International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-07, Issue-02, MAY 2021

Survey of Trees in Thazhakudy, Kanyakumari District, Tamil Nadu, Southern India

Dr. SIVAKAMA SUNDARI. S,

Department of Botany, Arignar Anna College, Aralvaimozhi, Tamil Nadu, India.

sssbotany@gmail.com

ABSTRACT - The study catalogues a sum of 69 tree species belonging to 62 genera and 33 families from the village Thazhakudy in Kanyakumari district of Tamilnadu in India. The family Fabaceae has been found to exhibit the highest species diversity with 14 species. The genus Ficus of Moraceae and Citrus of Rutaceae have been observed with 3 species each. Almost all tree species have some importance in one and another way for the local people. As per the existing IUCN Red List, 26 species of the area fall under different categories. The occurrence of these red listed trees in the study area enhances the importance of their proper management and conservation plan.

KEY WORDS: Trees Outside Forest (TOFs), Economic Importance, IUCN Red List, Conservation, Thazhakudy

I. INTRODUCTION

Forestry is the second-largest land use in India after agriculture with a forest and tree cover of 79.42 million ha or 24.16% of the geographical area (FSI, 2015). Trees play an important role in contributing towards sustainable livelihoods of rural poor worldwide. Roughly 275 million poor rural people in India (27% of the total population) depends on forests for at least part of their subsistence and cash livelihoods, which they earn from fuelwood, fodder, and a range of non-timber forest products such as fruits, flowers, and medicinal plants (Pandey.*et al.*, 2016). Over exploitation has resulted in the rapid loss of forests and is recognized to be one of the biggest environmental and economic problems around the world (Mani and Parthasarathy, 2006). Relatively increased anthropogenic pressures have led to agricultural expansion and overgrazing of livestock (Anitha.*et al.*, 2010).

Tree species diversity is an important aspect of forest ecosystem diversity (Rennolls and Laumonier, 2000, Tchouto.*et al.*, 2006) and is also fundamental to tropical forest biodiversity (Evariste.*et al.*, 2010). Trees, an important component of vegetation, must therefore be constantly monitored and managed in order to direct successional processes towards maintaining species and habitat diversity (Attua and Pabi, 2013). Trees outside forest (TOF) play an important role in global carbon cycling, since they are large pools of carbon as well as potential carbon sinks and sources to the atmosphere (Kuldeep Singh.*et al.*, 2012).

The trees are fast disappearing and genetic diversity in tree species has become more vulnerable than other plant species (Tripathi.*et al*,. 2013) in reality, tree species are typically subjected to multiple threats simultaneously. Effective conservation depends on identifying and countering threats that increase the risk of extinction. Thus it is imperative to document and conserve the tree flora of any area before they become threatened and lost. The present study adopted a field survey method following stratified random sampling in Thazhakudi village to enumerate the list of trees.

II. MATERIALS AND METHODS

The present study of surveying tree species was conducted in an agriculturally important village of Thazhakudy in Kanniyakumari district in the state of Tamil Nadu. Thazhakudy is a panchayat town in Kanniyakumari district situated between two rivers "Puthanaar" and "Palaiyaar" having Lattitude 8.23121 and Longitude 77.5060338 with 11 kms away from the district headquarter town Nagercoil. The study area Thazhakudy is geographically important as it is located nearer to the foot hills of the Western Ghats. Avvaiyar Amman temple is one famous temple which is 2 kms towards East from Thazhakudy. As of 2011 Census of India, Thazhakudy has a total population of 8992 with 4445 nos of males and 4547 nos of females. Thazhakudy has an average literacy rate of 91.93%, much higher than the national average of 74.04 %. Thazhakudy village has male literacy of 94.51% and female literacy of 89.42 %.

