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Tree diversity, composition and structure of two sacred groves forest of Alluri Sitaramaraju District, Andhra Pradesh, India

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ABSTRACT

In the present investigation, an attempt was made to study the tree diversity, composition and structure of two sacred groves, Alluri Sitarama Raju District, which comes under the Eastern Ghats of India. *Anogeissus latifolia* was the most common tree in the Gudem Sacred Groves, followed by *Lannea coromandelica, Tamarindus indica*, and *Xylia xylocarpa*. A total of 55 species, 45 genera, and 26 families were reported from the Daralamma Sacred Grove. *Garuga pinnata* was the dominating tree, and *Protium serratum, Bridelia airy-shawii,* and *Mallotus philippensis* were also dominant trees. Proper education should be provided to the people addressing about the need for conserving sacred groves.

Key words: *Tree diversity, Composition, Structure, Sacred groves, Alluri sitarama raju district.*

Introduction

The nature of religiousness associated with sacred groves suggests that the practice of sacred groves dates back to the nomadic hunter-gatherer age of human history (Gadgil and Vartak, 2004). Around 14,000 sacred groves have been reported from all over India, which act as reservoirs of rare fauna, and more often rare flora, amid rural and even urban settings. Experts believe that the total number of sacred groves could be as high as 100,000. The sacred groves in Andhra Pradesh are known as Pavithravanams. A total number of 730 sacred groves have been documented till date. These Pavithravanas or sacred groves are dedicated to various local deities and also to Hindu gods and goddesses. In Andhra Pradesh some investigators (Lakshminarayana *et al.,* 1998; Ravi Prasada Rao *et al.*, 2011; Savithramma *et al.,* 2014 and Rao *et al.,* 2015), worked on the sacred groves distributed in different parts of the state. The value of sacred groves is immense. It is also the repositories of rich medicinal plants, wild relatives of crops and many important species, which act as the valuable gene pool. They give much ecological and genetically significance and play an important role in wildlife conservation. The aim of the study was Assessment of tree diversity, composition and structure of the sacred groves of Alluri Sitarama Raju District, Andhra Pradesh.

Meterials and Methods

Study area

Gudem sacred grove (GM) is located in Sileru forest range of Gudem Kothaveedi Mandal, Alluri Sitarama Raju District, Andhra Pradesh (Fig. 1). The grove core area is extended over 0.5 hectares. The nearest village is Kothaveedi. Which is 160 Km

away from Visakhapatnam district town. The main deity in the grove is Kanaka Durgathalli. It lies between 17°51′59.18" North latitude and 82°10′56.82" East longitude. The vegetation is Semi evergreen forest. Annual jathara used to hold during Sivarathri. All tribal and non-tribal communities involve in the annual festival.

Darakondamma Sacred Grove (DK) is situated in Gudem Mandal, Alluri Sitarama Raju District, Andhra Pradesh, which is 170 km away from Visakhapatnam town. It grove covers an area of 0.5 ha. It lies between 17°58′52.86" North latitude and 82° 7′56.39" East longitude. The altitude of the grove is 717 meters (Elevation). Annual festivals celebrated in this sacred grove. The vegetation is Dry deciduous with semi-evergreen species. This grove belongs to sileru forest range.

Methodology

Phytosociological studies were carried out during year 2020-2022 at Gudem and Daralamma Sacred Grove, Alluri Sitarama Raju District, Andhra Pradesh. The following phytosociological parameters were undertaken for the study. Density, Relative Density, Frequency, Relative Frequency, Basal area, Relative Basal area, IVI (Importance Value Index). IVI is the sum totals of Relative Density, Relative Dominance and Relative Frequency for a species were estimated. Collected specimens were made into herbarium as per the methods suggested by Jain and Rao (1977). The collected specimens were identified only after a critical examination with the help of different floras like Flora of the Presidency of the Madras (Gamble and Fischer 1915–1936), Flora of Visakhapatnam District (Rao and Kumari, 2002–2008), and Flora of Vizianagaram District (Venkaiah 2004). The voucher specimens were deposited at the Botany Department Herbarium (BDH), Andhra University, Visakhapatnam.

