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The Sacred Groves and Their Significance in Conserving Biodiversity An Overview

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ABSTRACT

Sacred groves are tracts of virgin forest with rich diversity, which have been protected by the local people for centuries for their cultural and religious beliefs and taboos that the deities reside in them and protect the villagers from different calamities. Every sacred grove carries its own legends, lore, and myths which form the integral part of the sacred grove. An inextricable link between present society and past in terms of biodiversity, culture, religious and ethnic heritage exists in sacred groves. Sacred groves are distributed across the globe, and diverse cultures recognize them in different ways encoding various rules for their protection. Sacred groves occur in many parts of India viz., Western Ghats, Central India, northeast India, etc. particularly where the indigenous communities live. These are known by different names given to them by the ethnic people. Sacred groves act as an ideal centre for biodiversity conservation. 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 and the religious beliefs and taboos. Therefore, a holistic understanding of the current status, structure and function of sacred grove is essential for assessing their ecological role and formulating strategies for their conservation. This paper briefly reviews the studies on sacred groves across the globe in general and India in particular, highlighting that the tradition of sacred groves could provide a powerful tool for ensuring biodiversity conservation through community participation.

Key Words: Traditional Practices, Sacred Groves, Indigenous Beliefs and Taboos, Biodiversity Conservation

INTRODUCTION

Since time immemorial conservation of natural resource has been an integral part of diverse cultures in different ways. The traditional worship practices show the symbiotic relation of human beings and nature. Indigenous communities all over the world lived in harmony with the nature and conserved its valuable biodiversity. In course of time, science and technology developed and industries were established and expanded to meet the increasing demands of the people. Various anthropogenic activities have altered the structure and function of different ecosystems all over the world. One of the most conspicuous effects of ecosystem perturbation has been the depletion of biodiversity. Disappearance of species due to habitat alteration, overexploitation, 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

view of the adverse effects of biodiversity degradation, ecologists, environmentalists and conser-vationists has made conservation of biodiversity as an issue of global, national and regional significance. Many areas have been declared as protected areas and various *in-situ* and *ex-situ* conservation practices have also been undertaken in different parts of the world. Many laws governing the biodiversity conservation have also been enacted from time to time including "The Biological Diversity Act 2002" enacted by the Govt. of India. Besides these formal laws, there were many traditional conservation practices of indigenous communities in many parts of the world, which contributed to the conservation and protection of biodiversity. A good example of such traditional practices is the conservation and protection of small forest patches by dedicating them to the local deities by various indigenous communities of the world. Such forest patches are called "sacred groves". Sacred groves are the tracts of virgin forest that were left untouched by the local inhabitants, harbour rich biodiversity, and are protected by the local people due to their cultural and religious beliefs and taboos that the deities reside in them. The sacred groves of Asia and Africa and royal hunting forests are the historical examples (Chandrashekara and Sankar 1998, Kanowski et al. 1999). It is believed that these sacred virgin forests date back to thousands of years when human society was in the primitive state. Gadgil and Vartak (1975) have traced the historical link of the sacred groves to the pre- agricultural, hunting and gathering stage of societies. Hence, these virgin forests are believed to be pre-Vedic in origin. The area of sacred groves ranges from few square meters to several hectares. There exist some fascinating examples of forest patches harbouring native vegetation, which have been intertwined with various aspects of indigenous, cultural and religious practices along with the associated taboos (Gadgil and Vartak 1976). Physically, it is a piece of forest land, but culturally, it is associated with deities, rituals and taboos. Sacred groves provide the inextricable link between present society to the past in terms of biodiversity, culture, religious and ethnic heritage. In the present day society, there are several endogamous populations that continue to practice many forms of nature worship. Various traditional communities of our

