich diversity, which is essential for conservation and wealth biodiversity. In general, the optimal diversity of floral components in a condensed geographic area at the state or union territory level is used to determine the wealth status of biodiversity. In addition, Pondicherry is home to a diverse range of wildlife, including bears, moose, snowshoe hares, butterflies, and dragonflies. The combined sanctuary indices for fish, amphibians, reptiles, mammals, and Odonata (which includes birds, butterflies, damselflies, and dragonflies) are shown. The reports on floral diversity for different ecosystems, including Bahour Lake, Ousteri Wetland, restoration, Pondicherry University Campus, Thengaithittu Estuary, terrestrial grassland, sacred grooves, and coastal flora sites [3-6, 10, 13, 14, 17, 18, 20-22]. Regarding South India, the well-known Mayiladuthurai temple, located in the Nagapattinam district of Tamil Nadu, is a good place to see seasonal variations in the local vegetation [8]. The abundance of natural rubber, or *Hevea brasiliensis*, in the Ranni area of Kerala State in southwest India, as described by Tomasz Borowski and Tadeusz Hryniewicz [9]. Natural rubber is also utilized in conductive systems and electrochemical modification. In addition, he covered the scenic, natural, tourist, and environmental aspects of West India's breathtaking terrain. There are few published statistics on the overall floral vegetation in Puducherry. The major objective of this review is to draw attention to Puducherry's (U.T.) outstanding status, diversity, and wealth in terms of floral resources.

## 2. MATERIALS AND METHODS

The Puducherry region, the largest of the four on the Coromandel coast, is located between latitudes 11° 46'03" and 11°53'40" N latitude and 79°49'45" and 79°48'00" E longitude. The study area of four geographical entities (Puducherry, Karaikal, Mahe, and Yanam) distributed in Puducherry Union Territory (U.T.) were chosen for the review of the floral analysis (Figure 1).