Results and Discussion

Gudem Sacred Grove (Site-1)

The type of vegetation is Moist deciduous. It has 70 species, 60 genera and 31 families with 551 stems ha^{-1}. The most common genera are *Terminalia* with 3 species. Girth class frequency distribution shows that 64% of the total tree density if formed by girth classes 31-60 cm (36%) and 61-90 cm (28%). The total basal area with a maximum contribution by girth

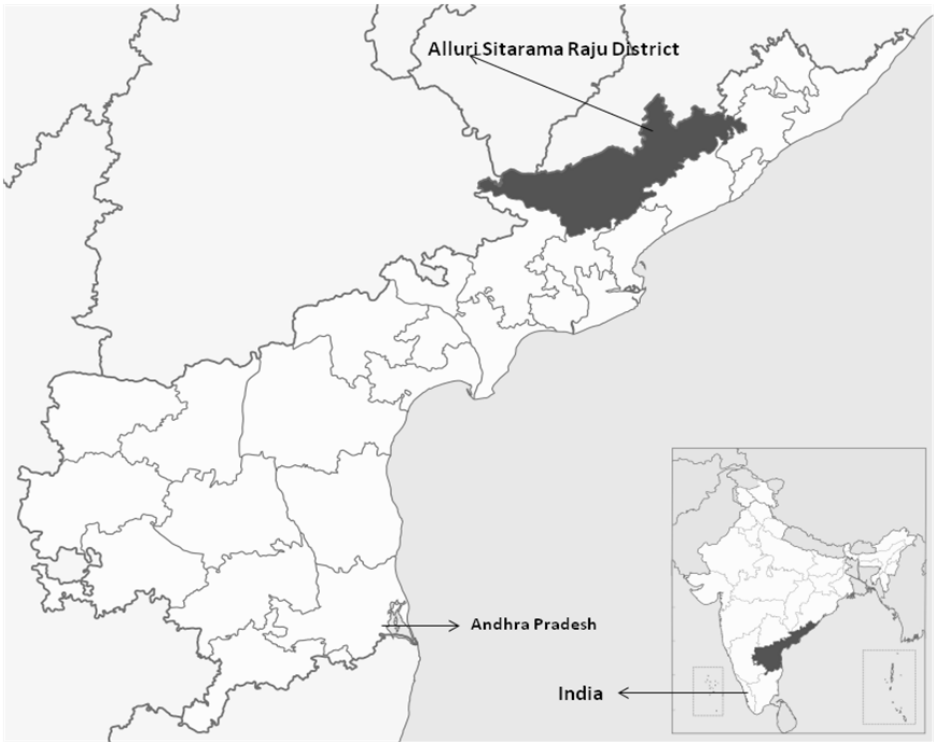

Fig. 1. Alluri Sitarama Raju District, A.P, India.

class 61-90 cm followed by 91-120 cm. Basal area and tree density are correlated against each other (Fig.1), the stand density is more for small stemmed individuals (31-60 cm), Red line shows high peak in the graph. The IVI of most dominated species represent 41% and top ten species of IVI value is shown in (Table. 1 Fig. 3). Predominant tree was *Anogeissus latifolia* and dominant trees were *Lannea coromandelica, Tamarindus indica* and *Xylia xylocarpa*. The Shannon index is 3.748, Simpson index is 0.966, Evenness index is 0.606 and Menhinick index is 2.982. Among the 31 observed families dominated families were Rubiaceae and Euphorbiaceae with 6, Combretaceae, Rutaceae, Fabaceae and Anacardiaceae with 4. Verbenaceae, Caesalpiniaceae and Mimosaceae with 3.

Daralamma Sacred Grove (Site-2)

The type of vegetation is Dry deciduous. It has 55 species, 45 genera and 26 families with 460 stems ha^{-1}. The most common genera are *Ficus* with 5 species. Girth class frequency distribution shows that 75% of the total tree density if formed by girth classes 31-60cm (33%) and 61-90 cm (42%). The total basal area with a maximum contribution by girth class 61-90cm followed by 91-120 cm. Basal area and tree density are correlated against each other (Fig. 2), the stand density is more for small stemmed individuals (61-90 cm), Red line shows high peak in the graph. The IVI of most dominated species represent 37% and top ten species of IVI value is shown in Table 1 Fig.4). Predominant tree is *Garuga pinnata* and dominant trees are *Protium serratum, Bridelia airy-shawii and Mallotus philippensis*. The Shannon index is 3.706, Simpson index is 0.9706, Evenness index is 0.7397 and Menhinick index is 2.564. Among the 26 observed families dominated families were Moraceae and Euphorbiaceae with 6, Anacardiaceae, Verbenaceae, Ebenaceae and Rubiaceae with 3.