The sampling study was carried out over a period of four months from December 2019 to March 2020. Intensive field trips to the study area were made on all Saturdays and Sundays during the above period. The identification of the trees was initially verified with the local people of Thazhakudy village. The social and economic importances of

 DOI : 10.35291/2454-9150.2021.0300

the trees were analyzed based on the information collected from the local people of Thazhakudy village. Questionnaire was prepared for getting the details of the trees and their economical uses from the local people. The voucher specimens collected from the field were prepared as herbarium (Jain *et al.*, 1977) and deposited in the Department of Botany, Arignar Anna College, Aralvaimozhi. Preliminary identification of trees were carried out by using different local and regional Floras (Gamble.*et al.*, 1915-1936, Mathew, 1983, Nair.*et al.*, 1983) and the conformity of identification compared with authenticated herbarium deposited in Botanical Survey of India, Southern Circle, Coimbatore. The valid nomenclature of the tree species were verified as per the working list of the plant list assessed through online (www.theplantlist.org). The IUCN threatening status of tree species were also checked from IUCN 2021, The IUCN Red List of threatened species, Version 2021-1. (www.iucnredlist.org).

III. RESULTS AND DISCUSSION

On analysis of the list of tree species accounted in Thazhakudy village, a total of 69 tree species were sampled during the survey. These documented species were belonging to 33 families and 62 genera.

Table 1. Tree Species of Thazhakudi Village with Family, Vernacular Name, Uses and Types of Plantation

SI No	Name of the Tree Species	Family Name	Tamil Vernacular Name	Economic Importance
1	*Acacia catechu* (L.f.) Willd.	Fabaceae	Karuvelam	Fodder, Firewood, Medicinal.
2	*Achras sapota* L.	Sapotaceae	Sapota	Fruits Edible
3	*Aegle marmelos* (L.) Correa	Rutaceae	Vilva maram	Religious, Medicinal
4	*Albizia lebbeck* (L.) Benth.	Fabaceae	Vagai maram	Fodder, Firewood, Timber Wood, Green Manure
5	*Albizia Saman* (Jacq.) Merr.	Fabaceae	Thoongu Moongi Maram.	Avenue Tree, Fire Wood
6	*Alstonia scholaris* (L.) R.Br.	Apocynaceae	Elilai Palai	Medicinal, Firewood
7	*Anacardium occidentale* L.	Anacardiaceae	Mundhiri Maram	Fruits Edible, Medicinal, Fodder, Firewood
8	*Annona Squamosa* L.	Annonaceae	Sitapalam	Fruits Edible, Medicinal
9	*Annona muricata* L.	Annonaceae	Mala Panchi	Fruits Edible
10	*Areca catechu* L.	Arecaceae	Pakku Maram	Fruits Edible, Firewood
11	*Artocarpus altilis* Fosberg	Moraceae	Irrppla	Fruits Edible, Fodder, Firewood
12	*Artocarpus heterophyllus* Lam.	Moraceae	Palaaa	Fruits Edible, Fodder, Timber Wood
13	*Averrhoa bilimbi* L.	Oxalidaceae	Pulima	Fruits edible, Firewood.
14	*Azadirachta indica* A. Juss.	Meliaceae	Vepa Maram	Medicinal, Household Timber, Green Manure.
15	*Bambusa vulgaris* Schrad.	Poaceae	Moongil	Firewood, Fencing, Pulp and Paper.
16	*Borassus flabellifer* L.	Arecaceae	Panai Maram	Fruits and Endosperm Edible, Leaves for Handicraft
17	*Calophyllum inophyllum* L.	Calophyllaceae	Punnai Maram	Firewood, Medicinal, Oil from Seeds.
18	*Carica papaya* L.	Caricaceae	Pappali	Fruits Edible, Medicinal.
19	*Caryota urens* L.	Arecaceae	Kuntal Panai	Ornamental, Leaves for Fibre
20	*Cascabela thevetia* (L.) Lippold	Apocynaceae	Thanga Arali	Religious, Medicinal.
21	*Cassia fistula* L.	Fabaceae	Konrai	Religious, Ornamental.
22	*Casuarina equisetifolia* L.	Casuarinaceae	Savukku	Firewood, Timber, Soil Erosion
23	*Citrus aurantium* L.	Rutaceae	Charukkarai Narattai	Fruits Edible, Medicinal.
24	*Citrus limon* (L.) Osbeck	Rutaceae	Elumicchai	Fruits Edible, Medicinal, Religious.
25	*Citrus maxima* (Burm.) Merr.	Rutaceae	Bamblimass	Fruits Edible
26	*Cocos nucifera* L.	Arecaceae	Thennai	Fruits Edible, Apiculture, Fibre, Timber, Oil
27	*Crateva magna* (Lour.) DC.	Capparaceae	Mavilingam	Medicinal, Firewood
28	*Cycas circinalis* L.	Cycadaceae	Salamapanai	Medicinal, Ornamental
29	*Delonix regia* (Hook.) Raf.	Fabaceae	Cemmayir Konrai	Avenue Tree, Ornamental
30	*Erythrina indica* Lam.	Fabaceae	Kalyana Murungai	Medicinal, Firewood.
31	*Eucalyptus camaldulensis* Dehnh	Myrtaceae	Kapura Maram	Medicinal, Firewood.
32	*Ficus benghalensis* L.	Moraceae	Aala Maram	Religious, Medicinal
33	*Ficus racemosa* L.	Moraceae	Aththi	Fruits, Edible, Medicinal
34	*Ficus religiosa* L.	Moraceae	Arasu	Religious, Medicinal
35	*Gliricidia sepium* (Jacq.) Walp.	Fabaceae	Semmai Agathi	Fodder, Firewood, Green Manure
36	*Grevillea robusta* A. Cunn. ex R. Br.	Proteaceae	Savukku	Firewood.