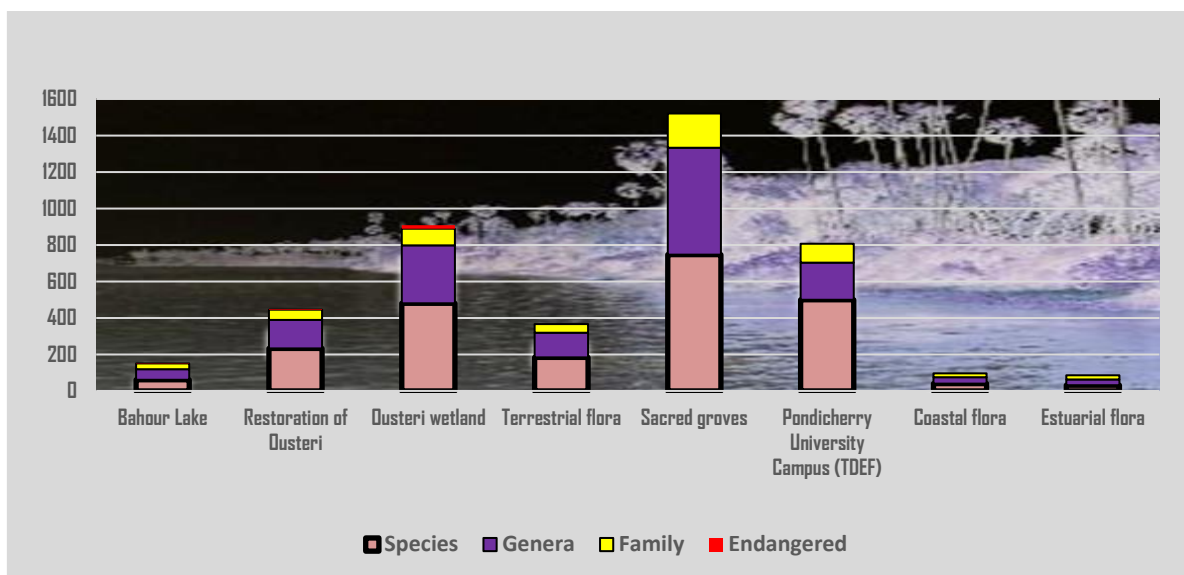


**Figure 1.** Study area of Puducherry Union Territory.  
E. Source: www.google earth.com

Based on earlier reports, eight floral habitats have been identified, including Bahour Lake, Ousteri Wetland, Ousteri Restoration, Pondicherry University Campus, Thengaithittu Estuary, Terrestrial Grassland, Sacred Grooves, and Coastal Flora [3-6, 10, 13, 14, 17, 18, 20-22]. The phrase "Octa Floral Diversity Region" (OFDR) was first used to describe this region. The results of the study's outcomes were contrasted among the various floral sites using computational Excel, and the data was then condensed.

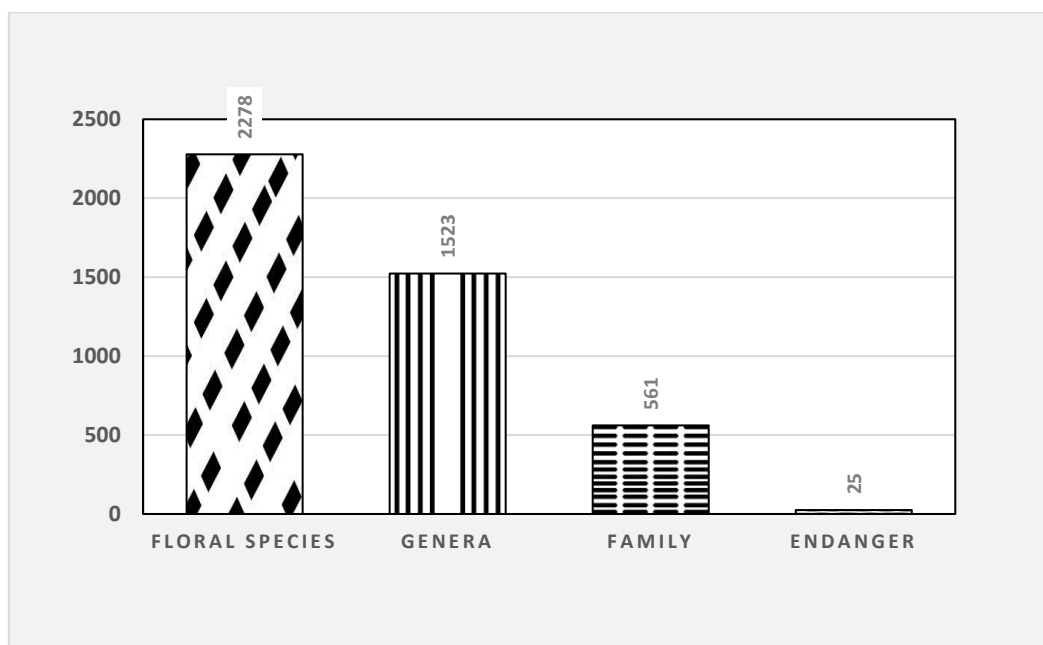
### 3. RESULT

Comparable floral analyses can be observed in the various habitats, according to the data gathered. There are around eight floral diversity regions listed in earlier reports (Figure 2).



**Figure 2.** Quantitative analysis of Octa Floral Diversity Region (OFDR) explored in Puducherry (U.T).

Screening on earlier studies, the OFDR's floral elements recorded in 2278, genera 1523, families 561, and endangered 25 altogether in and around aquatics and terrestrial ecosystems such as Bahour Lake, Ousteri wetland, and restoration, Pondicherry University campus, estuary, terrestrial grassland, sacred grooves, and coastal flora (Figure 3) [3-6, 10, 13, 14, 17, 18, 20-22].