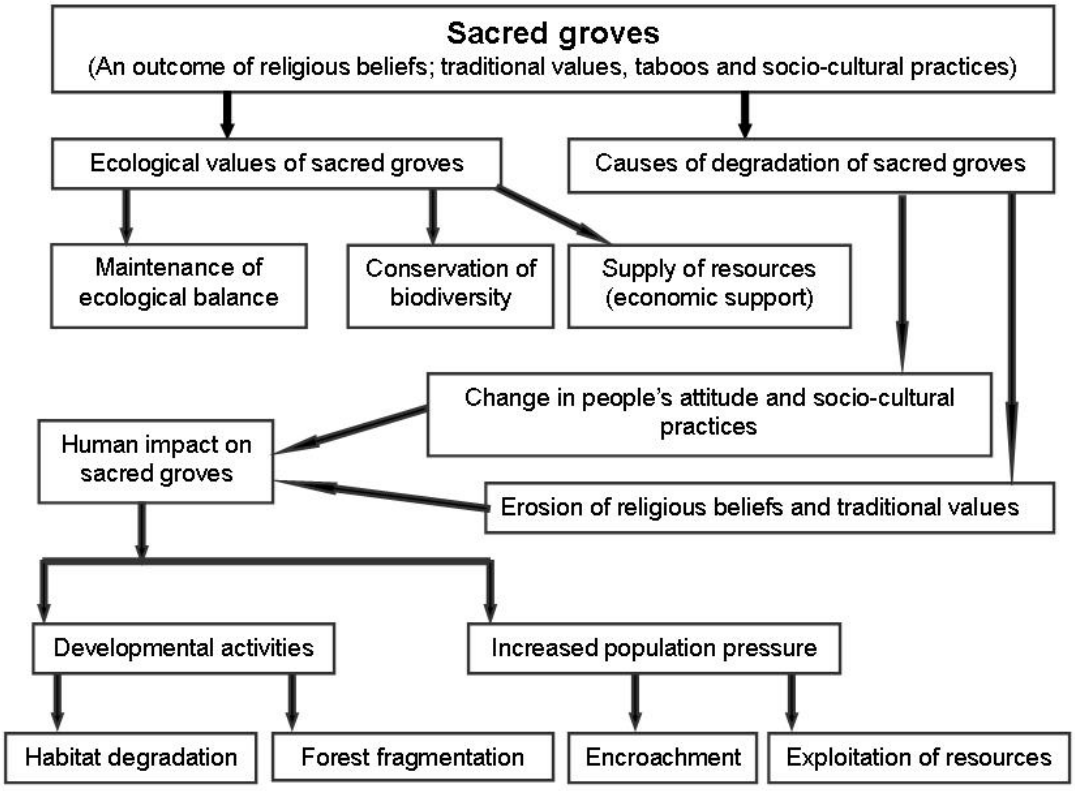

Figure 1. Relationships between ecological values, religious beliefs and traditional values, and causes of degradation of sacred groves (modified from Khumbongmayum et al. 2004)

country follow nature worship in their own ethnic ways, based on the premise that all creations of nature have to be protected. The concept of sacred groves could be traced to such communities as have preserved several virgin forests in their pristine form by dedicating them to the ancestral spirits or deities. As a result, sacred groves still possess a great heritage of diverse gene pool of many forest species. Some of the species present in sacred groves are considered as sacred. These 'sacred' species have socioreligious concept of the sacred groves intertwines carefully with various socio - cultural and religious beliefs, and taboos, and ecological services of sacred groves. People's changing attitudes, erosion of traditional beliefs, and human impact have caused degradation of sacred groves over the years (Figure 1). Gadgil and Berkes (1991) have mentioned that various traditional approaches to conservation of nature require a belief system which includes a number of prescriptions and proscriptions for restrained resource use. Dafni (2006) elaborated the typology and worship status of sacred trees in the middle east and mentioned about 24 known reasons for the establishment of sacred groves.

All forms of vegetation in the groves are supposed to be under the protection of reigning deity of that grove, and the removal of even a small twig is a taboo (Vartak and Gadgil 1973). Collection and removal of any material from the sacred groves is prohibited (Khan et al. 1987, Khiewtam and Ramakrishnan 1989). Sacred groves can be used as indicators for potential natural vegetation (Schaaf 1998) and are vital for well being of the society. Sacred groves or sacred trees serve as a home for birds and mammals, and hence, they indirectly help in the conservation of living organisms (Islam et al. 1998). Karanth (1998) opined about the alternative concept of 'sustainable landscapes' in combination with the ideas of the emerging discipline of ecological economics and may provide useful tools for protecting the sacred groves in which our wildlife has to survive into the 21st century.

Besides, the sacred groves provide a number of ecosystem services such as reduction in erosive force of water, conservation of soil, maintenance of hydrological cycle, availability of water of desired quality and natural dispersal of seeds of useful species. The sacred groves also help in maintaining the desirable health of ecosystem, reduce habitat destruction, conserve the viable population of pollinators and predators, serve as the potential source of propagules that are required for colonization of wastelands and fallows, conserve the indigenous flora and fauna and preserve the cultural and ethical practices developed through indigenous knowledge of generations (Ramakrishnan and Ram 1988, Godbole et al. 1998, Godbole and Sarnaik 2004, Tiwari et al. 1998a,b, Singh et al. 1998). Thus, traditional nature worship practices as followed in different parts of world do contribute to the promotion of the regional/national goals of conservation of biodiversity.

