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Tree species of the point calimere wildlife and bird sanctuary in Tamil Nadu, India: A checklist

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Abstract
The Point Calimere Wildlife and Bird Sanctuary (PCWBS) in Tamil Nadu was declared a Ramsar site No. 1210 in 2002. The PCWBS consist of shallow waters, shores, and long sand bars, intertidal flats and intertidal forests, chiefly mangrove, and seasonal, often-saline lagoons, as well as human-made salt exploitation sites. It is famous for large congregations of waterbirds and is rich in both resident and migratory species of birds. These migratory and resident birds are dependent on plants. Birds retreat to trees and bushes as protection from predators and to rest and roost. Plants provide all the foods that birds eat and some species also nibble nutritious plant buds or sip flower nectar. Many birds construct nest on trees and lay their eggs on plants. Tree population in Point Calimere is crucial for birds and animals. Hence the present study made an attempt to record the tree species diversity in Point Calimere Wildlife and Bird Sanctuary, Tamil Nadu. The Point Calimere has a total of 91 tree species. They belong to 73 genera and 38 families. Family Fabaceae is the most dominant with 14 genera and 21 species. Species such as *Commiphora berryi and Dalbergia horrida* are the common peninsular endemics. Totally fifty tree species are used to treat various ailments. Major threats to the natural biodiversity and ecological balance of the sanctuary are: loss of habitat for waterbirds, soil and water salinisation by adjacent salt pans, spread of the invasive *Prosopis chilensis*, cattle grazing and scarcity of fresh water.

Keywords: biodiversity, flora, forest, point calimere wildlife and bird sanctuary

Introduction
India includes a diverse array of habitats or ecosystems such as forests, grasslands, wetlands, coastal, marine and desert and each with rich and unique floristic diversity. The country consists of ca. 19294 flowering plants [1] out of which ca. 2560 species have been estimated as trees [2]. In addition to many general floristic studies available during the early 20th century, the first systematic account on tree species of the entire country was brought out by Brandis (1906) [3] in his famous book 'Indian Trees' in which he has mentioned a total of 4,400 species including trees, shrubs and woody climbers from the then British India. Due to the various factors such as climate, altitude and edaphic factors, Tamil Nadu exhibits vast plant diversity. There are four different categories of vegetation found in the state, that is, (i) Coastal vegetation, (ii) Island vegetation, (iii) Vegetation of the interior plains and (iv) Vegetation of the hills and mountains [4]. Based on "A revised survey of forest types of India" every vegetation group may be further divided into different forest types [4]. Tamil Nadu harbours about 5640 species and infraspecific taxa of flowering plants including cultivated species [5, 6]. After about two decades the state flora analysis was revised and a checklist of angiosperms in Tamil Nadu as a floral database was prepared by Narasimhan [7]. According to which, the angiosperms in the state are represented by 5547 taxa, comprising 5239 species, 72 subspecies, 548 varieties in 1668 genera and 231 families. However, a recent analysis by Irwin *et al.* [8] revealed that there are about 5745 angiospermic taxa in Tamil Nadu state, which include 2757 herbs, 1365 shrubs, 1115 trees and 508 climbers, and are distributed in 233 families, of which 43 families are unigeneric. Point Calimere Wildlife and Bird Sanctuary in Tamil Nadu, was created as a sanctuary in 1967, essentially for the conservation of the endangered blackbuck antelope, endemic to the Indian subcontinent. Through is a small sanctuary, spread over only 21.5 square kilometres, Point Calimere has mangoves, tropical evergreen forests, wetlands and grassland ecosystems. The varied ecosystems support the growth of diverse tree species. Present study was undertaken to document trees of Point Calimere Wildlife and Bird Sanctuary, Tamil Nadu.