 DOI : 10.35291/2454-9150.2021.0300

37	*Lawsonia inermis* L.	Lythraceae	Marudaani	Medicinal, Dye Henna
38	*Leucaena leucocephala* (Lam.) de Wit	Fabaceae	Subapul	Fodder
39	*Magnolia champaca* (L.) Baill. ex Pierre	Magnolaceae	Sambagam	Religious, Ornamental
40	*Mangifera indica* L.	Anacardiaceae	Maa Maram	Edible Fruit, Timber Wood
41	*Melia azedarach* L.	Meliaceae	Kattu Vembu	Timber, Avenue Tree
42	*Millettia pinnata* (L.) Pierre	Fabaceae	Pungai Maram	Medicinal, Soil Fertility, Firewood
43	*Millingtonia hortensis* L.f.	Bignoniaceae	Panneer	Religious, Medicinal.
44	*Mimusops elengi.L*	Sapotaceae	Magizhambu	Religious, Ornamental
45	*Morinda tinctoria* Roxb.	Rubiaceae	Manjanathi	Firewood, Timber Wood, Medicinal
46	*Moringa oleifera* Lam.	Moringaceae	Murungai	Fruits and Leaves Edible, Medicinal
47	*Muntingia calabura*.L	Muntingiceae	Thean Poosani	Avenue Tree, Medicinal.
48	*Murraya koenigii* (L.) Spreng.	Rutaceae	Karivepillai	Medicinal, Leaves as Spices
49	*Nyctanthes arbor-tristis* L.	Oleaceae	Pavizhamalli	Medicinal, Ornamental
50	*Pandanus odorifer* (Forssk.) Kuntze	Pandanaceae	Talai Maram	Perfume, Aromatic Oil
51	*Peltophorum pterocarpum* (DC.) K. Heyne	Fabaceae	Perunkondrai	Ornamental, Avenue Tree
52	*Phoenix sylvestris* (L.) Roxb.	Arecaceae	Inthu Panai	Ornamental, Avenue Tree
53	*Phyllanthus acidus* (L.) Skeels	Phyllanthaceae	Aranelli	Fruits Edible, Firewood.
54	*Phyllanthus emblica L.*	Phyllanthaceae	Nelli	Fruits Edible, Medicinal
55	*Pisonia grandis* R. Br.	Nyctaginaceae	Chandi Keerai	Edible, Fodder, Medicinal.
56	*Pithecellobium dulce* (Roxb.) Benth.	Fabaceae	Kodukkapulli	Fruits Edible, Firewood, Medicinal.
57	*Polyalthia longifolia* (Sonn.) Thwaites	Annonaceae	Ashoka Maram	Ornamental, Medicinal
58	*Pouteria campechiana* (Kunth)Baehni	Sapotaceae	Muttapalam	Fruits Edible, Fodder
59	*Prosopis juliflora* (Sw.) DC.	Fabaceae	Seemai Karuvel	Firewood, Fodder
60	*Psidium guajava* L.	Myrtaceae	Koyyaa	Fruits Edible, Medicinal.
61	*Pterocarpus marsupium* Roxb.	Fabaceae	Vengai	Timber Wood, Medicinal
62	*Santalum album* L.	Santalaceae	Chandanam	Medicinal, Religious, Essential Oil, Timber.
63	*Swietenia macrophylla* King.	Meliaceae	Mahogany	Timber, Firewood.
64	*Syzygium cumini* (L.) Skeels	Myrtaceae	Naval	Fruits Edible, Fire and Timber Wood, Dyestuff
65	*Tamarindus indica* L.	Fabaceae	Pulli	Fruits Edible, Fodder, Firewood, Timber.