Existence of Sacred Groves Across the Globe

In India as well as in parts of Asia and Africa, care and respect for nature has been influenced by religious beliefs and indigenous practices. The existence of sacred groves has been reported in many parts of Asia, Africa, Europe, Australia and America by Hughes and Chandra (1998). Groves are also reported from Ghana, Nigeria, Syria, Turkey and Japan (Gadgil and Vartak 1976). A document of MAB (1995) has described the sacred groves present in Ghana, Senegal, and Sumatra. Several small size sacred groves were reported from Nepal by Ingles (1994). Various sacred sites associated with rich vegetation in Bangladesh were reported by Hussain (1998).

The Dubla Island sacred grove in Sundarbans mangrove forest in Bangladesh harbours rich vegetation and is a place of worship for low caste Hindus, who visit it once in a year for prayer (Islam et al. 1998). In Afghanistan, after advent of Islam, the creation and conservation of sacred grove became a part of historical and geographical tradition of the rural people (Mohamed 1998). The positive role of sacred groves in the socioeconomic and cultural lives of many rural folks in Ghana has been possible because of the collective efforts of people to protect them (Michaloud and Durry 1998).

However, in Mongolia sacred groves are not protected by the Government but few sacred places which have been declared officially as sacred sites are protected by the Government (Gongorin 1998). Ramakrishnan (1996) reported the existence of sacred groves in different parts of India and they are known by different names in different areas (Bhakat 1990).

Sacred Groves in India

Setting aside patches of forest land and leaving them intact on the grounds of religious belief of the traditional communities has been the practice for centuries in our country. Indian society comprises several cultures, each with its own set of traditional methods of conserving nature and its creatures. Sacred

groves are found all over India especially in those regions where indigenous communities inhabit. In India the earliest documented work on sacred grove is that of the first Inspector General of Forests, D. Brandis in 1897. Later, Gadgil and Vartak (1976, 1981ab) traced the historical link of sacred groves with the pre-agricultural, hunting and gathering stage, before human being had settled down to raise livestocks or till land. Recently, moving towards the scientific technologies, Gaikwad et al. (2004) have developed a web-interfaced multimedia database on sacred groves of India in order to build the comprehensive information resource documenting biodiversity status of sacred groves. The concept, structure and information model of the data base of sacred groves have been discussed. Such a factual database would support the development of strategies for conservation and protection of these unique heritage ecosystems.

Most of the sacred groves reported from India are in the Western Ghats, North Eastern India and Central India (Gadgil and Vartak 1976, Burman 1992, Rodgers 1994, Balasubramanyam and Induchoodan 1996, Tripathi 2001, Khumbongmayum et al. 2005a). Sacred groves have been reported in Meghalaya (Boojh and Ramakrishnan 1983, Ramakrishnan 1996, Tiwari et al. 1998a, Jamir 2002, Law 2002, Upadhaya 2002, Mishra et al. 2004), Manipur (Khumbongmayum 2004, Khumbongmayum et al. 2005a), Western Ghats (Gadgil and

Table 1. Sacred groves distributed in different parts of India along with the area covered by them. (Adopted from Malhotra 1998 and Malhotra et al. 2001)

Location	Number of sacred groves	Districts	Area (ha)	References
Andhra Pradesh	800	-	-	Rao (1996)
Andhra Pradesh	750	23	-	WWF, Andhra Pradesh (1996)
Arunachal Pradesh	58	2	-	Chatterjee et al. (2000)
Arunachal Pradesh	101	4	-	Khan et al. (2007)
Assam	40	1	-	Deb (unpublished data)
Gujarat	29	1	0.42	Gupta et al. (2000)
Harayana	248	18	-	NAEB (1995)
Himachal Pradesh	11	-	-	Singh et al. (1998)
Karnataka (Coorg)	1214	-	2407	Kalam (1996)
Kerala	2000	-	500	Rajendraprasad (1995)
Madhya Pradesh	275	-	-	(Srivastava 1994)
Maharashtra	1600	-	-	Deshmukh et al. (1998)
Maharashtra	483	10	3570	Gadgil and Vartak (1981b)
Maharashtra	250	1	-	Godbole et al. (1998)
Manipur	365	-	-	Devi (2000)
Manipur	166	4	756.42	Khumbongmayum et al. (2004)
Meghalaya	79	-	26,326	Tiwari et al. (1998a)
Orissa	322	-	50	Malhotra et al. (1997)
Rajasthan	1	-	83	Singh and Saxena (1998)
Rajasthan	9	-	158	Jha et al. (1998)
Sikkim	56	4	-	Chatterjee et al. (2000)
Tamil Nadu	10	-	127	Swamy et al. (1998)
Tamil Nadu	3	-	-	Oliver King et al. (1997)
Tamil Nadu	1	-	-	Maheswaran et al. (1995)
Tamil Nadu	448	28	-	Amrithalingam (1998)
Uttar Pradesh	6	-	5500	Sinha and Maikhuri (1998)
West Bengal	7	-	2	Malhotra et al. (1997)
West Bengal	190	-	15	Deb and Malhotra (2001)
West Bengal	670	5	-	Deb et al. (1997)