Area of study
Point Calimere Wildlife and Bird Sanctuary is situated on a low promontory on the Coromandel Coast in Nagapattinam district (Map: 1). The Sanctuary forms one of the seaward apexes of the Cauvery river delta. Point Calimere or Kodikkarai (10° 18' N; 79° 51' E), the headquarters of the Sanctuary, was connected by a branch line of the Southern Railway from 1936, but the train service was discontinued in 1986. It is now accessible only by road from Vedaranyam (11km). In 1967, the forests of Point Calimere with an area of 24.17 km^2, was declared the Point Calimere Wildlife Sanctuary. In 1988, a proposal was sent to the Tamil Nadu Government to extend the area of the Sanctuary to include the Great Vedaranyam Swamp and the Talaignayar Reserve Forest. The new Sanctuary, with a total area of 377 km^2, will bear the name Point Calimere Wildlife and Bird Sanctuary. There are only two villages, namely Kodikkarai and Kodikkadu. Traditionally, the tribals, called Seenthikodi Valaiyars. It has been designated as a Ramsar site**.** The sanctuary is well known for the substantial mixture of transient water birds that visit each year for winter

bolstering. The most noticeable is the Greater Flamingo. Point Calimere has a great history; an epic called Ramayana has highlighted the significance of this coastal place.

Methodology

The source of materials for this floristic research was the extensive field collections of specimens made from the area of study. Gamble and Fischer's Flora of the Presidency of Madras [9], Matthew's Flora of the Tamil Nadu Carnatic [10], Henry *et al*., Flora of Tamil Nadu [6] and Daniel and Umamaheswari's Flora of Gulf of Mannar [11] were the basic reference materials for identification. For recent binomial the online databases TROPICOS [12] and The Plant List [13] are referred, whenever necessary. The eflora of Karaikal also referred for common names. The use and parts used are explored based in the published literature [14, 15].

Results and Discussion

The Angiospermic tree diversity of the Point Calimere has a total of 91species. They belong to 73 genera and 38 families. 86 are Dicot and belong to 68 genera and 35 families; 5 are monocot and belong to 5 genera and 3 families (Table: 1). Family Fabaceae (Papilionaceae) is the most dominant with 14 genera and 21 species, followed by Moraceae with 6 species. 17 families are unigeneric. Families such as, Malvaceae, Rutaceae, Meliaceae, Celastraceae, Myrtaceae, Rubiaceae, Apocynaceae, Lamiaceae and Arecaceae are represented by three species each. *Ficus* and *Acacia* with 5 spp. each, *Cassia* with 3 spp., are some of the dominant genera having maximum number of tree species.

