



Floral Diversity Conservation through Sacred Groves in Koraput District, Odisha, India: A Case Study

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Abstract

The tribal dominated Koraput district of Odisha has rich tradition of nature conservation through cultural and religious practices. Though maximum number of sacred groves has been reported from Koraput, there is hardly any scientific documentation of plant species in them. The present study has documented floral diversity and uses of 94 sacred plant species distributed in 63 genera belonging to 43 different families from 6 different sacred groves in a systematic manner. Most of the plant species are distributed under *Caesalpiniaceae* followed by *Asteraceae* and *Combretaceae*. The plant species are distributed in 48 trees, 26 shrubs and 21 herbs. Many of the plant species are used as herbal medicines (39%) by the tribals followed by religious importance (23 %), and food (13 %) plants. Some existing threats related to the sacred groves as well as plants under threat categories have also been recorded. While only plant species *Pterocarpus santalinus* comes under IUCN endangered category and 3 species of plants *Shorea robusta*, *Buchanania lanzan* and *Woodfordia fruticosa* comes under low risk and least concern categories whereas 6 species are under least concern category. The plants under vulnerable categories are *Ageratum conyzoides*, *Dalbergia latifolia*, *Delonix regia*, *Pterocarpus marsupium*, *Santalum album* and *Saraca asoca*. Thus, for assessing the ecological role of sacred groves and formulating strategies for their conservation, a holistic understanding of their structure and function as well as their current status is essential.

Keywords: Biodiversity conservation, herbal medicines, floral diversity, sacred groves.

Introduction

Sacred groves are tracts of virgin forest harbouring rich biodiversity and are protected by local communities to keep them in a relatively undisturbed state¹. These are the small patches of relic forest, protected by local communities on religious ground, which are the traditional Indian way of *in situ* conservation of biodiversity². Various indigenous communities dedicate sacred groves to the local deities or ancestral spirits. Such a grove may consist of a multi-species, multi-tier primary forest or a cluster of trees, depending on the history of the vegetation. These groves were protected by local communities, usually through customary taboos and sanctions with cultural and ecological implications¹.

Many rare and endemic wild plant species having potential benefit to man in medicine, agriculture and industry have been preserved in sacred groves. Sacred groves are the good source of a variety of medicinal plants, fruits, fodder, fuel wood, spices, etc.^{3,4}. In India, the sacred groves were reported earlier from the Himalayas, North-east India, highlands of Bihar, Orissa, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala, particularly where the indigenous communities live. The floristic and ethno-botanical aspects of sacred groves in India has been dealt by earlier workers^{4,9}. Several plants and animals that are threatened in the forest are still well conserved in some of the sacred groves. It has been observed that several medicinal plants that are not to be found in

the forest are abundant in the sacred groves. Further, rare, endangered, threatened and endemic species are often concentrated in sacred groves. The sacredness, religious beliefs and taboos play a significant role in promoting sustainable utilization and conservation of flora and fauna of the region. However, with the passage of time, considerable changes have taken place in the extent of the sacred groves, in their vegetation structure, peoples' perception towards them.

Koraput district of Odisha, India is the home for a number of tribal communities and all have their own culture, customs, traditions and practices in connection with the rituals of their life cycle. The religious beliefs of the tribals are specific to each group. Among most of the tribes, the deities are believed to reside in sacred groves and even the village goddesses are worshiped under a tree at the outskirts of the village. They show utmost respect to these places and preserve them like precious treasure¹⁰.

The maximum number, 322 sacred groves, were recorded from Semiliguda block of Koraput district⁸. The biodiversity studies of sacred groves of Koraput district by earlier workers are incomplete and scanty and there is a lack of systematic study on floral diversity and its importance of sacred groves. Keeping in view of above points, the present paper deals with the systematic study on floral diversity and its importance of some selected sacred groves of Koraput, Odisha.

Material and Methods

An ethno-botanical exploration was made to find out the floristic diversity and the importance of some selected sacred groves of Koraput Forest Division (Odisha) during 2013-14. Field studies were undertaken in different sacred groves of Koraput during this period (figure-1).