Vartak 1976). Mitra and Pal (1994) also reported the occurrence of sacred groves in Meghalaya, Bihar, Rajasthan and the states along the Western Ghats. Their existence along the Himalaya, from northwest to northeast, was described by Burman (1992) and Rodgers (1994). Sacred mangroves, experiencing little or no damage at all, with some religious significance, were reported from Rann of Kutch, Maharashtra, Goa, Tamil Nadu and West Bengal (Untawale et al. 1998).

In India, sacred groves are found mainly in tribal dominated areas and are known by different names in ethnic terms (Bhakat 1990) such as *Sarna* or *Dev* in Madhya Pradesh, *Devrai* or *Deovani* in Maharashtra, *Sarnas* in Bihar, *Orans* in Rajasthan, *Devaravana* or *Devarakadu* in Karnataka, *Sarpakavu* and *Kavu* in Tamil Nadu and Kerala, *Dev van* in Himachal Pradesh, *Law Lyngdoh* or *Law Kyntang* etc. in Meghalaya, *Sarana* or *Jaherthan* in Jharkhand and *Lai umang* in Manipur. They are protected and managed by local people on religious grounds and traditional beliefs. Wherever the sacred groves existed, the indigenous traditional societies, which have a spiritual relationship with their physical environment, sustain them.

Several studies have been conducted on sacred groves of different parts of India (Table 1). About 4215 sacred groves covering an area of 39,063 hectares are estimated to be distributed in India (Malhotra 1998). Gadgil and Vartak (1975, 1976) made an inventory of the sacred groves or '*Devrais*' of Maharashtra. Detailed information on the location, area and associated deity, folklores and traditional beliefs of 233 groves from different districts of Maharashtra were collected by Gadgil and Vartak (1981b), who recorded a range of vegetation from semi-evergreen to dry deciduous type in rainfall regimes from 5,000 mm to 500 mm. According to Burman (1992), the number of sacred groves in Maharashtra in the Western Ghats is much more than the number recorded by Gadgil and Vartak (1976, 1981 b) in their various studies. Balasubramanyan and Induchoodan (1996) reported 761 sacred groves in Kerala with floristic wealth of over 722 species belonging to 217 families and 474 genera. Induchoodan (1996) reported that out of the 761 sacred grove in Kerala, 399 (32.17 %) were of less than 0.02 ha in extent and only 362 groves were larger than 0.02 ha. Kushalappa et al. (2001) inventoried 1214 sacred groves covering an area of 2550.45 ha in Kodagu district in Karnataka. The groves in Karnataka have been protected in the names of 165 different deities and perhaps this state has the highest density of the groves in the world and could be regarded as the 'hot-spot' of sacred grove tradition in the world (Kushalappa et al. 2001). However, it may be mentioned that most of the sacred groves of Karnataka are much smaller in area compared to the sacred groves of northeast India, particularly Meghalaya. Kadamba (1998) enumerated 80 sacred groves from the Marakkanam-Pondicherry-Cuddalore regions on the south-eastern coast, and their status was assessed on the basis of their appearance and composition (Kadamba et al. 2000). Sunitha and Rao (1999) studied the characteristics and distribution of the flora of the sacred groves in Kurnool district of Andhra Pradesh. Basu (2000) reported a sacred grove spread over 72,681m^2 area and harbouring 106 species from the Purulia district of West Bengal. Panda et al. (2003) reported 10 important sacred groves of Santhals from the Bankura district of West Bengal. Singh et al. (1998) recorded several sacred groves in Himachal Pradesh, most of which were of small size, while Sinha and Maikhuri (1998) reported several sacred groves from different parts of the Garhwal Himalaya.

Sacred Groves in Northeast India

Various ethnic groups of north-eastern India have preserved and protected several forest patches and even individual trees or animals due to their traditional belief and respect for nature. Many sacred groves were reported from the states of Meghalaya and Manipur and from Karbi Anglong area of Assam, in north-eastern India (Tripathi 2001). In Arunachal Pradesh a few of the sacred groves managed by Lamas and Mompa tribe, are attached to the Buddhist monasteries and they are called Gompa Forest Areas (GFAs). These monasteries are mainly in West Kameng and Tawang districts of the state and 58 GFAs were reported from these two districts (Malhotra et al. 2001) and a few sacred groves from Lower Subansiri and Siang district of the state (Chatterjee et al. 2000). In a recent inventory, Khan et al. (2007) have reported a total of 101 sacred groves with detailed information from the different districts of Arunachal Pradesh. Most of the sacred groves are located at high altitudes in the state. Largest number (39) of them are located in the Tawang district followed by West Kameng (24) and Lohit (15) and only 2 in the Papumpare district. Many of these sacred groves are attached to the 'Gompa' *i.e.*, Buddhist monasteries and they are under the control of monasteries and conserved due to religious considerations. The forest dwelling tribes such as Bodo and Rabha, inhabiting the plains and foothills of Western Assam have the traditions of maintaining sacred groves which are locally called