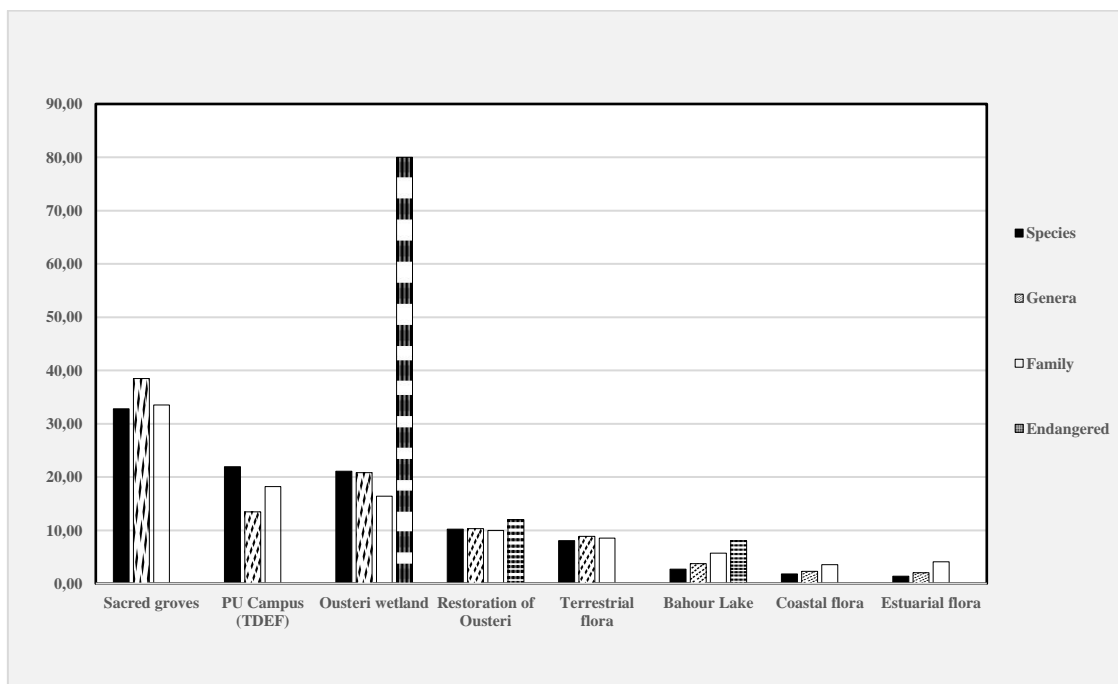
**Figure 3.** Total floral status of OFDR's region in Puducherry (U.T.)