In the present forest study sites species richness is correlated with tropical forests of Indian Eastern Ghats and Western Ghats, i.e., the number of species in Nallamalais (69, Sudhakar Reddy *et al*, 2008), Kolli hills (25-56, Chitti Babu and Parthasarathy, 2000), Kalarayan hills (42-47, Kadavul and Parthasarathy, 1996), the sacred groves of Kerala (14-23, Chandrasekhar and Sankar, 1998), Thirumani Kuzi Sacred grove (38, Parthasarathy and Karthikeyan, 1997), 30 species ha^{-1} in Nelliampathy (Chandrasekhar and Ramakrishnan, 1994), to 57 species ha^{-1} in Mylodai area of Courtallum reserve forest (Parthasarathy and Karthikeyan, 1997a) and similar to a range of 59-79 species ha^{-1} in thirty 1-ha plots of tropical evergreen forest, Varagalair, Anamalais (Ayyappan and Parthasarathy, 1999).

Conclusion

The present study on the selected two sacred groves of Alluri Sitarama Raju district, Andhra Pradesh highlights the importance of conserving the biodiversity of that area. The plant species which are documented from such groves are characterized based on their floristic diversity, composition and structure. Tree diversity assessment is tried at local and regional levels to understand the present status, in this regard transect method technique is followed

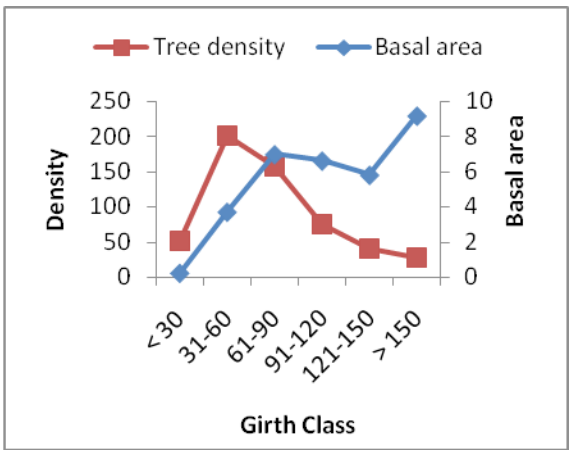

Fig. 1. (Site-1)

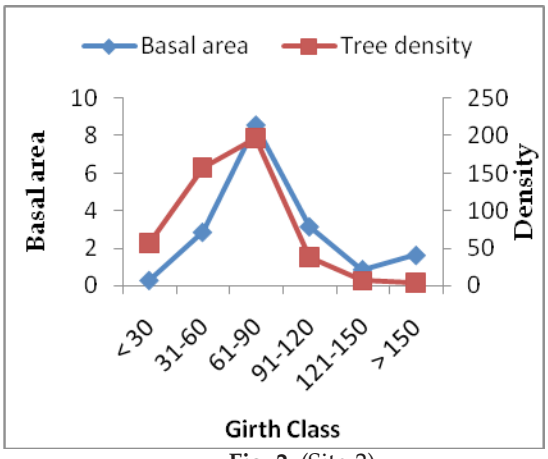

Fig. 2. (Site-2)

(Stand structure based on tree density (Red line) and basal area (Blue line) in Site-1&2)