"*Than*". Karbi Anglong district of Assam also has about 40 sacred groves. Dimasa tribes in the North Cachar hills in Haflong district of Assam call sacred groves as "*Madaico*". The size of *Madaico* is generally not more than one acre. Sacred groves are also found in the plains of Brahmaputra valley in Assam. The Vaishnav temples like "*Shankara Deva Mathas*" distributed all over the state of Assam also have sacred groves (Malhotra et al. 2001).

In Manipur, Devi (2000) mentioned the existence of about 365 sacred groves and Rajendro (2001) did the mapping of a few sacred groves of Manipur with special reference to concentration of rare and endemic species in these groves. Directory of ancestral deities (*Umanglai*) residing in various sacred groves of Manipur was published by Chandrashekhar (1987) and Kulachandra (1963, 1996). Recently, a total of 166 sacred groves were inventoried covering an area of 175.62 hectares from the four districts of Manipur that are distributed in different locations of the state (Khumbongmayum et al. 2004). The size of the individual sacred grove varied from a clump of a few trees to 40 ha within the elevation of 691 to 860 m. 145 groves were inventoried in the valley, 6 in the foothills, 7 in the hillocks and 4 each near catchment areas or river banks and hills. Their distribution in varied locations helps in the conservation of whole variety of valuable medicinal plants and several rare and endemic plant and animal species (Khumbongmayum 2004, Khumbongmayum et al. 2005a). Precisely, sacred groves of Manipur are the ideal places for worshipping the *Umanglais* and are meant for the preservation of forest, culture and religion. Meiteis (an ethnic group of Manipur) worship *Umanglais* with the celebrations called *Lai-Harouba* which means 'pleasing of gods' or merry festivals of the deities. The celebration starts with the onset of the wet season in the month of *Kaalen* (in Manipuri calendar) that normally coincides with May.

Tiwari et al. (1998a) inventorised 79 sacred groves of Meghalaya. Among them, Mawphlang is one of the most important sacred groves in Meghalaya having a dense forest cover. According to their study, in Meghalaya only 1.3% of the total sacred grove area was undisturbed, 42.1% area had relatively dense forest, 26.3% had sparse canopy cover, and 30.3% had open forest.

In Sikkim, 35 sacred groves have been reported that are either attached to the local monasteries (Gumpas) or main-tained by the village community. Floristic studies on the Kabi sacred grove of North Sikkim revealed 241 species representing 183 genera under 84 families (Dash 2005).

Sacred Groves:
Ideal Centres for Biodiversity Conservation

The importance of sacred groves in the conservation of biological diversity has been well recognized. Gadgil and Vartak (1975, 1976) found a grove in the Koloba district of Maharashtra harbouring a solitary specimen of the liana *Entada phaseoloides*. A new species of a leguminous climber *Kunstleria keralensis*, has been reported from one of the sacred groves of Kerala (Gadgil and Chandran 1992). They observed that G*urjan* tree (*Dipterocarpus indicus*) has its northern limit in the Western Ghats in a couple of sacred groves of Uttara Kannada. *Ficus benghalensis* L. (Aal) in sacred groves at Suriampettai plays the role of a keystone species providing a niche for the large number of birds and plants (Oliver King et al. 1997). According to several reports there is a concentration of rare, endemic and endangered species in sacred groves. Chandrashekara and Sankar (1998) recorded 73 species in three sacred groves of Kerala, and among them 13 are endemic to south Western Ghats, 3 are endemic to Western Ghats and 1 is endemic to peninsular India. Khan et al. (1997) reported that about 4% of the total plant species found in Meghalaya are confined to sacred groves. Gadgil and Chandran (1992) have also noticed a small population of endangered primates, and lion-tailed macaques in and around Katlekan sacred grove of Uttara Kannada. Several trees having non-timber uses and macrofungi useful to the local people, as well as those with medicinal properties were abundant in sacred groves of Western Ghats (Bhagwat et al. 2005). They also reported that threatened trees were more abundant in sacred groves than in reserve forest.