Table 1: List of Trees in the study area

Botanical Name	Family	Local Name
Annona squamosa L.	Annonaceae	Seetha
Polyalthia longifolia (Sonn.) Thwaites	Annonaceae	Nettlingam.
Crataeva religiosa Hook. f. & Thomson.	Capparaceae	Mavilingam
Calophyllum inophyllum L.	Calophyllaceae	Punnai
Hibiscus tiliaceus L.	Malvaceae	Kattupoovarasu
Thespesia populnea (L.) Sol. ex Correa	Malvaceae	Poovarasu
Ceiba pentandra (L.) Gaertn.	Malvaceae	Illavam
Aegle marmelos (L.) Correa	Rutaceae	Vilvam
Limonia acidissima L.	Rutaceae	Vizha
Murraya koenigii (L.) Spreng	Rutaceae	Kariveppilai
Ailanthus excelsa Roxb.	Simaroubaceae	Perumaram
Ochna obtusata DC.var. *Obtusata* Kanis,	Ochnaceae	Chilanti
Commiphora berryi (Arn.) Engl.	Burseraceae	Mul kiluvai
Commiphora caudata (Wight & Arn.) Engler in DC.	Burseraceae	Mangkiluvai
Azadirachta indica A. Juss.	Meliaceae	Vembu
Melia azedarach L.	Meliaceae	Thulukkavembu
Walsura trifoliolata (A. Juss.) Harms	Meliaceae	Walsurai
Cassine glauca (Rottb.) Kuntze	Celastraceae	Karuvali
Maytenus emarginata (Willd.) Ding.	Celastraceae	Nandunari
Pleurostylia opposita (Wall.) Alston	Celastraceae	Sivapivari
Ziziphus mauritiana Lam.	Rhamnaceae	Illanthai
Ziziphus xylopyrus (Retz.) Willd	Rhamnaceae	Kottei
Lepisanthes tetraphylla (Vahl) Rodlk.	Sapindaceae	Neykkottan
Sapindus emarginatus Vahl	Sapindaceae	Poovanthi, Nuraikkai
Lannea coromandelica (Houtt.) Merr.	Anacardiaceae	Uthiyam
Mangifera indica L.	Anacardiaceae	Maa
Moringa pterygosperma Gaertn.	Moringaceae	Murungai
Dalbergia sissoo Roxb.	Fabaceae	Thesi maram
Erythrina variegata L.	Fabaceae	Kalyana murukku, Mul murukku
Pongamia pinnata (L.) Pierre	Fabaceae	Pungam
Cassia fistula L.	Fabaceae	Sarakontrai
Cassia roxburghii DC.	Fabaceae	-
Cassia siamea Lam.	Fabaceae	Manjal konnei
Delonix elata (L.) Gamble	Fabaceae	Vathanarayanan
Delonix regia (Boj. Ex Hook.) Raf.	Fabaceae	Seemai Vathamadakki
Hardwickia binata Roxb.	Fabaceae	Aacha
Parkinsonia aculeata L.	Fabaceae	-
Tamarindus indica L.	Fabaceae	Puli
Acacia auriculiformis A. Cunn ex Benth.	Fabaceae	-
Acacia leucophloea (Roxb.) Willd.	Fabaceae	Velvel
Acacia nilotica (L.) Willd.	Fabaceae	Karuvelam
Acacia planifrons Wight & Arn.	Fabaceae	Kudaivel, Udaimaram
Albizia amara (Roxb.) Boivin.	Fabaceae	Usil, Unja, Araippu
Albizia lebbeck (L.) Willd.	Fabaceae	Vaagai
Dichrostachys cinerea (L.) Wight & Arn.	Fabaceae	Vidaththalai, Vidathther
Leucaena leucocephala (Lam.) de Wit	Fabaceae	Nattuchavandal
Pithecellobium dulce (Roxb.) Benth.	Fabaceae	Kodukkaipuli

Prosopis chilensis (Molina) Stuntz.	Fabaceae	Neerkarvel, Velikaruvai
Lumnitzera racemosa Willd.	Combretaceae	Thipparathai
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	Combretaceae	Marutham
Terminalia catappa L.	Combretaceae	Nattu Vadumai
Eucalyptus tereticornis Sm.	Myrtaceae	Nilagirithaila Maram
Psidium guajava L.	Myrtaceae	Koyya
Syzygium cumini (L.) Skeels	Myrtaceae	Naaval
Memecylon umbellatum Burm. f.	Melastomataceae	Kayampoo
Psydrax dicoccos Gaertn.	Rubiaceae	Eervali
Ixora pavetta Andr.	Rubiaceae	Kura, Sulundu
Morinda pubescens J.E. Smith	Rubiaceae	Nuna, Manjanathi
Madhuca longifolia (Koen.) Macbr. var. *latifolia* (Roxb.) A. Cheval.	Sapotaceae	Illuppai
Manilkara hexandra (Roxb.) Dubard,	Sapotaceae	Pala, Kannupalai
Manilkara zapota (L.) P. Royen	Sapotaceae	Sapota
Mimusops elengi L.	Sapotaceae	Mahilam
Diospyros vera (Lour.) A.Chev.	Ebenaceae	Tuvarai
Salvadora persica L.	Salvadorasceae	Uga, Kalarvagai
Plumeria alba L.	Apocynaceae	Alari
Plumeria rubra L.	Apocynaceae	Ezaththalari
Wrightia tinctoria (Roxb.) R. Br.	Apocynaceae	Vetpalai
Cordia dichotoma G.Forst.	Boraginaceae	Vizhi
Premna serratifolia L.	Lamiaceae	Peimunnai
Tectona grandis L.	Lamiaceae	Thekku
Vitex negundo L.	Lamiaceae	Vennotchi
Avicennia officinalis L.	Acanthaceae	Uppatha, Madaipattai
Pisonia grandis R. Br.,	Nyctaginaceae	Illatchakottai
Gyrocarpus americanus Jacq.	Hernandiaceae	Vellai thanukku, Kaththadi
Drypetes sepiaria (Wight & Arn.) Pax & Hoffm.	Putranjivaceae	Veerai
Euphorbia tirucalli L.	Euphorbiaceae	Tirukalli
Euphorbia antiquorum L.	Euphorbiaceae	Chathurakkalli
Phyllanthus emblica L.	Phyllanthaceae	Nelli
Holoptelea integrifolia Rendle	Ulmaceae	Ayil
Ficus benghalensis L.	Moraceae	Aal
Ficus hispida L.f.,	Moraceae	Peyaththi
Ficus microcarpa L.f.	Moraceae	Ichchi, Ponitchchi
Ficus religiosa L.	Moraceae	Arasu
Ficus virens Alton	Moraceae	Iththi
Streblus asper Lour.	Moraceae	Piray
Casurina litorea var. *souderi* Fosberg & Sachet	Causurinaceae	Chavukku
Musa paradisiaca L.	Musaceae	Vazhai
Borassus flabellifer L.	Arecaceae	Panai
Cocos nucifera L.	Arecaceae	Thennai
Phoenix pusilla Gaertn.	Arecaceae	Sitreechi
Pandanus odorifer (Forssk.) Kuntze	Pandaceae	Thaazhai