Study site: Koraput is the Southernmost district of Odisha lies between 18° 14' to 19° 14' N latitude and 82° 05' to 83° 25' E longitude with a total geographical area of 8, 807 sq. km (accounting 5.38% of Odisha state), Physiographically it is contiguous to the main land of Eastern Ghat, High land zone and South-Eastern Ghat zone¹¹. The general topography varies from plain lands to high hills, with elevation gradients of 300m; to 1000m; above mean sea level. The highest mountain peak of Odisha i.e. Deomali (1672m) lies in this district. The predominant soil type of the entire district is sandy and clay. The area is characterized by tropical to sub-tropical climate. Four distinct seasons are generally experienced here. Koraput receives an annual rainfall of 1500 mm. High humidity is experienced especially in monsoon and post monsoon months.

Observation, documentations and plant identification: Floral diversity observations were carried out in six selected sacred groves of Koraput with documentation on the history, size and location of the grove, rituals performed in the groves and GPS

readings were taken for each site. Ethno-botanical information was gathered through oral interviews of the local people, especially older persons. All gathered information was cross-checked with people of other villages and other individuals practicing in or near the locality in which the plant materials were collected. Also, comparison was made between the information provided by the people and the available literature. The plants were identified as per flora of Orissa by Saxsena and Brahumam¹². Efforts have been made to collect plants in flowering and fruiting condition and have been provisionally identified by consulting the regional floras. The unidentified plants were collected in polythene bags and taken into the laboratory and were identified with the help of herbarium of Regional Plant Resource Centre, Bhubaneswar, India.

Results and Discussion

Floral Diversity and Ethno-botany of sacred species: In the present study six sacred groves of Koraput Forest division were documented and the study indicated that these small forest patches of Sacred Groves play an important role in the conservation of biodiversity. Furthermore, natural sacred sites are maintained in a traditional way of life, as community based conservation, which does not require governmental involvement. The collected data on floral diversity and their ethno-botanical importance was presented in table 2, 3 and 4.