66	*Tectona grandis* L.f.	Verbenaceae	Thekku	Timber, Firewood.
67	*Terminalia catappa.L*	Combretaceae	Vathakottai / Saraparuppu	Fruits Edible, Essential Oil, Medicinal.
68	*Thespesia populnea* (L.) Sol. ex Correa	Malvaceae	Puvarasu	Timberwood, Medicinal.
69	*Vitex negundo* L.	Lamiaceae	Nocchi	Medicinal, Fodder.

Source: Primary data

The highest family was Fabaceae consisting 14 tree species, while the other major families were Arecaceae, Moraceae, Rutaceae comprising 5 tree species each. They were followed by Anonaceae, Meliaceae, Myrtaceae and Sapotaceae comprising 3 tree species each. Anacardiaceae, Apocynaceae and Phyllanthaceae families each have 2 species. The Remaining 22 families had only one species each. Out of 69 tree species, 61 are Dicotyledons, 7 are Monocotyledons (*Areca catectu*, *Bambusa vulgaris*, *Borassus flabellifer*, *Caryota urens*, *Cocos nucifera*, *Pandanus oderifer* and *Phoenix dactylijera*) and 1 Gymnosperm (*Cycas circinalis*) was identified in the study area.

Table 2. Dominant Families observed in the study area

Sl No	Name of the Family	No of Tree species
1	Fabaceae	14
2	Arecaceae	5
3	Moraceae	5
4	Rutaceae	5
5	Meliaceae	3
6	Myrtaceae	3
7	Sapotaceae	3
8	Anonaceae	3

 DOI : 10.35291/2454-9150.2021.0300

Source: Primary data

The contribution of the individual species documented in the study area was dominated by *Cocus nucifera* followed by *Mangifera indica, Azadirachta indica, Tectona grandis, Ficus religiosa, Psidium guqjava, Morinda tinctoria, Moringa oleifera, Carica papaya,* and *Murraya koenigii.* The important agricultural crop tree was *Cocus nucifera* which is the highly economical tree in the study area followed by *Mangifera indica* and *Moringa oleifera.* Some other commercial crops cultivated in the study area are *Areca catechu, Atrocarpus heterophyllus, Psidium guajava, Phyllanthus emblica, Tamaridus indica and Anacardium occidentale.* Some other edible fruit trees cultivated in the homestead areas are *Carica papaya, Achras sapota, Psidium guajava, Citrus limon* and *Annona Squamosa*. Local people of Thazhakudy are growing *Tectona grandis, Thespesia populnea , Azadirachta indica* and *Swietenia macrophylla* mainly for their timber purpose. *Ficus religiosa, Ficus benghalensis, Aegle marmelos, Cassia fistula* and *Santalum album* are the important religious trees existing in the study area.

