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A Study on the Role of Sacred Groves in Conserving the Genetic Diversity of the Rare, Endangered and Threatened Species of Flora & Fauna of Chhattisgarh State (India)

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Abstract- Despite of extensive deforestation and land use changes in India, one of the most resilient features of the country's landscape is the temple or sacred forests. Because of their 'divine' protection, a number of tree species that have otherwise been heavily extracted from the forests continue to exist in the groves. However in recent years with the erosion of religious faith and encroachment of these sacred groves, there is a growing concern if the groves indeed can offer a refugium to the endemic and endangered species of the Chhattisgarh state. In this context, we examined the population genetic structure and genetic diversity of Chhattisgarh state, a canopy tree species in sacred groves of varying sizes.

Index Terms- Sacred Grove, Endemic, Endangered, Genetic Diversity, Refugium & Forest Fragmentation.

I. INTRODUCTION

'Sacred groves' are small patches of native vegetation traditionally protected and managed by local communities. In other words, sacred groves are the refuge of certain plant species preserved on religious grounds which can satisfy the aesthetic, scientific, cultural, and recreational needs of mankind (Bhakat, 1990). India ranks 10th in the list of most forested nations in the world with 76.87 million ha of the forest & tree cover i.e. 20.6 percent forest of the total geographical area of the country (ICFRE, 2013). The forests of India are estimated to contain about 5,00,000 of the 10 to 30 million species on earth (Gadgil, 1996). The country contains three of the mega diversity centers in the forests of Western Ghats, Eastern Himalayas and Indo-Burma. During the last three to four decades, increasing human pressures has to lead to severe land use changes. However, 'sacred groves' or sacred forests have remained resilient to extensive deforestation and land use changes. The sacred groves have played an important role in conserving the forest and its constituent biodiversity elements since ancient times. In recent years with the erosion of religious faith and encroachments of these sacred groves, there is a growing concern if the groves indeed can offer a refugium to the rare, endangered and endemic species. During the last one century the total area under the groves decreased substantially, due to fragmentation of the groves. Fragmentation of the groves has led to habitat disturbance and poor regeneration of many economically important species (Kushalappa and Bhagwat, 2001). The study was conducted to assess the genetic diversity of the species of flora & fauna across the fragment size & also assess if a set of small fragments harbor more genetic variation among themselves, than a set of large forest fragments.

II. STUDY SITE

The study was carried out in the forest fragments represented by sacred groves in Chhattisgarh state ($21^0$30' N latitude & $82^0$00' E longitude). It is estimated that over 44.6 percent of the geographical area of the state are under forest with much of the remaining area converted into paddy fields.

Tribals do not cut or damage the trees which are planted in sacred groves and their surrounding environment. Tribals perform various traditional religious rites and rituals inside these groves. Elderly tribal people have been found worshipping trees, small plants and animals in their sacred groves. A large number of social scientists and ethno- botanists have documented in their studies that tribals consider these sacred groves as an abode of their gods and goddesses whom they worship. Bhatla et al. (1984) have emphasized on the importance of plants which are traditionally worshipped in different parts of India. Pandey (1989) has described a number of sacred plants found in India and different religious rites being performed on them. Alcron (1996) emphasized the role of indigenous people in conservation of biodiversity. Godbole (1996) described the role of tribals in preservation sacred forests in India & has described these sacred groves which are found in India have religious importance and many species which are becoming rare and threatened due to deforestation are being conserved in such sacred groves. He further emphasized that these sacred groves play an important role for in-situ conservation of biological diversity.

III. METHODOLOGY

An ethno-botanical study has been conducted to record information on sacred groves existing in tribal pockets of Chhattisgarh State. The tribal communities were interviewed to collect information on existence of groves, plants and animals conserved their ethno- botanical information etc. The information was recorded from tribals who were of age group from 16 to 70 years and resided in villages of Chhattisgarh.

The study revealed that a large number of useful plants and animals are conserved by the tribals in sacred groves. Plants and animals conserved in sacred groves are documented with scientific name, local name, worshipped as symbol to local deity, along with their present status in IUCN Red lists in this paper and presented in Tables 1 & 2, respectively.