Socio-cultural Practices and Sacred Species

Descriptive accounts of religious and cultural practices, and people's attitudes related to sacred groves, forests/ecosystems/landscapes have been given by several workers (Gadgil and Vartak 1976, Messerschmidt 1987, Khiewtam and Ramakrishnan 1989, Ramakrishnan 1996, Singh et al. 1996, Nair et al. 1997, Tiwari et al. 1999). Moreover, the role of beliefs, folklores and taboos associated with sacred groves has been emphasized by several workers (Gadgil and Vartak 1975, 1976, Vartak and Gadgil 1981, Oliver King et al. 1996, Sinha and Maikhuri 1998, Swamy et al. 1998, Tiwari et al. 1999, Basu 2000, Kushalappa et al. 2001, Ramanujam and Kadamba 2001). Sethi (1993), Visalakshi (1995), Oliver King et al. (1996), Swamy et

al. (1998), Ramanujam and Kadamba (2001) and Kumar and Swamy (2003) studied the traditional culture associated with the sacred groves in Tamil Nadu.

Religious and cultural importance of the species is a factor promoting their sustainable utilization as well as conservation (Singh et al. 1998). Importance of the sociologically recognized plants which have linkage with the deities of the groves or other religious practices in maintaining the ecological balance was addressed by Rodgers (1994). Such sociologically recognized plants are the 'sacred species', the concept of 'sacred species' could be recognized as a social evolution through a process of condensation of sacred groves to the lowest level in the hierarchical organization (Ramakrishnan 1998, Ramakrishnan 2002). Khumbongmayum et al. (2004) described 16 sacred species, found in different sacred groves of Manipur along with their associated religious beliefs and taboos. Some of the common sacred species are *Ficus* of fig family (Moraceae), which is culturally valued across Asia region and amongst many tribes of Africa (Khaneghah 1998, Michaloud and Durry 1998, Ramakrishman 1998) and Oak in central Himalaya (Ramakrishman 1998, Sinha and Maikhuri 1998). *Ficus religiosa* and *Ocimum sanctum* are regarded as sacred by the Hindus. Sacred trees in different parts of Iran are related to different faiths and beliefs, and have close linkage with local ecological values (Khaneghah 1998). In Maldives, medicinal plants of traditional importance are regarded by the local people as sacred (Hussein 1998).

Ecological Services of Sacred Groves

Biodiversity keeps the ecological processes in a balanced state, which is necessary for human survival. Therefore, the biodiversity-rich sacred groves are of immense ecological significance. They also play an important role in the conservation of flora and fauna. Besides, several rare and threatened species are found only in sacred groves, which are, perhaps, the last refuge for these vulnerable species. Several ecological studies have been carried out in these sacred forest patches. Floristic composition of sacred groves in different parts of India viz., Karnataka (Vasanth et al. 2001), Kerala (Chandrashekara and Sankar 1998), Pondicherry (Kadamba et al. 2000, Ramanujam and Kadamba 2001, Ramanujam and Kumar 2003), West Bengal (Basu 2000), Meghalaya (Tiwari et al. 1998b, 1999, Tripathi et al. 2002, Jamir 2002, Jamir and Pandey 2002, Law 2002, Upadhaya 2002) and Manipur (Khumbongmayum 2004) has been studied by a number of researchers.

Several ecological investigations have been made in sacred groves of Meghalaya (Khiewtam 1986, Khan et al. 1987, Barik 1992, Rao 1992, Khiewtam and Ramakrishnan 1993, Barik et al. 1996ab, Rao et al. 1997, Tiwari et al. 1998ab, Tiwari et al. 1999, Tripathi 2002, Tripathi et al. 2002, Pandey et al. 2003, Upadhyaya et al. 2003, Mishra et al. 2004). The regeneration status of some important species was studied in sacred groves of Karnataka (Boraiah et al. 2001, 2003, Kumar and Swamy 2003), Meghalaya (Khan et al. 1986, Barik et al. 1992, Rao et al. 1990, 1997) and Manipur (Khumbongmayum 2004, Khumbongmayum et al. 2005b, 2006).