Table 1. Important Value Index (IVI) for Site-1 & Site-2

S. No.	Species Name	Family	Site-1				Site-2			
			RD	RF	RBA	IVI	RD	RF	RBA	IVI
1	*Acacia catechu*	Mimosaceae	0.36	1.01	0.09	1.46	—-	—-	—-	—-
2	*Aegle marmelos*	Rutaceae	1.09	2.02	0.73	3.84	—-	—-	—-	—-
3	*Aglaia elegnoidea*	Meliaceae	0.18	1.01	0.10	1.29	—-	—-	—-	—-
4	*Alangium salvifolium*	Alangiaceae	0.18	1.01	0.02	1.21	—-	—-	—-	—-
5	*Albizia amara*	Mimosaceae	—-	—-	—-	—-	1.96	2.78	0.79	5.52
6	*Albizia procera*	Mimosaceae	—-	—-	—-	—-	2.61	2.78	3.64	9.03
7	*Albizia odoratissima*	Mimosaceae	0.54	1.01	0.57	2.12	—-	—-	—-	—-
8	*Anogeissus acuminata*	Combretaceae	0.54	1.01	0.83	2.39	—-	—-	—-	—-
9	*Anogeissus latifolia*	Combretaceae	8.35	2.02	10.60	20.97	3.48	2.78	4.20	10.46
10	*Antidesma acidum*	Stilaginaceae	—-	—-	—-	—-	1.09	2.78	0.38	4.25
11	*Artocarpus heterophyllus*	Moraceae	—-	—-	—-	—-	0.65	1.39	0.48	2.52
12	*Atalantia monophylla*	Rutaceae	0.54	2.02	0.11	2.67	—-	—-	—-	—-
13	*Bauhinia malabarica*	Caesalpiniaceae	1.09	2.02	0.74	3.85	—-	—-	—-	—-
14	*Bauhinia racemosa*	Caesalpiniaceae	0.36	1.01	0.19	1.57	—-	—-	—-	—-
15	*Bridelia airy-shawii*	Euphorbiaceae	0.91	2.02	0.61	3.54	5.43	2.78	4.32	12.53
16	*Bridelia montana*	Euphorbiaceae	2.00	1.01	0.91	3.92	—-	—-	—-	—-
17	*Buchanania lanzan*	Anacardiaceae	1.63	2.02	0.66	4.31	0.43	1.39	0.41	2.24
18	*Callicarpa arborea*	Verbenaceae	—-	—-	—-		1.96	1.39	2.15	5.49
19	*Callicarpa tomentosa*	Verbenaceae	0.18	1.01	0.14	1.33	0.65	1.39	1.13	3.17
20	*Canthium dicoccum*	Rubiaceae	1.81	2.02	0.53	4.36	2.83	2.78	2.13	7.74
21	*Cassia fistula*	Caesalpiniaceae	—-	—-	—-	—-	1.52	2.78	0.97	5.27
22	*Careya arborea*	Lecythidaceae	0.18	1.01	0.18	1.37	—-	—-	—-	—-
23	*Casearia tomentosa*	Flacourtiaceae	0.91	1.01	0.07	1.99	—-	—-	—-	—-
24	*Chloroxylon swietenia*	Flindersiaceae	1.63	2.02	0.55	4.21	1.96	1.39	1.20	4.54
25	*Chukrasia tabularis*	Meliaceae	—-	—-	—-	—-	0.22	1.39	0.20	1.81