### 3. 1. Floral analysis of OFDR in aquatic ecosystems

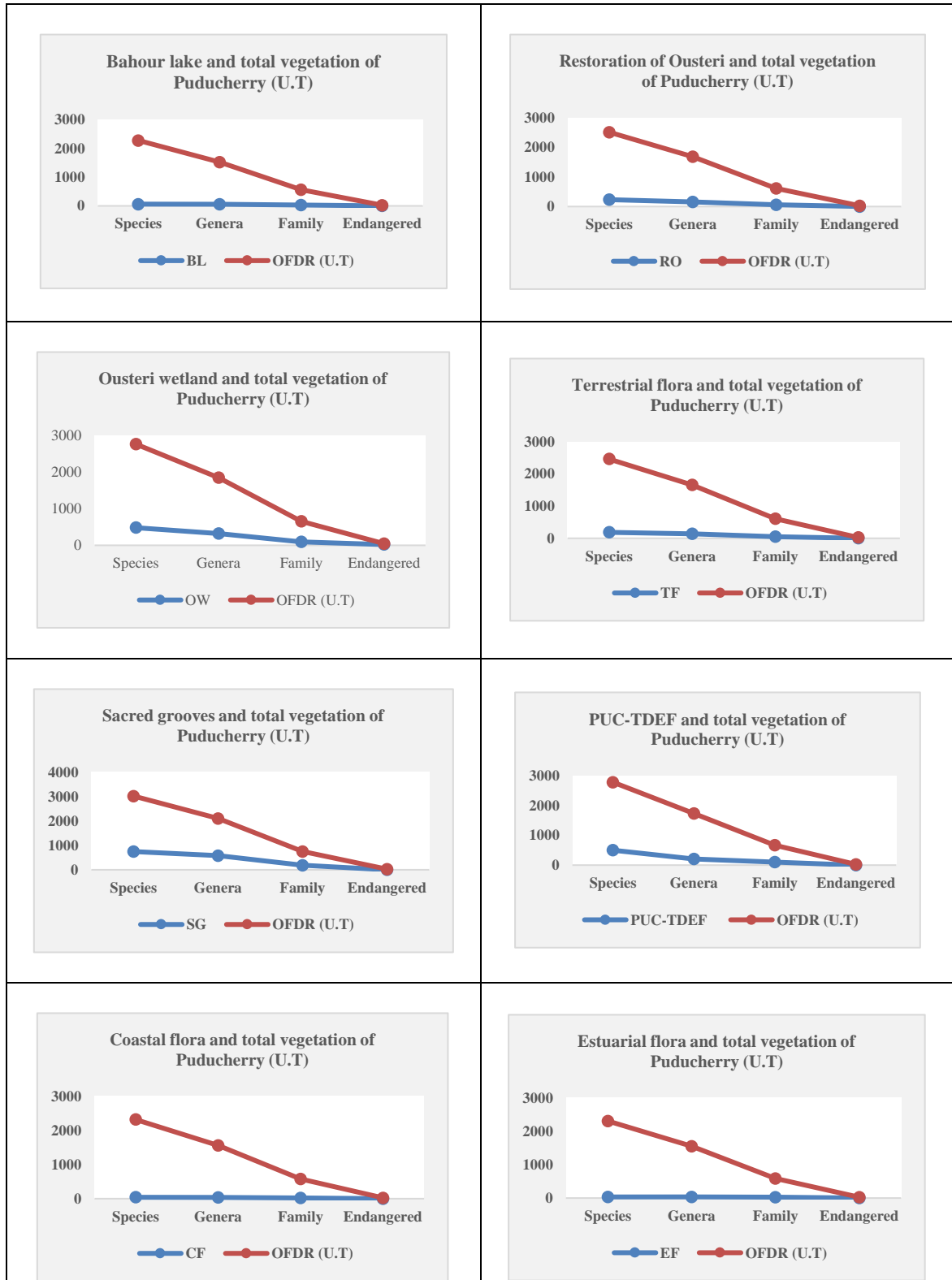
According to Anjan *et al.*, (2011), Ousteri Wetland is home to 480 species, 317 genera, 92 families, and 20 endangered species [10]. The Ousteri Lake, or Oussudu Eri in Tamil, is renowned for providing a multitude of ecological services, including recharging subsurface aquifers and providing numerous means of subsistence to the local population. It is rich in flora and wildlife. Established as a bird sanctuary in 2008, the Ousteri Wetland is home to hundreds of bird species, some of which are migratory and swarm here in large numbers during migratory seasons. The sanctuary is also well-known for its wide variety of fish, mussels, and crabs. However, the lake and its surroundings are currently under threat and strain due to a variety of human activities (such as pollution, poaching, and encroachment) as well as the rapid urbanization and infrastructure development in the lake's nearby area. The author has reported 62 species, 57 genera, 32 families, and 2 endangered species from Bahour Lake (Kumaran *et al.*, 2022). According to Muthukumaran *et al.*, (2012), there are 32 species, 31 genera, 23 families, and no endangered species in estuarine flora [3].

### 3. 2. Floral analysis of OFDR in terrestrial ecosystems

There are 747 species, 586 genera, 188 families, and no endangered species in the sacred grooves, which are the most significant ecological value-based vegetation (Ramanujam *et al.*, 2007). According to Ponnuchamy *et al.*, 2013, there are 184 species, 135 genera, 48 families, and no endangered species in terrestrial grassland. 499 species, 205 genera, 102 families, and no endangered species have been reported in the TDEF region of Pondicherry University [16]. Pondicherry University has a good quantity of greenery and some really large, very old trees. Parthasarathy (2010) has produced a superb inventory of the flora at the institution [16].



**Figure 4.** Percentile of floral diversity status on OFDR in different ecosystems of Puducherry (U.T).



**Figure 5.** Comparison of OFDR floral ecosystems and various floral ecosystems in Puducherry (U.T).

Understanding floristic vegetation characteristics and estimating species richness and variety in the studied area are the goals of phytosociological studies. Furthermore, it is often recognized that university campuses and other regulated areas are home to a wide variety of unusual flora and wildlife.