The vegetation of the sacred groves has certain distinctive ecological characteristics. The sacred groves of Kerala (Rajendraprasad 1995) have distinct tiers of trees, shrubs and herbs, climbers and stranglers, epiphytes, parasites, and many wild relatives of cultivated plants. Broadly, the vegetation of these groves has been classified into two types viz. evergreen type and the moist deciduous type (Chand Basha 1998). Khumbongmayum (2004), who has made a detailed ecological study of the four sacred groves of Manipur, has found that the biological spectrum of the groves is similar to the normal spectrum of phanerogamic flora of the world. This indicates that the vegetation is a relic of the tropical evergreen forests (Khumbongmayum 2004). Biological spectrum of sacred groves of Kerala also closely resembles the normal spectrum in the percentage of therophytes (Pushpangadan et al. 1998). Vasanth et al. (2001) carried out a detailed vegetation analysis of a sacred grove in Nandikoor village of the Udupi district in Karnataka. The stand density of the grove was low compared to that of Jadkal forest, a secondary semievergreen forest in the same district (Chandra-shekar et al. 2005). Sacred groves (Sarna) of Madhya Pradesh are characterized by the vegetation with a cluster of Sal (*Shorea robusta*) trees; all living and non-living components of the grove are sacrosanct and protected (Patnaik and Pandey 1998). Several workers have studied floristic composition of sacred groves of different states of the country such as Uttarakhand (Sinha and Maikhuri 1998), Kerala (Induchoodan 1988, Chandrashekara and Sankar 1998), Tamil Nadu (Britto et al. 2001), Karnataka (Gadgil and Vartak 1975, 1976), Meghalaya (Khan et al. 1987, Mishra et al. 2004, Tripathi et al. 2002), Manipur (Khumbongmaym 2004) and Arunachal Pradesh (Khan et al. 2007). Sinha and Maikhuri (1998) reported that

species diversity of tree stratum in a sacred grove in Garhwal Himalaya was lower, while density and basal cover values were significantly higher as compared with the other forest areas. The sacred grove of Garhwal Himalaya also nurtures rich fauna. Detailed ecological studies have been made on Mawphlang sacred grove in Meghalaya. These studies have covered community characteristics, gap phase regeneration and regeneration ecology of dominant tree species (Khan et al. 1986, 1987, Rao et al. 1990, Barik 1992, Barik et al. 1992, Rao 1992, Barik et al. 1996ab, Rao et al. 1997). Tiwari et al. (1998b) recorded greater species diversity in sacred groves than in the disturbed forest. Species composition and community characteristics of sacred groves and disturbed forests were also reported to differ significantly. Khiewtam (1986), and Khiewtam and Ramakrishnan (1993) studied the vegetation, litter and fine root dynamics, and nutrient flow in a sacred grove of Cherrapunji (Meghalaya). A sacred forest from Himachal Pradesh (called Nagoni sacred forest) had higher species richness compared to the non sacred forests (Singh et al. 1998), although the differences were not significant. Fragment sizes and diversity of species assemblages in Sholas and sacred groves showed that larger fragments had similar species composition whereas smaller fragments of forest are more diverse among themselves with respect to their species content (Tambat et al. 2001). The study carried out by Tripathi (2006) on the effects of forest fragment size (1ha - >5ha area) in a subtropical humid forest of Meghalaya in northeast India on species richness and regeneration showed that the tree species diversity was greater in larger fragments. However, the percentage of new species found regenerating in the small fragments was much larger (44%) compared to the large fragments where only three new species showed regeneration. The forest fragment size decreased with increase in anthropogenic disturbance. This finding could provide useful clues for devising management strategies for the maintenance of species diversity in the sacred groves. The threshold level of anthropogenic stress and fragment size may also be determined to ensure species perpetuation in sacred groves of a given region. This may have important implications for designing the size of the protected areas. A comparative assessment of regeneration of woody flora between the sacred groves and reserve forests showed that number of regenerating rare/endemic plant species was higher in some of the sacred groves as compared with the reserve forests (Boraiah et al. 2001, 2003).

Ethnobotanical Importance of the Sacred Groves

Sacred groves are the good source of a variety of medicinal plants, fruits, fodder, fuelwood, spices, etc. The study of interrelationship between the human beings and plants and animals in their surrounding environment (i.e. ethnobiology) is very revealing. Some interesting ethnobotanical studies were conducted by Vartak and Gadgil (1973) in the sacred groves of Maharashtra. A study of the tree wealth in the life and economy of the tribal people in Andhra Pradesh revealed that various species are used by the different ethnic groups for various purposes including the treatment of common diseases and disorders (Rani et al. 2003). Tolchha-Bhotiya subcommunity inhabiting the buffer zone villages of Nanda Devi Biosphere Reserve has a strong faith and belief in traditional healthcare system/herbal treatment and depends on various medicinal plants. There is a need to record and document their knowledge of various medicinal plants, which are used for treating different ailments by local practitioners (Maikhuri et al. 1998). The role of sacred groves in the conservation of the regional medicinal plants has been emphasized in several studies from different parts of the country. Bhakat and Pandit (2003) recorded from the Chilkigarh sacred grove in Midnapore district (West Bengal) 105 medicinal plant species of which 12 are threatened elsewhere in the district. A total of 120 medicinal plants widely used for the treatment of various ailments were reported from four sacred groves of Manipur (Khumbongmayum et al. 2005c). Presence of a large number of medicinal plants is reported in 'Kavus' of Kerala (Pushpangadan et al. 1998) and 'Hariyali' sacred site of Garhwal Himalaya (Sinha and Maikhuri 1998). Conservation, utilization and assessment of the implications of exploitation of these species have become an important task (Dhar 2002, Sumit and Dhar 2002). Availability and habitat preference of critically endangered medicinal plants of west Himalaya were assessed for their conservation (Airi et al. 2000). Problems and prospects of the development of medicinal plant resources in different regions of the country have also been highlighted by several researchers (Biswas et al. 2003, Darshan and Veb 2003, Sarin 2003, Srinivasmurthy et al. 2003).