Figure No. 1: Structure of the New IUCN Categories

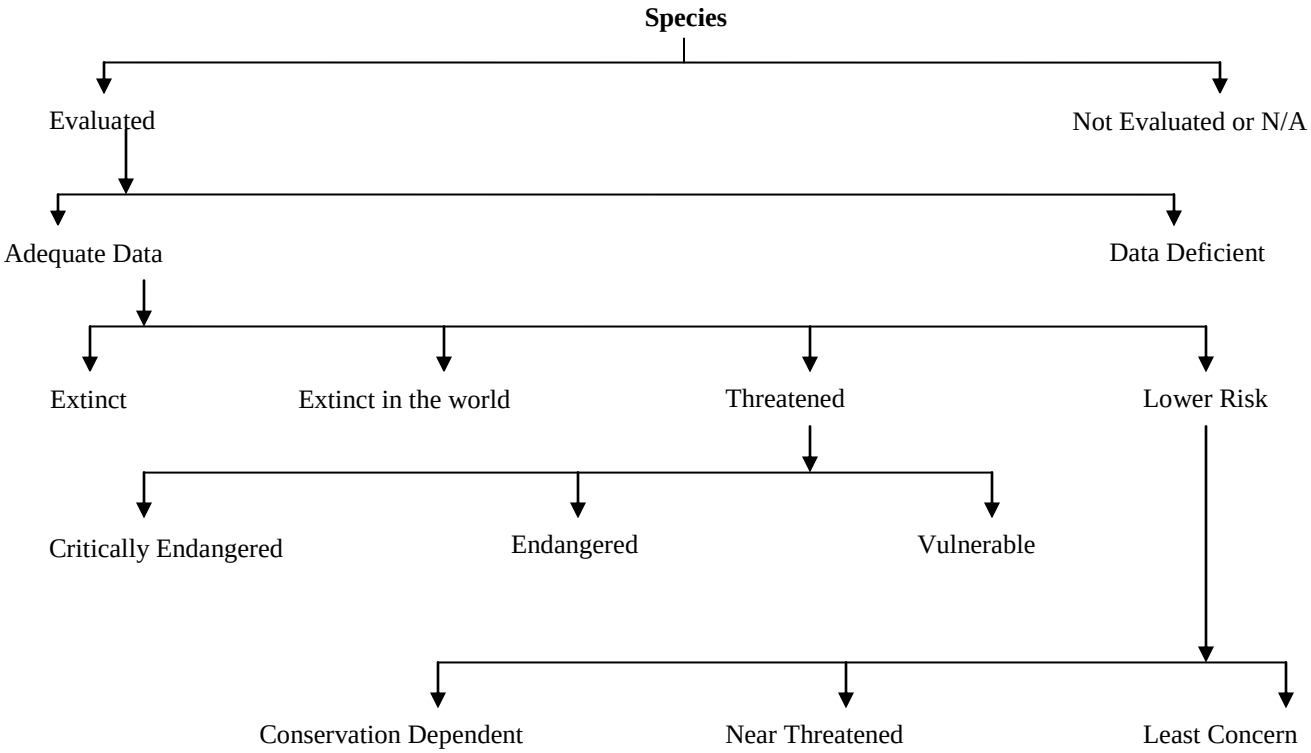

Table No. 1: Flora Associated With the God/Goddess and Other Unseen Powers:

