

Tree diversity in the Borra Sacred Groves of Anathagiri in Visakhapatnam District, Andhra Pradesh, India

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Abstract

Original Research Article

Sacred groves are tracts of virgin forest with rich biodiversity, as they have been protected for centuries by the local people for their cultural and religious beliefs and taboos. Sacred groves are representatives of climax vegetation and exhibit diversity of species such as trees, climbers and other shade loving herbs. In the present investigation, an attempt was made to study the tree diversity of a sacred grove of Borra, Visakhapatnam District, which comes under the Eastern Ghats of India. A total of 31 species, 28 genera and 20 families were reported in the sacred grove.

Keywords: Tree diversity, borra sacred groves, anthagiri, Visakhapatnam district.

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INTRODUCTION

Sacred groves are patches of native vegetation traditionally protected by local communities, and are unique, and significant, examples of *in situ* biodiversity conservation (Sunitha & Rao 1999; Upadhaya *et al.*, 2003). 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 & 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. India is believed to have nearly 14,000 sacred groves spread among different states.

The sacred groves in Andhra Pradesh are known as Pavithranams. A total number of 730 sacred groves have been documented till date. These Pavithranams or sacred groves are dedicated to various local deities and also to Hindu gods and goddesses. Some of the deities to whom the sacred groves are dedicated are Shiva, Rudrakoteswara, Hanuman, Saraswathi, Thimmaraya Swamy, Gangamma, Nagadevatha and Akkamma (WWF Andhra Pradesh, 1996). Sacred groves in Andhra Pradesh are deteriorating at an alarming rate due to changes in religious beliefs and developmental pressures. Many temples associated with sacred groves have been modernized by removing the vegetation. Some of the species commonly found in the sacred groves of Andhra

Pradesh are black plum, tamarind, mango, jackfruit, neem, beechwood and pipal.

In Andhra Pradesh some investigators (Lakshminarayana *et al.*, 1998; Ravi Prasada Rao *et al.*, 2011; S.K.M Basha, 2012, Savithamma *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 also.

STUDY AREA

Borra caves sacred grove is located in Anantagiri Mandal and Sunkarimetta Reserved Forest, is one of the rich biodiversity areas in the Eastern Ghats of India. It falls in the State of Andhra Pradesh. William King, the British geologist discovered the cave in 1807. It is a naturally formed cave believed to be 150 million years old. It lies between 18°16'50.50" North latitude and 83° 2'21.43" East longitude and at an altitude ranging from 800 to 926 m. The vegetation type is mixed dry deciduous with semi evergreen species. The name of local god is sivalingam is located inside the caves and local festival is holding during sivarathri.

MATERIAL METHODS

Phytosociological studies were carried out during year 2017-2018 at Anathagiri Mandal, Borra Sacred Grove, Visakhapatnam District, Andhra Pradesh.

The following phytosociological parameters were undertaken for the study. Density, Relative Density, Frequency, Relative Frequency, Abundance, Relative Dominance, IVI (Importance Value Index). IVI is the sum total 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 & 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 & Fischer 1915–1936), Flora of Visakhapatnam District (Rao & Kumari 2002–2008), and Flora of Vizianagaram District (Venkaiah 2004). The voucher specimens were deposited at the Botany Department Herbarium (BDH), Andhra University, Visakhapatnam.

RESULT AND DISCUSSION

The type of vegetation is mixed dry deciduous forest. It has 31 species, 28 genera and 20 families with 59 stems per 0.5 ha⁻¹. The total basal area of this site is 4.080346912 m² ha⁻¹, with a maximum contribution by girth classes 61-90cm and >150cm). Basal area and tree density are correlated against each other (Fig 1), the stand density is more for small stemmed individuals (31-60cm) and (61-90cm).