Distribution

The foreshore sandy vegetation consists of large *Pandanus odorifer* occur as coastal fence. *Commiphora berryi, C. caudata, Euphorbia antiquorum, Canthium diccocum, C. Parviflorum, Memecylon umbellatum, Dichrostachys cinerea, Ziziphus oenoplia, Z. Xylopyrus, Cassia fistula* and *Derris scandens* are habitat in the scrub forests of Ramarpadam. *Lepisanthes tetraphylla* are frequent along railway tract, near Ramarpadam and swarming with bees when in full blossom. *Acacia planifrons, Ficus virens, Mimusops elengi, Borassus flabellifer and Phoenix pusilla* are common in sandy lands near Ramarpadam on sand dunes. Few trees of *Pithecellobium dulce* and *Parkinsonia aculeata* are found around the fresh water pond. *Diospyros ferrea, Wrightia tinctoria* and *Cordia obliqua* are common in the thicket forests and flanks of the railway line. Many trees *Avicennia officinalis* are frequent in Nandupallam and Muniappan lake backwaters and chain of erect pneumatophores arises from the horizontal roots. *Euphorbia tirucalli* is common as house fence in the villages. A large tree of *Ficus benghalensis* is occupying Modimandapam. *Ficus hispida* and *Gyrocarpus asiaticus* are less common in Nandupallam area. A large tree *Ficus microcarpa* is found near Avulia mosque. *Casurina litorea* is extensively planted on the seashore sands. Many species such as *Lannea coromandelica, Salvadora persica, Morinda pubescens, Syzygium cumini, Albizia lebbeck* and *Pongamia pinnata* occur in different habitats. *Musa paradisiaca, Cocos nucifera, Phyllanthus emblica, Plumeria rubra, Plumeria alba, Murraya koenigii, Psidium guajava, Mangifera indica, Annona squamosa, Polyalthia longifolia* grown in the home garden. *Delonix regia, Cassia siamea, Cassia roxburghii, Azadirachta indica, Ailanthus excelsa, Pongamia pinnata, Polyalthia longifolia* and *Hibiscus tiliaceus* planted along road sides as avenue trees. Sacred trees, *Aegle marmelos* are planted in temples. *Manilkara hexandra* is the characteristic omnipresent tree of Kodikkarai vegetation.

Endemism

The endemic status has been derived based on the literature available in Flora of Gulf of Mannar [11], Species such as *Commiphora berryi and Dalbergia horrida* are the common

peninsular endemics recorded in the present study. The flora of the region has close affinity with that of Sri Lanka. The Indo - Sri Lankan species are *Acacia planiferons*, *Dichrostachys cinerea*, *Euphorbia antiquorum*, *Phoenix pusila*, *Polyalthia longifolia*, *Terminalia arjuna*, *Zizyphus mauritiana* and *Z. xylopyrus. Calophyllum inophyllum*, *Ziziphus mauritiana*, *Delonix elata*, *Dichrostachys cinerea*, *Lumnitzera racemesa*, *Avicennia officinalis* and *Euphorbia tirucalli* are classified as "least concern" plants in IUCN Red listed data [16]. *Aegle marmelos* reported as vulnerable in Foundation for Revitalisation of Local Health Traditions (FRLHT) database.