S.No.	Trees/Plants	Botanical Name	Status	Associated with Gods/ Goddesses
1.	Akh	*Calotropis procera*	Threatened	Shiva, Fertility cult
2.	Amalaki/ Amla	*Emblica officinalis*	N/A	Laksmi, Kartik, Fertility cult
3.	Amaltas	*Cassia fistula*	N/A	Krishna, Vishnu, Fertility cult
4.	Amati/ Kachnar	*Bauhinia malabarica*	Threatened	Ram, Fertility cult
5.	Anjan	*Hardwickia binnata*	N/A	Fertility cult
6.	Arjun	*Terminalia arjuna*	Near Threatened	Vishnu, Fertility cult
7.	Ashwagandha	*Withania somnifera*	Rare	Fertility cult
8.	Asoka	*Saraca indica*	Endangered	Buddha, Indra
9.	Bahera	*Terminalia bellirica*	Threatened	Vishnu, Fertility cult
10.	Bael	*Aegle marmelos*	Vulnerable	Mahesver, Spirits, Shiva
11.	Bhelwa	*Semecarpus anacardium*	Endangered	Spirits
12.	Bhirra	*Chloroxylon swietenia*	Vulnerable	Fertility cult
13.	Bija	*Pterocarpus marsupium*	Endangered	Shiva, Vishnu
14.	Chandan	*Santalum album*	Endangered	Vishnu, Shiva, Brahma, Fertility cult
15.	Char	*Buchanania lanzan*	Low Risk	Krishna, Fertility cult
16.	Dhatura	*Datura alba*	N/A	Shiva, Krishna, Fertility cult
17.	Dhawda	*Anogeissus latifolia*	N/A	Fertility cult
18.	Dumar	*Ficus glomerata*	N/A	Vishnu, Rudra
19.	Giloy	*Tinospora cordifolia*	Vulnerable	Fertility cult
20.	Gulmohar	*Delonix regia*	N/A	Shiva, Fertility cult
21.	Hajari	*Plumeria rubia*	N/A	Lakshmi, Vishnu, Parvati, Shiva

22.	Haldu	*Adina cordifolia*	N/A	Vishnu, Fertility cult
23.	Harra	*Terminalia chebula*	Near Threatened	Vishnu, Fertility cult
24.	Imli	*Tamarindus indica*	N/A	Spirits, Witches
25.	Jamun	*Syzygium cuminii*	N/A	Fertility cult
26.	Jungle Jalebi	*Pithecolobium dulce*	N/A	Krishna
27.	Kadamba	*Anthocephalus cadamba*	N/A	Krishna, Fertility cult
28.	Kala siris	*Albizia lebbeck*	N/A	Fertility cult
29.	Kali musli	*Cholrophytum tuberosum*	Endangered	Fertility cult
30.	Kalihari	*Gloreosa superb*	Endangered	Fertility cult
31.	Kapok	*Ceiba pentandra*	N/A	Fertility cult
32.	Karanj	*Pongamia pinnata*	Least Concern	Krishna, Spirits
33.	Karpur	*Hedychium spicatum*	Near Threatened	Moon
34.	Karra	*Cleistanthus collinus*	Vulnerable	Spirits
35.	Khamar	*Gmelina arborea*	Least Concern	Shiva
36.	Kullu	*Sterculia urens*	Near Threatened	Krishna, Fertility cult
37.	Kumbhi	*Pachira rosea*	N/A	Shiva, Lakshmi, Kali mata
38.	Kusum	*Schliechera oleosa*	Threatened	Kuber, Krishna
39.	Mahaneem	*Ailanthus excelsa*	Threatened	Shitla, Witches, Varun
40.	Mahua	*Madhuca latifolia*	Endangered	Krishna, Fertility cult
41.	Mango	*Mangifera indica*	N/A	Laksmi, Goverdhan, Fertility cult
42.	Mundi	*Mitragyna parvifolia*	N/A	Shiva, Fertility cult
43.	Narikel	*Cocos nucifera*	Endangered	Shiva, Brahma, Visnu, Sri Hari, Kuber, Lakshmi, Fertility cult
44.	Neem	*Azadirachta indica*	Data Deficient	Sitala, Manasa, Witches
45.	Palasa	*Butea monosperma*	Data Deficient	Brahma,Gandharva
46.	Parijaat	*Nycthanthus spp.*	Endangered	Vishnu, Lakshmi, Shiva, Brahma
47.	Peltaforum	*Peltaphorum pterocarpum*	N/A	Vishnu
48.	Pipal	*Ficus religiosa*	N/A	Visnu, Ancestor worship, Krishna
49.	Sagon	*Tectona grandis*	Least Concern	Shiva, Vishnu, Brahma
50.	Saja	*Terminalia tomentosa*	Near Threatened	Vishnu, Fertility cult
51.	Sal	*Shorea robusta*	N/A	Vandurga, Lakshmi
52.	Salfi	*Caryota urens*	Endangered	Mahadeva
53.	Sarpagandha	*Rauwolfia serpentine*	Vulnerable	Fertility cult
54.	Satavari	*Asparagus racemosus*	N/A	Fertility cult
55.	Semal	*Bombax ceiba*	N/A	Visnu, Fertility cult
56.	Soma	*Amanita muscaria*	N/A	Moon
57.	Tendu	*Diospyros melanoxylon*	Endangered	Fertility cult
58.	Tulsi	*Oscimum sanctum*	N/A	Laksmi, , Ancester Worship
59.	Vata	*Ficus bangelensis*	N/A	Brahma, Visnu, Sri Hari, Kuber, Muni