Medicinal trees are important components of the biodiversity of the Western Ghats. The high anthropogenic pressures and associated fragmentation of natural forests have resulted in loss of habitat and species. Biogeographically, the Western Ghats have long been isolated from the vast south-east Asian humid forest tract and thus protect a relict pocket of evolutionarily distinct biota. Geology, soil and climate also contribute to promote high biodiversity in these regions (Sivakamasundari *et al.*, 2015). The locality of the study area Thazhakudy is nearer to the Western Ghats and catalogues many important medicinal trees such as *Azadirachta indica, Alstonia scholaris, Caryota urens, Cassia fistula, Cycas circinalis, Ficus religosa, Ficus benghalensis, Ficus racemosa, Eucalyptus camaclulensis, Moringa oleifera, Phyllanthus emblica,Pterocarpus marsupium, Santalum album, Syzygium cumini, Vitex negunda* and *Aegle marmelos.* Growing medicinal plants is a great way to ensure good health of the human. The local people use these plants for their wide range of health benefits and basic healthing properties.

The palm tree 'Tala Vilasam' has been praised for its 801 uses in a Tamil poem from the medieval period, and Coconut tree termed as 'Kalpa vriksha' in the ancient Indian literatures has many uses including providing food and oil for millions of people (Jerard *et al.*, 2008). *Cocus nucifera* and *Borassus flabellifer* are the important multipurpose trees with each and every part for some economic purpose by the local people of Thazhakudy. *Atrocarpus heterophyllus, Leucaena leucocephala*, and *Albizzia lebbeck* are some of the trees which are used for fodder purpose by the local people of the study area.

Around 7,800 tree species are currently recorded as threatened with extinction at the global scale (Oldfield *et al*., 1998; Newton and Oldfield, 2008). However, information is lacking on the status and distribution of many suspected rare species of trees, and the true figure is likely to be much higher. The present study also envisages 26 tree species fall under different categories of IUCN Red List of threatened species as per IUCN Version 2021-1. *Borassus flabellifer* is the Endangered (EN) species enduring in the study area. *Santalum album* and *Swietenia macrophylla* are the Vulnerable (VU) tree species, *Aegle marmelos* and *Cycas circinalis* are the Near Threatened (NT) tree species accounted in the study area. *Alstonia scholaris, Azadirachta indica, Calophyllum inophyllum, Caryota urens, Citrus maxima, Delonix regia, Erythrina indica, Ficus racemosa, Gliricidia sepium, Grevillea robusta, Lawsonia inermis, Melia azedarach, Magnolia champca, Millettia pinnate, Mimusops elengi, Pandanus oderifer, Pithecellobium dulce, Psidium guajava, Syzygium cumini, Terminalia catappa* and *Thespesia populnea* are the tree species with the status of least concern as per IUCN 2021-1 accounted in the study area.

Table 3. Conservation status of tree species as per IUCN Red list of Threatened species (EN = Endangered, VU=Vulnerable, NT=Near Threatened, LC=Least concern)