26	*Cleistanthus collinus*	Euphorbiaceae	3.99	1.01	0.78	5.78	2.17	1.39	0.85	4.41
27	*Cochlospermum religiosum*	Cochlospermaceae	1.09	1.01	1.13	3.22	0.43	1.39	0.17	1.99
28	*Crateva magna*	Capparaceae	—-	—-	—-	—-	0.22	1.39	0.09	1.70
29	*Dalbergia paniculata*	Fabaceae	2.00	2.02	2.84	6.86	—-	—-	—-	—-
30	*Diospyros melanoxylon*	Ebenaceae	0.36	1.01	0.14	1.52	1.30	1.39	0.55	3.24
31	*Diospyros sylvatica*	Ebenaceae	1.09	1.01	0.22	2.32	2.83	2.78	2.46	8.06
32	*Erythrina suberosa*	Fabaceae	0.18	1.01	0.04	1.23	—-	—-	—-	—-
33	*Ficus exasperata*	Moraceae	—-	—-	—-	—-	0.43	1.39	0.29	2.11
34	*Ficus semicordata*	Moraceae	0.54	2.02	0.17	2.73	1.52	1.39	1.51	4.42
35	*Ficus tomentosa*	Moraceae	0.54	2.02	0.46	3.03	0.22	1.39	0.07	1.68
36	*Firmiana colorata*	Sterculiaceae	—-	—-	—-	—-	0.43	1.39	0.44	2.26
37	*Flacourtia jangomas*	Flacourtiaceae	—-	—-	—-	—-	0.65	1.39	0.46	2.50
38	*Gardenia latifolia*	Rubiaceae	1.27	2.02	0.43	3.72	—-	—-	—-	—-
39	*Garuga pinnata*	Burseraceae	3.81	2.02	4.07	9.90	5.22	2.78	6.62	14.62
40	*Glochidion velutinum*	Euphorbiaceae	—-	—-	—-	—-	0.65	1.39	0.46	2.51
41	*Glochidion zeylanicum*	Euphorbiaceae	—-	—-	—-	—-	0.43	1.39	0.62	2.44
42	*Gmelina arborea*	Verbenaceae	0.36	1.01	0.14	1.51	3.04	1.39	3.42	7.85
43	*Grewia tiliifolia*	Tiliaceae	1.81	2.02	1.13	4.97	2.83	2.78	2.70	8.31
44	*Haldinia cordifolia*	Rubiaceae	3.63	2.02	7.57	13.22	1.30	1.39	1.66	4.35
45	*Holoptelea integrifolia*	Ulmaceae	0.54	2.02	0.74	3.30	—-	—-	—-	—-
46	*Homalium nepaulense*	Flacourtiaceae	—-	—-	—-	—-	1.52	1.39	1.06	3.97
47	*Hymenodictyon orixense*	Rubiaceae	0.73	1.01	0.68	2.42	—-	—-	—-	—-
48	*Ixora pavetta*	Rubiaceae	0.18	1.01	0.01	1.20	—-	—-	—-	—-
49	*Kydia calycina*	Malvaceae	3.27	2.02	2.07	7.36	3.04	1.39	2.45	6.88
50	*Lagerstroemia parviflora*	Lythraceae	0.91	1.01	0.84	2.76	—-	—-	—-	—-
51	*Lannea coromandelica*	Anacardiaceae	5.63	2.02	7.38	15.02	2.61	1.39	2.41	6.41
52	*Litsea glutinosa*	Lauraceae	—-	—-	—-	—-	1.30	1.39	0.69	3.39