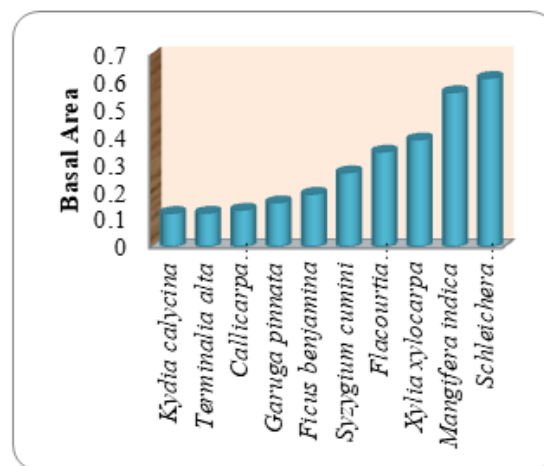


Fig 1: Top Ten Basal Area in Site

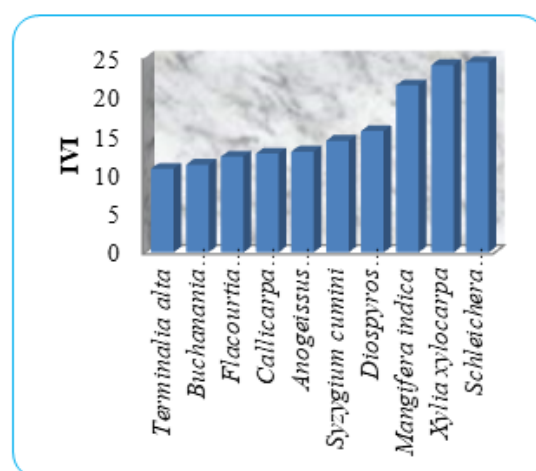


Fig 2: Top Ten IVI Species in Site

Table 1: Important Value Index (IVI) of Borra Sacred Grove

S. NO	Name of the plants	Family	T 1	T 2	T NI	D	F	BA	RD	RF	RBA	IVI
1	<i>Anogeissus latifolia</i>	Combretaceae	2	2	4	2	100	0.073798 536	6.77966 102	4.3478 2609	1.80863 386	12.936 12097
2	<i>Artocarpus heterophyllus</i>	Moraceae	0	1	1	0.5	50	0.050922 979	1.69491 525	2.1739 1304	1.24800 612	5.1168 34413
3	<i>Bauhinia racemosa</i>	Caesalpiniaceae	1	0	1	0.5	50	0.049657 861	1.69491 525	2.1739 1304	1.21700 096	5.0858 29256
4	<i>Buchanania lanzan</i>	Anacardiaceae	2	1	3	1.5	100	0.074681 731	5.08474 576	4.3478 2609	1.83027 896	11.262 85081
5	<i>Callicarpa tomentosa</i>	Verbenaceae	1	2	3	1.5	100	0.133585 296	5.08474 576	4.3478 2609	3.27387 104	12.706 44289
6	<i>Canthium dicoccum</i>	Rubiaceae	1	0	1	0.5	50	0.024069 064	1.69491 525	2.1739 1304	0.58987 788	4.4587 06181
7	<i>Cleistanthus collinus</i>	Euphorbiaceae	0	1	1	0.5	50	0.009197 963	1.69491 525	2.1739 1304	0.22542 11	4.0942 494
8	<i>Diospyros Montana</i>	Ebenaceae	2	3	5	2.5	100	0.112579 567	8.47457 627	4.3478 2609	2.75906 852	15.581 47087
9	<i>Ficus semicordata</i>	Moraceae	1	0	1	0.5	50	0.064449 395	1.69491 525	2.1739 1304	1.57950 773	5.4483 36031
10	<i>Ficus benjamina</i>	Moraceae	0	1	1	0.5	50	0.191160 089	1.69491 525	2.1739 1304	4.68489 795	8.5537 26252
11	<i>Firmiana colorata</i>	Sterculiaceae	1	1	2	1	100	0.114576 703	3.38983 051	4.3478 2609	2.80801 377	10.545 67036
12	<i>Flacourtia jangomas</i>	Flacourtiaceae	1	0	1	0.5	50	0.344525 78	1.69491 525	2.1739 1304	8.44354 138	12.312 36968