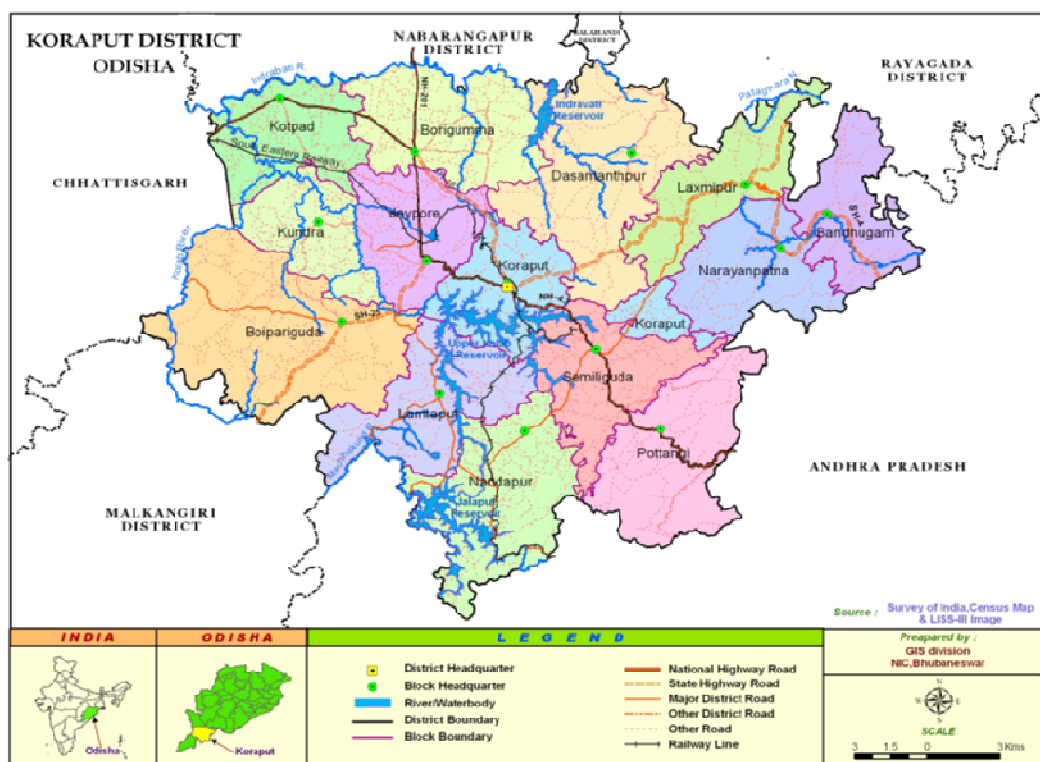


Figure-1
 Map of Study site (Koraput, Odisha, India)

Table-1
Selected sacred groves of Koraput for the study with location, area and the community associated with

SI No	Name of the Grove	Deity	Area (ha)	Location	Tribal Community
1	Alligam Sacred Groves	Ganga Maa	0.20	18 ^o 41'35.25" N to 82 ^o 54'43.65" E	Paraja
2	Maulimaa Sacred Grove	Maha Prabhu	0.19	18 ^o 41'01.94" N to 82 ^o 54'23.00" E	Mali and Adibasi
3	Bhairabguda Sacred Grove	Devi Bhairabi	0.12	18 ^o 31'42.75" N to 82 ^o 50'18.49" E	Paika, Dora and Mali tribe
4	Dudhari Sacred Grove	Shiba Dev	0.16	18 ^o 43'4.76" N to 82 ^o 57'5.06" E	Sundi, Mali, Paraja, Kandha and Paika
5	Mali Dusara Sacred Gove	Ganga Maa	0.12	18 ^o 37'22.70" N to 82 ^o 48'31.62" E	Paraja
6	Kanta Baunsuni Sacred Groves	Devi Kanta Baunsuni	1.61	18 ^o 45'21.37" N to 82 ^o 53'16.52" E	Gouda, Dombo, Gadaba, Paraja

Table-2
List of tree species distributed in different sacred groves (SG) of Koraput

SI No.	Name of the plant	Family	English Name	Importance	Presence in SG
1	<i>Acacia auriculiformis</i> Benth.	Mimosaceae	Acacia	Economical	3
2	<i>Acacia nilotica</i> L.	Mimosaceae	Babul tree	Economical	4, 6
3	<i>Aegle marmelos</i> L.	Rutaceae	Wood apple	Medicinal and religious	4, 6
4	<i>Albizia lebbeck</i> L.	Mimosaceae	Indian walnut	Economical	6
5	<i>Anacardium occidentale</i> L.	Moraceae	Cashew nut	Food	6
6	<i>Antiaria toxicaria</i> Lesch.	Moraceae	Sack tree	Medicinal and religious	6
7	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Jack fruit	Food	3, 4
8	<i>Azadiracta indica</i> L.	Meliaceae	Neem tree	Medicinal and religious	1, 4
9	<i>Bambusa bambos</i> L.	Poaceae	Thorny Bamboo	Religious	6
10	<i>Bambusa tulda</i> Roxb.	Poaceae	Bamboo	Religious	3
11	<i>Bombax ceiba</i> L.	Bombacaceae	Cotton tree	Economical	1, 2, 5
12	<i>Cascabela thevetia</i> L.	Apocyanaceae	Yello-oleander	Religious	3
13	<i>Cassia fistula</i> L.	Caesalpiniaceae	Purging Cassia	Economical	5, 6
14	<i>Cassia siamea</i> Lam.	Caesalpiniaceae	Kassod Tree	Economical	1, 3, 6
15	<i>Cipadessa baccifera</i> Roth.	Meliaceae	Ranabili	Food	4
16	<i>Delonix elata</i> L.	Caesalpinaceae	Goldmohur	Economical	5
17	<i>Delonix regia</i> Bojer ex Hook	Caesalpinaceae	Gulmohur	Economical	1, 6
18	<i>Diospyros malabarica</i> Desr.	Ebenaceae	Goub Persimmon	Religious	5
19	<i>Eucalyptus globules</i> Labill.	Myrtaceae	Eucalyptus	Economical	2
20	<i>Ficus benghalensis</i> L.	Moraceae	Banyan tree	Religious	4, 6
21	<i>Ficus racemosa</i> Roxb.	Moraceae	Cluster Fig Tree	Religious	2, 4
22	<i>Ficus religiosa</i> L.	Moraceae	Peepal tree	Religious	2,3, 4
23	<i>Grevilla robusta</i> Cunn.	Proteaceae	Silver oak	Religious	1
24	<i>Lagerstromic parviflora</i> L.	Lythraceae	Crape myrtle	Economical	5
25	<i>Lannea coromondelica</i> Houtt.	Anacardiaceae	Indian Ash tree	Medicinal	2
26	<i>Mangifera indica</i> L.	Anacardiaceae	Mango tree	Food	3, 4, 6
27	<i>Melia azedarach</i> L.	Meliaceae	Persian Lilac	Religious	1, 3, 6
28	<i>Michelia champaca</i> L.	Magnoliaceae	Champak tree	Religious	6
29	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Indian Goose berry	Religious	3
30	<i>Pithecellobium dulce</i> Roxb.	Mimosaceae	Quamachil	Medicinal	5
31	<i>Plumeria rubura</i> L.	Apocyanaceae	Temple tree	Religious	4