SI No	Name of the Tree Species	Family	Common Name	Tamil Vernacular Name	IUCN STATUS
1	*Aegle marmelos* (L.) Correa	Rutaceae	Golden Apple	Vilva Maram	NT
2	*Alstonia scholaris* (L.) R.Br.	Apocynaceae	Blackboard Tree	Elilai Palai	LC
3	*Azadirachta indica* A. Juss.	Meliaceae	Neem	Vepa Maram	LC
4	*Borassus flabellifer* L.	Arecaceae	Toddy Palm	Panai Maram	EN
5	*Calophyllum inophyllum* L.	Calophyllaceae	Alexandrian Laurel Ball Tree	Punnai Maram	LC
6	*Caryota urens* L.	Arecaceae	Fish Tail Palm	Kuntal Panai	LC
7	*Citrus maxima* (Burm.) Merr.	Rutaceae	Pomelo	Bamblimass	LC
8	*Cycas circinalis* L.	Cycadaceae	Queen Sago	Salamapanai	NT
9	*Delonix regia* (Hook.) Raf.	Fabaceae	Flame Tree	Cemmayir Konrai	LC
10	*Erythrina indica* Lam.	Fabaceae	Indian Coral Tree	Kalyana Murungai	LC
11	*Ficus racemosa* L.	Moraceae	Cluster Fig	Aththi	LC
12	*Gliricidia sepium* (Jacq.) Walp.	Fabaceae	Gliricidia	Semmai Agathi	LC
13	*Grevillea robusta* A. Cunn. ex R. Br.	Proteaceae	Silver Oak	Savukku	LC
14	*Lawsonia inermis* L.	Lythraceae	Henna	Marudaani	LC

 DOI : 10.35291/2454-9150.2021.0300

15	*Magnolia champaca* (L.) Baill. ex Pierre	Magnolaceae	Champak	Sambagam	LC
16	*Melia azedarach* L.	Meliaceae	China Berry Tree	Kattu Vembu	LC
17	*Millettia pinnata* (L.) Pierre	Fabaceae	Indian Beech	Pungai Maram	LC
18	*Mimusops elengi* L.	Sapotaceae	Spanish Cherry	Magizhambu	LC
19	*Pandanus odorifer* (Forssk.) Kuntze	Pandanaceae	Fragrant Screw Pine	Talai Maram	LC
20	*Pithecellobium dulce* (Roxb.) Benth.	Fabaceae	Manila Tamarind	Kodukkapulli	LC
21	*Psidium guajava* L.	Myrtaceae	Guava	Koyyaa	LC
22	*Santalum album* L.	Santalaceae	Sandal Tree	Chandanam	VU
23	*Swietenia macrophylla* King.	Meliaceae	Big Leaved Mahagony	Mahogany	VU
24	*Syzygium cumini* (L.) Skeels	Myrtaceae	Black Plum	Naval	LC
25	*Terminalia catappa* L.	Combretaceae	Indian Almond	Vatha Kottai / Saraparuppu	LC
26	*Thespesia populnea* (L.) Sol. ex Correa	Malvaceae	Indian Tulip Tree	Puvarasu	LC

Source: Primary data

The present study reveals that the study area endures 26 tree species out of total 69 tree species (nearly 38 %) fall under different categories of IUCN red list. Conservation status of Indian forests have been under severe pressure for meeting growing demands for alternative land uses, fuel, fodder, grazing, timber, pulpwood and NWFPs from ever growing human and livestock populations and industrial development and infrastructure needs. Thus there is an urgent need to conserve tree species and a strategy for proper management plan is highly recommended for their conservation and sustainable utilization.

IV. CONCLUSION

Information from this quantitative inventory will provide a valuable reference of TOF assessment and improve our knowledge by the identification of ecologically, useful species as well as species of special concern, thus identifying conservation efforts for sustainability of trees biodiversity in outside Forest. The present study revealed the occurrence of 26 numbers of tree species falls under Red List of threatened species as per IUCN Version 2021-1. Conservation measures for these threatened tree species should be adopted in both in-situ and ex-situ conditions. It is recommended for making participation in broad partnerships to promote the sustainable use of trees outside forests by rural communities to contribute to the achievement of food security and nutrition. TOFs can efficiently fix atmospheric C02 in its woody biomass and fulfill the timber demands but need to be managed and monitored properly for which local, regional or national inventory is required.

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