Economic importance

Totally fifty tree species are used to treat various ailments (Table: 2). Flowers of *Pandanus odorifer* are fragrant and used for decoration. *Cocos nucifera* meat of seeds is used in food, pastries and confectionary and for extraction of fatty oil. *Borassus flabellifer* is a toddy yielding plant. Fruits are edible in *Musa paradisiaca*, *Phyllanthus emblica*, *Manilkara zapota*, *M. hexandra*, *Annona squamosa Syzygium cumini*, *Psidium guajava*, *Tamarindus indica*, *Mangifera indica*, *Ziziphus mauritiana* and *Limonia acidissima. Moringa pterygosperma* fruits are used as vegetable and leaves as greens. *Erythrina variegata* is planted in hedges for green manure and goat fodder. Fruit kernal of *Terminalia catappa* is edible. Leaves of *Pisonia grandis* are used as green. *Avicennia officinalis* bark is used for tanning. *Tectona grandis*, *Dalbergia sissoo*, *Mangifera indica*, *Terminalia catappa* woods are valued timber. *Diospyros vera* wood is hard and used for boat anchors, handles and rafters. *Casurina litorea* wood is used for house posts, rafters and masts *Gyrocarpus americanus*, *Cassia siamea* and *Pleurostylia opposita* woods are useful to make furniture. *Prosopis chilensis* fruits are used as cattle feed. *Leucaena leucocephala* wood is used for making paper pulp. *Acacia planifrons* wood is used to make agricultural implements. *Ceiba pentandra* silky fibres of the capsule are used in the preparation of pillows. *Sapindus emarginatus* kernels yield fixed oil and are used for soap manufacture. *Albizia amara* dried leaves are powdered and used as bathing powder.

Eucalyptus tereticornis, *Anacardium occidentale*, *Annona squamosa*, *Ceiba pentandra*, *Cocos nucifera*, *Delonix regia*, *Parkinsonia aculeata*, *Plumeria alba*, *P. rubra*, *Psidium guajava*, *Borassus flabellifer*, *Pithecellobium dulce*, *Pisonia grandis* and *Tamarindus indica* are commonly cultivated alien species for food / forage / timber / ornamental / other economic purposes in the study area.