32	<i>Polyalthia longifolia</i> Sonn.	Annonaceae	Mast tree	Medicinal	6
33	<i>Pongamia pinnata</i> L.	Fabaceae	Indian beach	Medicinal	1, 4, 6
34	<i>Psidium guajave</i> L.	Myrtaceae	Common guava	Food	6
35	<i>Pterocarpus marsupium</i> Roxb.	Fabaceae	Indian kino tree	Economical	1, 4, 6
36	<i>Pterocarpus santalinus</i> L.	Fabaceae	Red sandal wood	Religious	5
37	<i>Schleichera oleosa</i> Lour.	Sapindaceae	Kusum tree	Medicinal	1, 2, 4
38	<i>Santalum album</i> L.	Santalaceae	Sandal plant	Religious	3, 4, 6
39	<i>Simarua glauca</i> DC.	Simaruaceae	Paradise tree	Economical	1, 2, 4, 6
40	<i>Shorea robusta</i> Roth.	Dipterocarpaceae	Sal tree	Religious	4
41	<i>Saraca asoca</i> Roxb.	Caesalpiniaceae	Ashoka tree	Religious	6
42	<i>Syzygium cumini</i> L.	Myrtaceae	Java palm	Food	2, 4, 5, 6
43	<i>Terminalia alata</i> Willd.	Combretaceae	Sian	Economical	1, 3, 4
44	<i>Terminalia arjuna</i> Roxb.	Combretaceae	Arjuna tree	Medicinal	4
45	<i>Terminalia belirica</i> Gaertn.	Combretaceae	Belericmyrobalan	Medicinal	1, 2
46	<i>Terminalia chebula</i> Retz.	Combretaceae	Chebolicmyrobalan	Medicinal	2, 4
47	<i>Tamarindus indica</i> L.	Caesalpiniaceae	Tamarind plant	Economical	3

1- Alligam Sacred Groves; 2- Maulimaa Sacred Grove; 3- Bhairabguda Sacred Grove; 4- Dudhari Sacred Grove; 5- Mali Dusara Sacred Gove; 6- Kanta Baunsuni Sacred Groves.

Table-3
List of shrub species distributed in different sacred groves (SG) of Koraput.