Therefore, it is essential to record, study, and document its vegetation to preserve its biodiversity and facilitate future research and management [16]. Around 233 species, 157 genera, 56 families, and 3 endangered species have been published in the restoration of the genus *Ousteri* [4]. According to Padmavathy *et al.*, (2010), there are 41 species, 35 genera, 20 families, and no endangered species in the coastal flora [5]. The percentiles of all ecosystems were examined based on the ratio of particular ecosystems and the OFDR value (Figure 4 & 5).

### **3. 3. Percentile of floral elements and ecosystems importance in Puducherry (U.T)**

Bahour Lake had a percentile of 2.72 species, 3.74 genera, 5.70 families, and 8.0 endangered species (DST project, Puducherry) [12]. The Space Applications Centre (ISRO-Ahmedabad, India) has mapped the 259 small and major wetlands that make up the Puducherry border. The surveyed area is approximately 6335 hectares (National Wetland Atlas, 2010) [15]. Bahour Lake, the second largest wetland of the 84 tanks in Puducherry, is located near the Bahour village, about 20 kilometers from Puducherry town, north of the Pennaiyar River in the Union Territory of Puducherry. It is highly valued for its enormous water storage capacity for irrigation, primarily for crop fields. This region is referred to as Puducherry's rice bowl. According to a field survey of Ponnusamy *et al.*, (2013), the restoration of *Ousteri* had a percentile of 10.23 species, 10.31 genera, 9.98 families, and 12 endangered species [4]. The *Ousteri* Wetland exhibits had a percentile of 21.07 species, 20.81 genera, 16.40 families, and 80 endangered species [10].

According to Ramanujam *et al.*, (2007), the sacred grooves had a species percentile of 32.79, 38.48 genera, 33.51 families, and no endangered species [17]. The plant richness and profusion of four sacred groves—two man-made stands and two natural forest patches—along India's southeast coast, which borders Pondicherry, have been documented. Four sites with a combined woody species area of about 15.6 hectares were identified. The range of forest wealth is maximum from Keezbuvanagiri > Kilialamman grove > Periyakattupalayam > to Periyamudaliar Chavadi.

Based on the grove's wealth, *Aglaia elaeagnoidea*, *Borassus flabellifer*, and *Pterospermum suberfolium* are associated with Periyamudaliar Chavadi Grove. There are records of a two-layered forest structure in this undeveloped area that mimics a tropical dry evergreen forest.

The profusion of scrub species suggested the formation of a scrub woodland, concealing the strata of the Keezbuvanagiri Grove. There are a few species that are reportedly plentiful in Kilialamman Grove and Periyakattupalayam (Ramanujam *et al.*, 2003). Mahe and Puducherry had the highest percentage of sacred grooves, with 32.79 species. Descending order of percentile included tropical forest and aquatic flora from PUC-TDEF, *Ousteri* wetland, restoration field, terrestrial flora, Bahour lake, and coastal flora.

Parthasarathy *et al.*, (2010) found that the percentiles for species, genera, and families in the TDEF region of Pondicherry University were 21.91, 13.46, 18.18, and some endangered species were added [16]. No endangered species were found in the coastal flora, which had a percentile of species in 1.80, 2.30 genera, and 3.57 families, according to Padmavathy *et al.*, (2010). The vegetation of the tropical coastal dunes on India's southeast coast has been

described as very, somewhat, and moderately disturbed. a variety of species, such as *Bulbostylis barbata* and a few other dune species in the back dune, *Gisekia pharmacoides*, *Glinus oppositifolius*, *Cyperus sp.* *Ipomea pescapre*, and *Spinifix litoreus* in the fore dune. The intermediate disturbance is also reported as a higher species variety.

According to Muthukumaran *et al.*, (2012), estuarial flora contained 1.40 percent of species, 2.04 genera, 4.10 families, and no endangered species [3]. In Thengaithittu sites, the estuary has the lowest species percentile (1.40). According to reports, mangrove ecosystems support Puducherry's herb diversity. The floral elements of herbs, associatees and mangroves were also reported in Ariyankuppam, Murungapakkam Bridge, Pomayarpalayam; Kanagachettikulam, Pillaichavadi, and Kottakuppam.