Degradation of the Sacred Groves

Belief and taboos are the constructive tools for conserving the sacred groves, and erosion of belief and taboos has led to deterioration of groves (Vartak and

Gadgil 1981, Tiwari et al. 1998b, 1999). It has been seen that religious beliefs and taboos that were central to the protection of sacred groves are being eroded over the years due to various reasons and thus the present status of sacred groves is rather precarious. Various anthropogenic pressures due to developmental activities, urbanization, exploitation of resources and increase in human population have threatened many sacred groves of the country. A study on the status of some sacred groves in the Himalayan region indicated that the economic forces are influencing the traditional communities to discard the community-oriented protection to these groves and they are now being exploited (Saxena et al. 1998, Singh et al. 1998). Sacred groves (Orans) located in Shekhala village of Rajasthan are becoming degraded due to change in peoples' attitude towards conservation of biodiversity, introduction of exotic species and concern for more income generation (Singh and Saxena 1998). Likewise, sacred groves in Peepasar and Khejarli villages of the state have been degrading due to uncontrolled grazing (Jha et al. 1998). Conversion of sacred groves into coffee plantations and human habitation is the major threat to the conservation of groves in Kodagu districts of Karnataka (Kushalappa and Bhagwat 2001). Increasing threats to biodiversity demand new conservation approaches emphasizing on the hidden values of conservation to the local communities and positive local attitude towards national and global conservation goals (Saxena et al. 1998). Traditional ways of resource management are becoming nonfunctional due to direct conflict between ever increasing human population and limited natural resources (Sinha and Maikhuri 1998). Considerable changes have been taking place in the physical extent, vegetation structure and nature of worship in sacred groves of Karnataka due to developmental activities (Kushalappa et al. 2001). Boojh and Ramakrishnan (1983) argued that with the ongoing large-scale deforestation activities in the region, the religious beliefs are the only hope and way of conserving this relict vegetation. On the other hand, Tiwari et al. (1998b) who made a detailed study of sacred groves of Meghalaya found that traditional beliefs regulating subsistence practices no longer seem to exist in reality, and even where they do, they are being increasingly disregarded. It is amply clear that myths and beliefs associated with the sacred groves which used to be followed strictly in earlier days, have been eroded during the last few decades and the groves no longer enjoy the same status and privilege as they used to in the past (Khumbongmayum 2004). It has been found that cultural changes among the young people are so rapid that they no longer believe in the methods their ancestors followed to maintain the fragile ecosystem. This is a global tragedy, because "with the disappearance of each indi-genous group, the world loses an accumulated wealth of millennia of human experience and adaptation' (Posey 1983). For ecologists, traditional ecological knowledge offers a means to improve research and also to improve resource management and environment impact assess-ment (Stevenson 1996). One unfortunate matter that hinders the conservation of sacred grove is that the village people living nearby the sacred groves are poor and so they depend on the grove to meet their vital domestic necessities, such as fuel wood, vegetables, medicinal plants etc. Totey and Verma (1996) argued that the rural poor depend upon biological resources for meeting 90% of their day-to-day needs. So, until and unless viable option is provided to these people for sustaining their economic condition, any step for the conservation of the sacred groves will not be successful.

Following significant points emerge from the foregoing review:

- It is very important to uphold traditions and beliefs in order to protect and conserve these unique forest patches which represent the relict vegetation of the concerned area.
- These forest patches are no longer free from anthropogenic pressure. The disappearance and/or degradation of sacred groves not only symbolize the loss of the rich relict flora and fauna but also its rich tapestry of culture associated with the grove (Kushalappa and Bhagwat 2001).
- Management of sacred groves and sacred sites through the traditional local system is now being challenged by a number of economic and social issues, and thus the traditional methods are rendered less effective. This calls for external intervention taking the local people into confidence.
- Important sacred groves should be brought under the 'Protected area Network' to ensure their proper conservation.
- Ecological services rendered by sacred groves needs to be highlighted and people should be made to realize that the conservation of groves is crucial for their sustenance.

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