SI No.	Name of the plant	Family	English Name	Importance	Presence in SG
1	<i>Ageratum conyzoides</i> L.	Asteraceae	Goat weed	Medicinal	1, 3, 5, 6
2	<i>Anisomeles malabarica</i> L.	Lamiaceae	Malabar Catmint	Medicinal	6
3	<i>Aralia spinosa</i> L.	Araliaceae	Angelica-tree	Economical	6
4	<i>Buchanania lanzan</i> Spreng.	Anacardiaceae	Almondette	Medicinal	1
5	<i>Caesalpinia pulcherrima</i> L.	Caesalpiniaceae	Peacock flower	Medicinal	5, 6
6	<i>Calotropis gigantean</i> L.	Asclepiadaceae	Giant milk-weed	Medicinal	4, 6
7	<i>Calycopetris floribunda</i> Roxb.	Combretaceae	Ukshi	Medicinal	6
8	<i>Cascabela thevetia</i> L.	Apocyanaceae	Yello-oleander	Religious	4
9	<i>Cassia tora</i> L.	Caesalpiniaceae	Sickle Pod	Medicinal	3, 5, 6
10	<i>Citrus aurantifolia</i> Christm.	Rutaceae	Lime	Medicinal	2
11	<i>Colocasia esculenta</i> L.	Araceae	Elephant ear taro	Food	6
12	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Potato yam	Food	3, 4
13	<i>Dioscorea tomentosa</i> L.	Dioscoreaceae	Koening exspreng	food	6
14	<i>Holarrhena pubescens</i> L.	Apocyanaceae	Indrajao	Ornamental	1
15	<i>Hibiscus mutabilis</i> L.	Malvaceae	Chinese rose	Ornamental	6
16	<i>Hibiscus rosa sinensis</i> L.	Malvaceae	Shoe flower	Ornamental	6
17	<i>Jasminum arborescens</i> Roxb.	Oleaceae	Tree jasmine	Ornamental	2, 5
18	<i>Lantana camara</i> L.	Verbenaceae	Wild sage	Medicinal	1, 4, 6
19	<i>Murraya koenigii</i> L.	Rutaceae	Curry Leaf Tree	Medicinal	1, 4, 6
20	<i>Naringi crenulata</i> Roxb.	Rutaceae	<i>Naringi</i>	Medicinal	4, 5
21	<i>Parthenium hysterophorus</i> L.	Asteraceae	Whiteweed	Medicinal	1, 6
22	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Amla	Medicinal	1
23	<i>Rauwolfia serpentine</i> L.	Apocynaceae	Serpentine root	Medicinal	4, 6
24	<i>Stachytarpheta jamaicensis</i> L.	Verbenaceae	Brazilian Tea	Medicinal	4
25	<i>Vitex leucoxydon</i> L.F.	Verbenaceae	Chaste tree	Food	4
26	<i>Woodfordia fruticosa</i> L.	Lythraceae	Fire flame bush	Medicinal	6

1- Alligam Sacred Groves; 2- Maulimaa Sacred Grove; 3- Bhairabguda Sacred Grove; 4- Dudhari Sacred Grove; 5- Mali Dusara Sacred Gove; 6- Kanta Baunsuni Sacred Groves.

Table-4
List of herb species distributed in different sacred groves (SG) of Koraput