Table 1. *Contiued ...*

S. No.	Species Name	Family	Site-1				Site-2			
			RD	RF	RBA	IVI	RD	RF	RBA	IVI
53	*Limonia acidissima*	Rutaceae	0.36	1.01	0.35	1.72	—-	—-	—-	—-
54	*Macaranga peltata*	Euphorbiaceae	1.81	1.01	1.47	4.30	3.04	2.78	2.59	8.41
55	*Madhuca longifolia*	Sapotaceae	—-	—-	—-	—-	1.30	1.39	0.58	3.27
56	*Madhuca indica*	Sapotaceae	0.18	1.01	0.35	1.54	—-	—-	—-	—-
57	*Mallotus philippensis*	Euphorbiaceae	7.08	2.02	3.11	12.21	4.78	2.78	5.09	12.65
58	*Mangifera indica*	Anacardiaceae	0.54	1.01	6.72	8.28	0.22	1.39	0.06	1.66
59	*Michelia champaca*	Magnoliaceae	—-	—-	—-	—-	0.43	1.39	6.33	8.15
60	*Miliusa tomentosa*	Annonaceae	0.18	1.01	0.14	1.33	0.43	1.39	6.33	8.15
61	*Mitragyna parvifolia*	Rubiaceae	1.45	1.01	3.50	5.97	—-	—-	—-	—-
62	*Mimusops elengi*	Sapotaceae	—-	—-	—-	—-	0.22	1.39	0.02	1.63
63	*Mitragyna parvifolia*	Rubiaceae	—-	—-	—-	—-	1.09	1.39	0.76	3.24
64	*Naringi crenulata*	Rutaceae	0.36	2.02	0.25	2.64	—-	—-	—-	—-
65	*Nyctanthes arbortristis*	Oleaceae	1.45	1.01	0.27	2.73	—-	—-	—-	—-
66	*Oroxylum indicum*	Bignoniaceae	0.54	2.02	0.08	2.65	—-	—-	—-	—-
67	*Ougeinia oojeinensis*	Fabaceae	0.18	1.01	0.82	2.01	—-	—-	—-	—-
68	*Phyllanthus emblica*	Euphorbiaceae	0.73	1.01	0.15	1.88	—-	—-	—-	—-
69	*Polyalthia cerasoides*	Annonaceae	0.36	1.01	0.09	1.46	—-	—-	—-	—-
70	*Pongamia pinnata*	Fabaceae	0.36	1.01	0.65	2.02	0.65	1.39	0.44	2.48
71	*Premna tomentosa*	Verbenaceae	0.54	1.01	0.62	2.18				
72	*Protium serratum*	Burseraceae	0.54	1.01	0.34	1.90	5.65	2.78	5.93	14.36
73	*Pterospermum xylocarpum*	Sterculiaceae	3.99	2.02	2.54	8.56	—-	—-	—-	—-
74	*Schleichera oleosa*	Sapindaceae	2.90	2.02	3.13	8.06	2.83	2.78	2.62	8.23
75	*Sterculia urens*	Sterculiaceae	—-	—-	—-	—-	1.52	1.39	0.91	3.82
76	*Schrebera swietenoides*	Oleaceae	1.63	2.02	1.53	5.18	—-	—-	—-	—-
77	*Semecarpus anacardium*	Anacardiaceae	1.27	1.01	1.35	3.63	—-	—-	—-	—-
78	*Sterculia urens*	Sterculiaceae	1.27	1.01	0.39	2.67	—-	—-	—-	—-
79	*Stereospemum personatum*	Bignoniaceae	0.18	1.01	0.48	1.67	—-	—-	—-	—-
80	*Strychnos nuxvomica*	Loganiaceae	2.18	2.02	1.31	5.51	—-	—-	—-	—-
81	*Strychnos potatorum*	Loganiaceae	0.36	1.01	0.18	1.55	—-	—-	—-	—-
82	*Syzygium cumini*	Myrtaceae	0.36	1.01	0.74	2.12	2.83	2.78	5.99	11.59
83	*Tamarindus indica*	Caesalpiniaceae	2.00	2.02	10.16	14.17	0.65	1.39	0.98	3.03
84	*Terminalia alata*	Combretaceae	0.36	1.01	0.60	1.97	1.74	1.39	1.39	4.52
85	*Terminalia arjuna*	Combretaceae	0.36	1.01	1.29	2.66				
86	*Terminalia bellirica*	Combretaceae	0.54	1.01	1.19	2.75	3.26	2.78	3.82	9.86
87	*Toona ciliata*	Meliaceae	—-	—-	—-	—-	3.70	1.39	3.02	8.10
88	*Trema orientalis*	Ulmaceae	—-	—-	—-	—-	1.30	1.39	1.37	4.06
89	*Trichilia connaroides*	Meliaceae	2.00	1.01	0.51	3.52	—-	—-	—-	—-
90	*Wrightia arborea*	Apocynaceae	0.54	2.02	0.21	2.77	—-	—-	—-	—-
91	*Wrightia tinctoria*	Apocynaceae	3.27	2.02	0.84	6.13	3.91	2.78	1.77	8.46
92	*Xylia xylocarpa*	Mimosaceae	5.63	2.02	6.18	13.82	—-	—-	—-	—-
		Total	100.00	100.00	100.00	300.00	100.00	100.00	100.00	300.00

Relative Density (RD), Relative Frequency (RF), Relative Basal area (RBA), Important Value Index (IV

based on objective of the study. The vegetation in the groves consists of different tree species. The economic analysis of sacred plants species consists of medicinal, edible and other potentiality of plants in the groves.

When compared to other dry deciduous forests, the study's findings showed that the reserve forest of the Alluri Sitarama Raju district have good species richness, variety, dominance, and stand density, and the calculation of IVI has helped in understanding the ecological value of species. The local population frequently uses trees, which has led to biodiversity loss, which is typically accompanied by species extinction and a decline in biodiversity. So it needs a sustainable conservation since it harbours most of the threatened, rare and endangered species

in some core forest pockets.

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