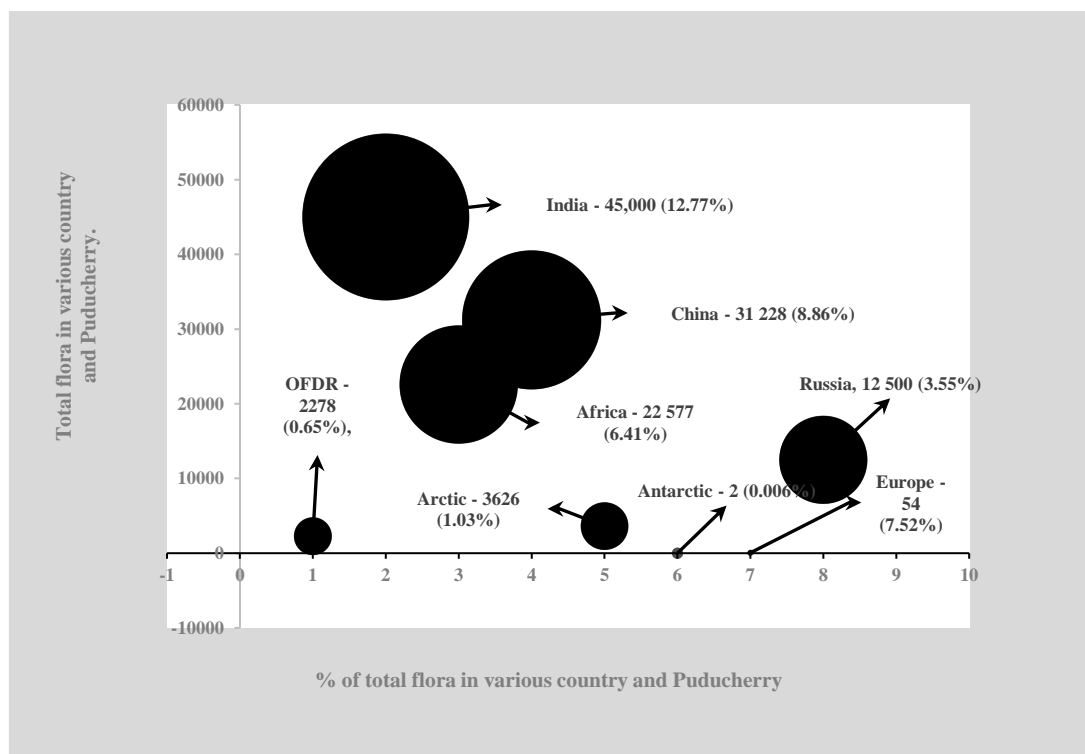
These back mangroves and their mangrove companions were all impacted by the 2011 storm's effects on the coastal vegetation [3]. The installation of highway bridges and a black stone guard belt is said to have reduced the herb population of mangrove habitats. Overuse of mangroves by humans is another factor contributing to mangrove extinction. Non-woody back mangroves of the Coromandel Coast and its cousins have been found to have pharmacological qualities, such as blistering agents, antihelminthic, antipyretic, antidiuretic, antileukemia, and anti-hemorrhaging effects. According to Ponnusamy *et al.*, 2013, the percentile of species in terrestrial grassland was 8.08, with 8.86 genera, 8.86 families, and no endangered species [4]. Sacred grooves show the highest percentage of vegetative status in terms of species, genus, and family when compared to the floral diversity status on OFDR for the entire region in Puducherry [6, 17, 19].

#### 4. DISCUSSIONS

The TDEF of the Pondicherry University campus (PU), Ousteri wetland, Sacred groves, Restoration, and terrestrial flora all had different percentages, but the estuarine floral exploration had the lowest percentage. Around 352282 flowering plants are known to exist globally. The exploration of floristic diversity revealed 22,577 species (97% of them) in tropical African forest ecosystems [21]. According to Li DZ., (2008), 31,228 plant species have been recognized in China's floristics and plant biogeography [2]. According to Zhang *et al.*, (2023), the Arctic flora includes 3626 species in polar regions [7]. According to the World Ocean Review (Jan Lehmköster, 2019), the floral diversity of flowering plants regarded at 2218 species in the polar regions of Arctic and Antarctic, two vascular plant species can be found – antarctic hair grass (*Deschampsia antarctica*) and antarctic pearlwort (*Colobanthus quitensis*) in Antarctic boundary [11].