Sl No.	Name of the plant	Family	English Name	Importance	Presence in SG
1	<i>Achyranthes aspera</i> L.	Amaranthaceae	Prickly Chaff flower	Medicinal	6
2	<i>Asparagus racemosus</i> Willd.	Liliaceae	Satabari	Medicinal	4, 6
3	<i>Bauhinia vahlii</i> Wight & Arn.	Caesalpiniaceae	Camel's foot	Economical	5
4	<i>Begonia</i> spp.	<u>Begoniaceae</u>	<i>Begonia</i>	Ornamental	6
5	<i>Biden pilosa</i> L.	Asteraceae	Spanish needle	Medicinal	4, 6
6	<i>Blumea lacera</i> L.	Asteraceae	Kakronda	Medicinal	6
7	<i>Centella asiatica</i> L.	Apiaceae	Indian Penny wart	Medicinal	4, 6
8	<i>Chrysopogon aciculatus</i> Retz.	Poaceae	Golden bread grass	Medicinal	3, 4
9	<i>Cissampelos pareira</i> L.	Menispermaceae	False Pereira Brava	Medicinal	4
10	<i>Curcuma aromatic</i> Salisb.	Zingiberaceae	Wild turmeric	Medicinal	4
11	<i>Cynodon dactylon</i> L.	Poaceae	Bermuda grass	Medicinal	4, 6
12	<i>Dactyloctenium aegyptium</i> L.	Poaceae	crowfoot grass	Food	4
13	<i>Dianella congesta</i> R.Br.	Liliaceae	Lily	Ornamental	6
14	<i>Dryopteris erythrosora</i> D.C.Eaton	Dryopteridaceae	Dryopteris	Ornamental	4
15	<i>Laportea interrupta</i> L.	Utricaceae	Hen's Nettle	Medicinal	4
16	<i>Marselia minuta</i> L.	Marsileaceae	Dwarf Water Clover	Food	3, 6
17	<i>Mimosa pudica</i> L.	Mimosaceae	touch me not	Medicinal	4
18	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Four o'clock plant	Ornamental	6
19	<i>Ocimum sanctum</i> L.	Laminaceae	Sacred basil	Religious and medicinal	3, 4
20	<i>Sida rhombifolia</i> L.	Malvaceae	jelly lea	Medicinal	6
21	<i>Tridax procumbens</i> L.	Asteraceae	Coat button	Medicinal	5

1- Alligam Sacred Groves; 2- Maulimaa Sacred Grove; 3- Bhairabguda Sacred Grove; 4- Dudhari Sacred Grove; 5- Mali Dusara Sacred Gove; 6- Kanta Baunsuni Sacred Groves.

Based on the reconnaissance survey of above selected sacred groves of Koraput revealed that there are 94 plant species distributed in 63 genera belonging to 43 different families (table 2, 3 and 4). In most of the sacred groves the first story of vegetation mainly consists of *Azadiracta indica*, *Ficus racemosa*, *Ficus religiosa*, *Bombax ceiba*, *Artocarpus sheterophullus*, *Mangifera indica*, *Diospyros malabarica*, *Acacia nilotica*, *Pterocarpus marsupiums* etc. The second story mainly consists of *Syzygium cumini*, *Cassia siamea*, *Melia azedarac*, *Pterocarpus marsupium*, *Cassia siamea*, *Lannea coromondelica*, *Terminalia belirica* and *Phyllanthus emblica*. The ground layers mainly contain the herbaceous plants and climbers. Most of the sacred species comes under the Caesalpiniaceae followed by Asteraceae and Combretaceae (figure-2). The sacred plants are distributed in 48 trees, 26 shrubs and 21 herbs. From the interaction with local inhabitants the importance of sacred plants have been documented and presented in figure-3. Among the plants documented, higher percentage of plants are used as herbal medicines (39%),

followed by religious importance (23%), food (13%), economical (17%) and ornamental (7 %) purposes. The plants like *Terminalia belirica*, *Achyranthus aspera*, *Citrus aurantifolia*, *Buchanania lanzan*, *Caesalpinia pulcherrima*, *Calotropis gigantea*, *Calycopetris floribunda* and *Lannea coromondelica*, are commonly used as herbal medicines. Most of the sacred tree species are of religious importance and the plants like *Ficus benghalensis*, *Ficus racemosa*, *Ficus religiosa*, *Grevilla robusta*, *Bambusa bambos*, *Bambusa tulda*, *Artocarpus sheterophullus*, *Mangifera indica*, *Phyllanthus emblica* are the major trees species which are worshiped by the tribal's and remain conserved as these have remain uncut since many years in the groves. The present study reveals that sacred groves of the Koraput are endowed with a large number of medicinal plants. In fact sacred groves represent a good model of *in situ* conservation of biodiversity and act as the gene pool of a variety of important species. The proper identification of medicinal plants has a vital role in their sustainable utilization and conservation in the groves as well as in forest^{13,14}.