13	<i>Gardenia latifolia</i>	Rubiaceae	1	0	1	0.5	50	0.050922 979	1.69491 525	2.1739 1304	1.24800 612	5.1168 34413
14	<i>Garuga pinnata</i>	Burseraceae	0	1	1	0.5	50	0.160534 691	1.69491 525	2.1739 1304	3.93433 927	7.8031 6757
15	<i>Grewia tiliifolia</i>	Tiliaceae	1	0	1	0.5	50	0.064449 395	1.69491 525	2.1739 1304	1.57950 773	5.4483 36031
16	<i>Kydia calycina</i>	Malvaceae	1	1	2	1	100	0.121873 011	3.38983 051	4.3478 2609	2.98682 964	10.724 48624
17	<i>Mallotus philippensis</i>	Euphorbiaceae	1	1	2	1	100	0.049021 324	3.38983 051	4.3478 2609	1.20140 089	8.9390 57483
18	<i>Mangifera indica</i>	Anacardiaceae	1	1	2	1	100	0.560351 687	3.38983 051	4.3478 2609	13.7329 423	21.470 59889
19	<i>Murraya paniculata</i>	Rutaceae	2	0	2	1	50	0.025310 312	3.38983 051	2.1739 1304	0.62029 804	6.1840 41594
20	<i>Naringi crenulata</i>	Rutaceae	0	1	1	0.5	50	0.023201 782	1.69491 525	2.1739 1304	0.56862 278	4.4374 51077
21	<i>Phyllanthus emblica</i>	Euphorbiaceae	1	1	2	1	100	0.089910 885	3.38983 051	4.3478 2609	2.20351 08	9.9411 67398
22	<i>Protium serratum</i>	Burseraceae	1	1	2	1	100	0.108983 132	3.38983 051	4.3478 2609	2.67092 809	10.408 58469
23	<i>Pterocarpus marsupium</i>	Fabaceae	0	1	1	0.5	50	0.071809 357	1.69491 525	2.1739 1304	1.75988 362	5.6287 11919
24	<i>Schleichera oleosa</i>	Sapindaceae	1	2	3	1.5	100	0.612070 337	5.08474 576	4.3478 2609	15.0004 485	24.433 02035
25	<i>Stereospermum personatum</i>	Bignoniaceae	1	0	1	0.5	50	0.016112 349	1.69491 525	2.1739 1304	0.39487 694	4.2637 05237
26	<i>Syzygium cumini</i>	Myrtaceae	1	1	2	1	100	0.269334 819	3.38983 051	4.3478 2609	6.60078 236	14.338 43895
27	<i>Terminalia alta</i>	Combretaceae	1	1	2	1	100	0.122740 293	3.38983 051	4.3478 2609	3.00808 474	10.745 74134
28	<i>Terminalia arjuna</i>	Combretaceae	0	1	1	0.5	50	0.045957 989	1.69491 525	2.1739 1304	1.12632 553	4.9951 53828
29	<i>Terminalia chebula</i>	Combretaceae	1	0	1	0.5	50	0.024069 064	1.69491 525	2.1739 1304	0.58987 788	4.4587 06181
30	<i>Wrightia tinctoria</i>	Apocynaceae	1	1	2	1	100	0.031516 55	3.38983 051	4.3478 2609	0.77239 879	8.5100 55381
31	<i>Xylia xylocarpa</i>	Mimosaceae	3	3	6	3	100	0.388971 992	10.1694 915	4.3478 2609	9.53281 67	24.050 13432
	Total		30	29	59	29.5	2300	4.080346 912	100	100	100	300
	TNI = Total Number of individuals		IVI = Important Value Index					D= Density		F= Frequency		

The IVI of ten most species represent 53% and top ten species of IVI value is shown in Fig-2. Predominant tree is *Schleichera oleosa* and *Xylia xylocarpa* and dominant trees are *Mangifera indica*, *Diospyros montana*, *Syzygium cumini*, *Anogeissus latifolia* and *Callicarpa tomentosa*. The Shannon index is 3.262, Simpson index is 0.9543, Evenness index is 0.8423 and Menhinick index is 4.036. Among the 20 observed families, Combretaceae with 4 species Euphorbiaceae and Moraceae with 3species each, Anacardiaceae, Burseraceae, Rubiaceae and Rutaceae with 2 species each. In the present forest study sites species richness is correlated with taxonomical studies, most of the trees show random distribution and was lowered when compared that of 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, 1997) 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

Proper education should be provided to the people addressing about the need for conserving sacred groves. In the settlement areas, fencing the grove would help in reducing grazing and other human intervention especially, encroaching the grove area. Reforestation of groves by planting native plant species or species similar to that in the nearby groves, may help the survival and growth of many species. Constant grazing, extraction of fuel wood, collection of medicinal plants and non timber forest products causes the degradation of various rare and threatened plants in the sacred grove. This kind of

degraded sacred grove should be immediately restored or regenerated using appropriate technologies and by creating awareness about the significance of sacred groves in the maintenance of biodiversity. Therefore, it is important to take appropriate measures and protect such ecologically important groves.

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