Table 2: List of trees used for medicinal purpose

Botanical Name	***Uses***
Polyalthia longifolia	Bark used as febrifuge
Crataeva religiosa	Bark is used in urinary calculi and other urinary affections.
Calophyllum inophyllum	Seed oil used as burning oil and as external application in cases of rheumatism and skin diseases.
Thespesia populnea	Root, bark, fruit, seed used as external medicine in skin diseases.
Aegle marmelos	Unripe fruits astringent, digestive and stomachic
Murraya koenigii	Leaves and roots used as tonic, stomachic and carminative
Ailanthus excelsa	Stem bark anthelmintic, febrifuge, expectorant and antispasmodic
Ochna obtusata	Stem bark digestive, tonic
Azadirachta indica	Bark and seed oil used in skin diseases. Leaves antiseptic
Melia azedarach	Leaves used as anthelmintic.
Walsura trifoliolata	Stem bark stimulant, expectorant, emmenagogue and emetic
Maytenus emarginata	Decoction of shoots used in colic, dysentry, diarrhoea in children
Ziziphus xylopyrus	Root bark and fruit used in bronchial asthma, diarrhoea and as emetic
Lepisanthes tetraphylla	Roots and bark expectorant and demulcent
Lannea coromandelica	Bark used to heal wounds, Wood for building and packing cases
Erythrina variegata	Leaves laxative, diuretic, anthelmintic, galactogogue
Pongamia pinnata	Leaf, root, flower, seed, oil is useful in glandular swellings, skin diseases, and abdominal disorders.
Cassia fistula	Used in constipation, skin diseases, venereal diseases
Delonix elata	Leaves used in rheumatism and flatulence
Delonix regia	Useful in diseases of rhumatism
Hardwickia binata	Useful in diseases of rheumatism
Tamarindus indica	Fruit pulp refrigerant, carminative and laxative
Acacia leucophloea	Bark used in bronchitis and biliousness
Acacia nilotica	Decoction of bark used as gargle and of pods in urino-genito diseases
Albizia lebbeck	Whole plant used in diseases of kapam, leucorrhoea, venereal diseases, bleeding piles, diarrhoea
Dichrostachys cinerea	Roots used in rheumatism
Terminalia arjuna	Stem bark used as cardio tonic
Eucalyptus tereticornis	Essential oil from leaves used as antiseptic, expectorant, febrifuge, diaphoretic
Memecylon umbellatum	Root and leaf used in leucorrhoea, polyuria, mennorhagia
Psydrax dicoccos	Bark used as a febrifuge and applied externally in bone fracture
Ixora pavetta	Decoction of bark used in general debility and anaemia
Morinda pubescens	Fried fruits are eaten to alleviate bowel complaints
Madhuca longifolia	Flowers used as a tonic and appetizer
Mimusops elengi	Bark. Flower and seed used in eye diseases and dental diseases
Salvadora persica	Root used as antipyretic
Plumeria alba	Root cathartic, bark stimulant
Plumeria rubra	Stem bark used as a purgative, febrifuge and emmenagogue

Wrightia tinctoria	Leaves used in skin diseases
Cordia dichotoma	Fruit resinous, astringent anthelmntic
Premna serratifolia	Root used as carminative antiperiodic
Vitex negundo	Root, leaf, bark useful in intermittent fever and worm infestations
Pisonia grandis	Used as anti-inflammatory and diuretic
Euphorbia tirucalli	Useful in the application for warts
Phyllanthus emblica	Fruit sour, astringent, diuretic and laxative. Fruits edible
Holoptelea integrifolia	Bark used in the diseases of vatam
Ficus benghalensis	Infusion of bark considered tonic and astringent, used in diarrhoea,
Ficus hispida	Fruit used as purgative
Ficus microcarpa	Bark used in liver diseases
Ficus religiosa	Bark infusion used for ulcers and skin troubles
Streblus asper	Decoction of the bark is given in cases of fever and dysentry

Map 1: Area of the study

Discussion

Similar to present observation many reports [17, 18, 19, 20, 21, 22] were carried out. Trees play essential cultural, economical and ecological roles. Trees provide support for species diversity, habitats, regulating climate, water and air purification. Despite the global importance, the tropics lost 11.9 million hectares of tree cover in 2019. The trees are fast disappearing and have become more vulnerable than other plant species due to deforestation, urbanization and rapid depletion meeting various human needs [23]. The number of species of flowering plants is estimated to be in the range of 2,50,000 to 4,00,000. Out of these, about 1,00,000 species are expected as trees. Nearly a third of that loss, 3.8 million hectares, occurred within humid tropical primary forests [24, 25]. That is the equivalent of losing a football pitch of primary forest every 6 seconds for the entire year. Between 2015 and 2020, the world lost an estimated 10 million hectares (24.7 million acres) of forests per year, an estimated 420 million hectares of forest have been lost, more than three times the size of South Africa. There are over 7300 tree species as globally threatened [26]. With increased levels of human development, transportation and changing climates, there are greater instances of invasive species *Prosopis* introduction and spread across the Point Calemere Sanctuary. Such invasive species can cause significant ecological and economical impacts in biodiversity,

Conclusions

Study revealed that anthropogenic activities within the sanctuary limited the regeneration potential of tree species and consecutively reduced the species diversity. The selective felling of old-age trees and restriction for harvesting of juvenile individuals by local residents and raising of grasslands nearby their habitats to feed the livestock could be the prominent measures for sustainable development of the Point Calimere reserve Forest.

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