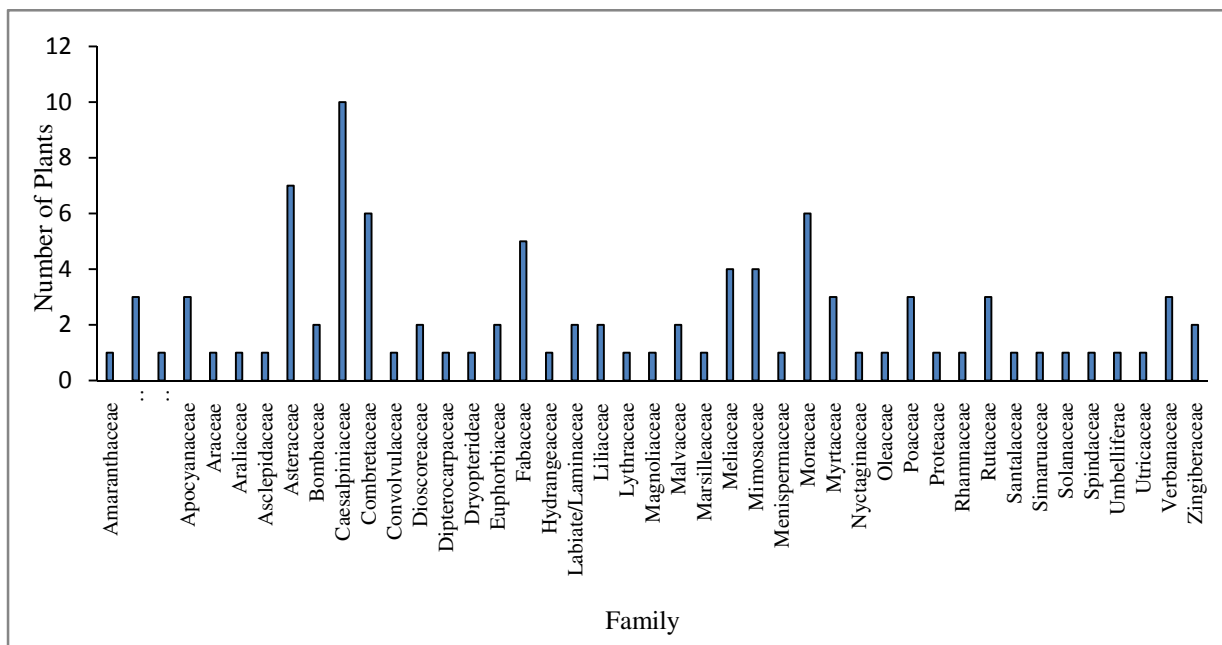


Figure-2
 Distribution of plants according to their family in different sacred groves of Koraput