Table No. 2: Fauna associated with God /Goddesses in sacred groves:

S.No.	Animals/Birds/Butterflies	Zoological Name	Status	Associated with Gods/ Goddesses
1.	Bat	*Pteropus giganteus*	Least Concerned	Shiva, Narad Muni
2.	Beer	*Melursus ursinus*	Threatened	Hanuman
3.	Bull	*Taurus indicus*	Endangered	Siva
4.	Chital	*Gazelle gazella*	Least Concerned	Jesus
5.	Crocodile	*Crocodylus palustris*	Endangered	Ganga, Varuna
6.	Crow	*Corvus splendens*	Least Concerned	Lord Shaneeshwarar
7.	Deer	*Axis axis*	Threatened	Vayu, Rama
8.	Eagle	*Aquila chrysaetos*	Threatened	Visnu
9.	Elephant	*Elephas maximus*	Threatened	Indra, Ganesha
10.	Fox	*Vulpes bengalensis*	Threatened	Muni

11.	Honey bee	*Apis spp.*	Least Concerned	-
12.	House sparrow	*Passer domesticus*	Least Concerned	Rama
13.	Kite	*Milvus migrans*	Least Concerned	Varun, Indra
14.	Koel	*Eudynamys scolopacea*	Least Concerned	Narayana
15.	Hyena	*Hyena hyena*	Threatened	Spirits, Witch
16.	Monkey	*Macaca fascicularis*	Near Threatened	Rama, Kama,Varuna
17.	Myna	*Acridotheres tristis*	Least Concerned	Kama
18.	Nilkanth	*Coracias benghalensis*	Threatened	Shiva
19.	Owl	*Glaucidium radiatum*	Least Concerned	Laksmi
20.	Parrot	*Psittacula krameri*	Least Concerned	Kama
21.	Peacock	*Pavo cristatus*	Least Concerned	Kartika, Saraswati, Krishna
22.	Rat	*Rattus norvegicus*	Least Concerned	Ganesha
23.	Serpent	*Naja naja*	Threatened	Siva, Sun, Vishnu
24.	Squirrel	*Sciurus carolinensis*	Least Concerned	Rama
25.	Swan	*Cygnus atratus*	Least Concerned	Saraswati
26.	Tiger	*Panthera tigris*	Endangered	Katyayani, Dattatrey
27.	Tortoise	*Geochelone elegans*	Least Concerned	Yamuna, Lakshmi
28.	Vulture	*Gyps indicus*	Critically Endangered	Sani
29.	Blue Mormon Butterfly	Papilio polymnestor	Threatened	Fertility Cult
30.	Common Yellow Swallowtail	*Papilio Machaon*	Near Threatened	Fertility Cult
31.	Large Cabbage White	*Pieris brassicae*	N/A	Fertility Cult
32.	Tawny Coster	*Acraea violea*	N/A	Fertility Cult
33.	Sailers	*Neptis hylas*	Least Concerned	Fertility Cult
34.	Indian Red Admiral	*Vanessa indica*	Least Concerned	Fertility Cult
35.	Common Mormon	*Papilio polytes*	N/A	Fertility Cult

IV. Result & Discussion

Habitat fragmentation is a pervasive threat to forest ecosystems throughout the world, eventually leading to a decline in biological diversity and impairment of ecological processes. A number of studies in the last couple of decades have addressed the ecological, demographic and genetic consequences of small fragmented populations. These studies highlight the importance of a set of small groves in harboring the variability among them in an endemic and endangered species of both flora & fauna. Thus, while designing conservation strategies for the groves, due importance should also be given to smaller groves as much as is given to large groves.

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