According to Lila *et al.*, (2023), there are 54 species of blooming plants in Europe and Turkey that represent floral diversity [14]. Out of the 12,500 species assessed by Kamelin (2007), 55% of the diversity of plants in Russia [11]. Sharma *et al.*, (1993) encountered 45,000 species of flowering plants in India, making it the region with the largest [20]. The country-level analysis of floral diversity (%) revealed a descending order in which India, China, Africa, Russia, the Arctic, the OFDR, Europe, and Antarctica were included. The floral diversity hierarchy is as follows: Africa > Russia > China > India > Arctic > OFDR > Europe > Antarctic. Quantitative studies on species and diversity strata in terrestrial and aquatic biomes carried out at the national and union territory levels produced varying results. The status of total flora was referred to among countries and Puducherry in Figure 6.





**Figure 6.** Total floral status of various countries and Puducherry

## 5. CONCLUSIONS

The biodiversity of plants and animals is essential to human existence, economic success, and the health and stability of ecosystems. Scientist Tomasz Borowski describes visiting India in the diversity of natural rubber as an incredible and intriguing experience [9]. A diversified population, distinct cultures, and breathtaking natural surroundings are some of this nation's advantages. Folks are incredibly polite and compassionate. There are significant disparities in socioeconomic status. He also mentioned that there was a serious problem with environmental protection in big cities like Cochin and Mumbai, but he thinks that problem will be solved soon. A comparison of quantitative studies conducted at the national, state, and union territory levels in the terrestrial and aquatic biomes revealed varying data concerning species and diversity strata.

The current research on the diversity of rich flora will serve as a foundation for future efforts to study ecotourism and protect the Puducherry OFDR region. The findings indicate that the floral status of OFDR across a range of ecosystems falls into the rich diversity and wealth category. Quantitative biodiversity data will be useful for wetland forest conservation and management. Thus, the author examined OFDR's floral status in light of Puducherry, India's outstanding status. There are a few recommendations that could be proposed to protect Puducherry's wealth: 1. Stop indiscriminate logging, 2. An in-depth analysis of the multi-decade inventory is required for the OFDR regions in Puducherry, 3. Both terrestrial and aquatic environments reported threatened flora, and actions can be conducted to save them.

## **Abbreviations**

OFDR – Octa Floral Diversity Region  
BL – Bahour Lake  
RO – Restoration of Ousteri  
OW – Ousteri Wetland  
TF – Terrestrial flora  
SG – Sacred Groves  
PUC – Pondicherry University campus  
TDEF –Tropical deciduous evergreen forest  
CF – Coastal flora  
EF – Estuarial flora  
U.T. – Union Territory  
DST – Department of Science and Technology  
ISRO – Indian Scientific Research Organisation  
*sp.* – Species

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## **References**

- [1] Kamelin, R.V., The flora of russia project (Russian Federation). *Her. Russ. Acad. Sci.* (2007) 77, 22–26
- [2] Li D.Z., Floristics and plant biogeography in China, *J Integr Plant Biol.* (2008) 50(7), 771-7
- [3] Muthukumar, M., Rao AVB., Nadanakunjidam S., Kadavul K., A. Pragasam, Non-woody back mangrove, mangrove associates and beach flora of Puducherry coast and their pharmacology, *Int J. Sci. Nat.* (2012) 3(4), 735-744
- [4] Ponnuchamy, R., Pragasam, A., Aravajy, S., Patel, P., Das, L., and Anupama, K., A floristic study on herbs and climbing plants at Puducherry, south India: an approach to biodiversity conservation and regeneration through eco-restoration. *Check List* (2013) 9(3), 555-600
- [5] Poyyamoli, G., Padmavathy, K., and Balachandran, N., Coastal sand dunes–vegetation structure, diversity and disturbance in Nallavadu Village, Puducherry, India. *Asian Journal of Water, Environment and Pollution* (2011) 8(1), 115-122
- [6] Ramanujam, M. P., and K. Praveen Kumar Cyril, Woody species diversity of four sacred groves in the Pondicherry region of South India. *Biodiversity & Conservation* 12 (2003): 289-299