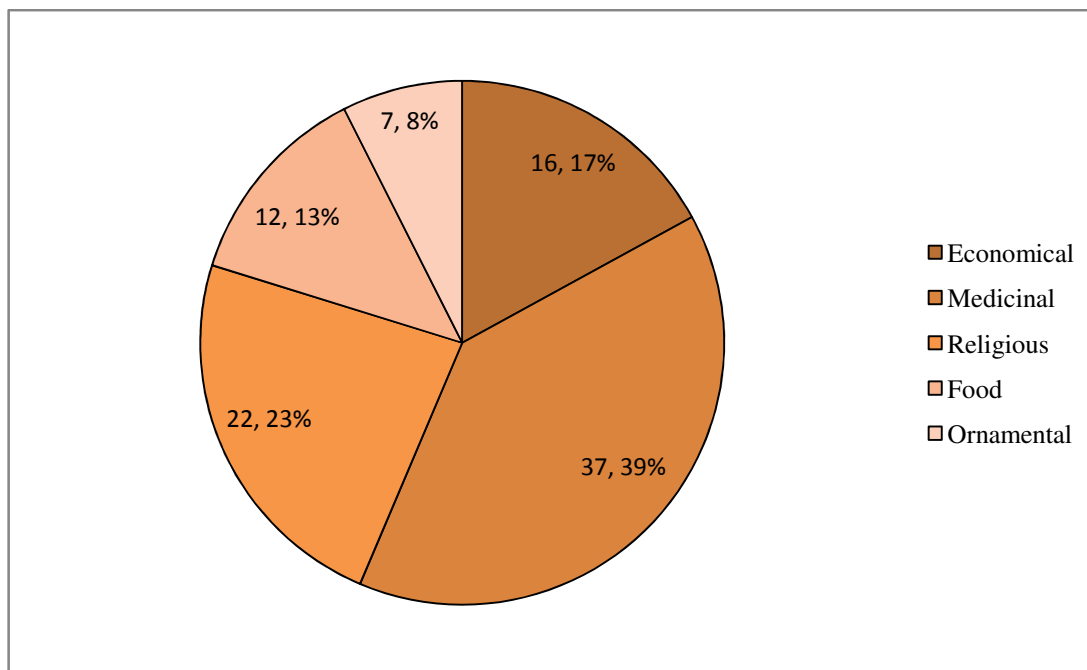


Figure-3
 Different uses of plants present in different sacred groves of Koraput and their importance

The depletion of biodiversity has been considered as one of the most conspicuous effects of ecosystem perturbation. Disappearance of species due to habitat alteration, over exploitation, pollution, global climate change and invasion of exotic species is so fast that many valuable taxa may vanish even before they are identified and their scientific value is discovered. In the present study only plant *Pterocarpus*

santalinus comes under IUCN endangered category and 3 plants *Shorea robusta*, *Buchanania lanzan* and *Woodfordia fruticosa* come under low risk and 6 species are found in least concern (table 5) category. The plants of the sacred groves comes under vulnerable categories are *Ageratum conyzoides*, *Dalbergia latifolia*, *Delonix regia*, *Pterocarpus marsupium*, *Santalum album* and *Saraca asoca*.

Table-5
List of Plants in IUCN categories present in the sacred groves of Koraput.

Sl. No	Name of the plant	IUCN Status
1	<i>Acacia auriculiformis</i> A. Cunn.	Least concern
2	<i>Ageratum conyzoides</i> L.	Vulnerable
3	<i>Bauhinia purpurea</i> L.	Least concern
4	<i>Buchanania lanzan</i> Spreng.	Low risk/Least concern
5	<i>Centella asiatica</i> L.	Least concern
6	<i>Colocasia esculenta</i> L.	Least concern
7	<i>Dalbergia latifolia</i> Roxb.	Vulnerable
8	<i>Delonix regia</i> Boj.	Vulnerable
9	<i>Marsilia minuta</i> L.	Least Concern
10	<i>Mimosa pudica</i> L.	Least concern
11	<i>Pterocarpus marsupium</i> Roxburgh.	Vulnerable
12	<i>Pterocarpus santalinus</i> L.f.	Endangered
13	<i>Santalum album</i> L.	Vulnerable
14	<i>Shorea robusta</i> Roth.	Low risk/List concern
15	<i>Saraca asoca</i> Roxb.	Vulnerable
16	<i>Woodfordia fruticosa</i> L.	Low risk/Least concern

Conclusion

Koraput is blessed with rich and diverse cultural heritage associated with sacred species of plants in sacred groves. These sacred groves not only enhance the economic status of the local tribal communities but also safeguard the germplasm wealth *in situ*, which are in the verge of elimination. Though enough research has not been made on the sacred groves of Koraput, today the conservation practices of the tribals in Koraput has played an important role as valuable store house of biodiversity containing innumerable kinds of endemic and endangered plants that have been conserved in these forests. The present information is helpful in formulating the conservation strategy of sacred groves by the government agencies and non government organisations and creating awareness among the local people for the conservation of biodiversity. Thus, for assessing the ecological role of sacred groves and formulating strategies for their conservation, a holistic understanding of their structure and function as well as their current status is essential.

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