- [7] Zhang, J., Li, X.Q., Peng, H.W., *et al.*, Evolutionary history of the Arctic flora, *Nat Commun* (2023).14, 1-4021
- [8] Sankar Ganesh, K., S. Rajasekaran, M. Rajesh, M. Nagarajan, and P. Sundaramoorthy, Seasonal variation of temple wall floras in Mayiladuthurai, Nagapattinam district of Tamil Nadu, India, *World Scientific News* (2015) 19, 50-68
- [9] Tomasz Borowski, Tadeusz Hryniewicz, Natural Rubber (*Hevea brasiliensis*) – a Scientific and Touristic Expedition to the South-West India. *The Institute of Biopaleogeography named under Charles R. Darwin* 14 (2022) 1-88.
- [10] Anjan Kumar Prusty, B. Arun P.R. Bhupathy S. Murugesan M. and Rachna Chandra, Comprehensive Management Action Plan for Conservation of Ousteri Lake, Puducherry. *DST Project Report* (2011) 1-118
- [11] Jan Lehmköster., The Arctic and Antarctic –Extreme, Climatically Crucial and In Crisis; Polar flora and fauna, *maribus, War* 6 (4), (2019) 179-237
- [12] Kumaran, B., and Presena J., Ecological impact assessment on the diversity of flora and fauna of bahour lake, Puducherry, *DST Project* (2020) 1(1), 1-45
- [13] Muthukumaran, M., A.V.B. Rao and Nagalakshmana, K., Loss of above ground biomass (AGB) on *Avicennia marina* (Forsk.) and CO<sub>2</sub> emission due to thane cyclone in Puducherry coast, South India. Editor Anisa B Khan. *Green India strategic knowledge for combating climate change prospects and challenges* (2014), Excel Publishers 5, 343-361.
- [14] Lila, A., Katharina, L., T. Karin, and Heino, K., (2023). A systematic review of threats, conservation, and management measures for tree species of the family Rosaceae in Europe, *Flora* Volume 301, April 2023, 152244
- [15] National Wetland Atlas: Union Territories, Space Applications Centre (ISRO), Ahmedabad, India (2010) 1-112
- [16] Parthasarathy, N., Arul Pragasam, L., Muthuperumal, C., Anbarsan, M., Flora of Pondicherry University Campus, Pondicherry University, India, (Ed. N. Parthasarathy), *Pondicherry University Publishers* (2010) 1, 2-5
- [17] Ramanujam, M. P., Ganesan, T., Kadamban, D., Kumaravelu, G., and Devaraj P., Flora of sacred groves of Puducherry Region-A Pictorial Guide, (Ed. M.P. Ramanujam), *Forest Department Publishers* (2007) 1, 77-95.
- [18] Saravanan, K.R., A study on the diversity and management of Pondicherry mangroves. *DST Project*, (2005) 1, 1-57.
- [19] Sasikala, K., Pradeepkumar, G., Harilal, C.C., and Ravindran, C.P, Ecological and socio-economic studies of the sacred groves in Mahe with special reference to the conservation and management. *DST Project* (2011) 1, 1-82.
- [20] Sharma B.D., N.P. Balakrishnan, Rao R.R., & P.K. Hajra, Flora of India (New Series), (Ed. Sharma *et al.*), Published by The Director, Botanical Survey of India (1994) 1, 1-461.

- [21] Sosef, M.S.M., Dauby, G., Blach-Overgaard, A. *et al.*, Exploring the floristic diversity of tropical Africa. *BMC Biol* (2017) 15, 1-15
- [22] Joppa Lucas N., Roberts David L., and Pimm Stuart, L., How many species of flowering plants are there? *Proc. R. Soc. B.* (2011) 278554–278559