Indian Forester, 141 (8) : 832-837, 2015
http://www.indianforester.co.in

ISSN No. 0019-4816 (Print)
ISSN No. 2321-094X (Online)

ENDANGERING SACRED GROVES OF A NON FORESTED REGION IN KERALA, INDIA AND STRATEGIES FOR THEIR CONSERVATION

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ABSTRACT

Alappuzha is the only district in Kerala state without natural forests. Therefore, sacred groves of this region attract utmost attention as they are the only remnants of natural forests once present. An exhaustive survey carried out in Alappuzha district revealed the presence of 1128 sacred groves varying in extent. Plant species numbering 687 were recorded from the sacred groves covering an area of 83.55 ha of Alappuzha district. They belonged to 493 genera and 127 families. Many valuable medicinal plants and wild relatives of cultivated species have been recorded which are important in species improvement programmes. Twenty-seven species were found to be endemic to Western Ghats. Most of the sacred groves in Alappuzha were proved to be invaluable resource pockets of floristic diversity. Many sacred groves in the district face threat due to the dense human population and change in socio-economic status. Break up of ancestral joint family system to nuclear families is the major reason for deterioration of these valuable resources. 'Ulladans', the tribal community collect canes and firewood indiscriminately. Overexploitation of the resources by them has lead to its retrogression to a great extent. Removal of litter alongwith the seeds from the floor has also resulted in retrogression by hindering the natural regeneration process. Exotic weeds namely, *Mikania micrantha, Lantana camera* and *Chromolaena odorata* overgrow the native species and play a major role in degradation. A detailed database on important sacred groves containing all the vital information including soil type, nutritional status, flora, fauna, plant associations, population structure, cultural and religious aspects and management operations will help in prescribing site specific conservation strategy.

Key words: Sacred Groves, Phytosociology, Floristics, Hotspots, Endemism.

Introduction

Sacred groves of Kerala are generally referred as *Kavu* and they exist almost throughout the state. Most of the sacred groves in Kerala are veritable sanctuaries of flora and fauna. Many of them can be seen in combination with sacred ponds and they also act as micro-watersheds of freshwater systems. Some groves give birth to streams and even rivers as in case of river Kavvai originating from Theyyottukavu in Kannur district (Mohanan and Prasad, 2004). A study conducted by the Tropical Botanic Garden and Research Institute, Thiruvananthapuram, Kerala revealed that structurally, the vegetation of the sacred groves is typically of tropical evergreen forest in general with several tiers or types of trees, climbers, shrub and undergrowth. Floristic diversity indices of the sacred groves of Kerala are equal or nearly equal to the forests of the Western Ghats (TBGRI, undated).

Unnikrishnan (1995) reported the presence of around 10000 groves (*Sarpakkavu*) in the northern districts of Kannur and Kasaragod alone and after 5 years, he updated the number of sacred groves (*Kavu*) in these two districts to be nearly 1000 (Unnikrishnan, 2004). Balasubramanian and Induchoodan (1999) verified that the number of groves having an area of 200 m^2 and above is only 761. Another report revealed that only less than 1000 sacred groves exist in the state and most of them are less than 10 m^2 in extent (Mohanan and Prasad, 2004). Though the decline is certain, all the above information indicate the requirement of a comprehensive data base detailing the number, distribution, extent and biodiversity values of these invaluable treasure houses in the state.

Alappuzha is the smallest of the 14 districts of Kerala (1414 km^2) with the highest population density (1492 persons per km^2). It is a sandy strip of land intercepted by lagoons, rivers, and canals the presence of which has given the appellation "The Venice of the East". Alappuzha is the only district in Kerala without natural forests (Department of Information Technology GOI, 2007). However, sacred groves of varying size are present in the area, which attract utmost attention as they are

Sacred groves possess incomparable values and those groves which support endemic species should be declared as *Hot Spots* for conservation.

the only remnants of natural forests once present. No thorough studies have been conducted to assess the status of the groves present in this region.

Methodology

Study area

Alappuzha district lies between 09^0 05' and 09^0 54' N latitude and 76^0 17' and 76^0 40' E longitude. The district is bounded on the north by Ernakulam district, on the east by Kottayam and Pathanamthitta districts, on the south by Kollam district and on the west by the Arabian sea. The total geographic area is 1,414 km^2 which constitutes only 3.64 per cent of the total area of the Kerala state. The entire area of the district lies in the low land and the midland divisions. There are neither mountains nor hills in the district except some scattered hillocks in the eastern region and is the only district in Kerala having no area under the high lands. Most of the area lies in lowland region with an altitude of 2 to 7.5m amsl. 'Kuttanad' area in the district is one of the few places in the world where, farming is done below (0.5 to 2.5m) sea level. The area receives a mean annual rainfall of 2763 mm. About 60 per cent of the rains are normally received during June, July and August, 25-30 per cent in the months of September, October and November and about 10-15 per cent as summer showers. It is a warm humid region with temperature ranging from 20 to 36^{0}C. The mean annual temperature is 27.3^{0}C. The soils of this district can be classified as sandy, peaty, alluvial and laterite. Among the 13 agro-ecological zones of Kerala, Alappuzha district represents four zones namely Coastal sandy, Onattukara, Southern midlands and Kuttanad

Survey of sacred groves

Extensive field survey was carried out throughout the district covering all the six taluks namely, Cherthala, Ambalappuzha, Kuttanad, Karthikapally, Mavelikkara and Chengannur. Visited all the 91 villages within these taluks and recorded first hand information on the existence of the sacred groves. As official records were not available regarding the distribution and extent of the groves, details were collected from the land owners, temple authorities and villagers. After visiting a grove, the neighbouring people were consulted for information on the presence of other sacred groves nearby. Since most of these groves form a part of the homegardens, their area was recorded based on the land survey records from the owners.

Floristic studies

Studied the floristic diversity of all the groves visited during the project period. Plants were identified with the help of floras (Bourdillon, 1908; Gamble and Fischer, 1915-1936; Pascal and Ramesh, 1987) and by verifying with reference collections of the Fischer Herbarium, Institute of Forest Genetics and Tree Breeding, Coimbatore. The status of rare, endemic, endangered or threatened species was checked with Jain and Sastry (1984) and Sasidharan (2004).

Phytosociology

Phytosociological studies were undertaken in 24 selected and permitted groves falling under the four agro-ecological zones mentioned above. Groves of each agro-ecological zone were grouped together and zone wise analyses performed. Sample plots of 10 x 10m were laid out at random in all the 24 groves. All individuals with girth at breast height (GBH) $\geq$ 10cm were considered as trees and GBH was recorded from all trees and climbers. Total number of individuals in a species was also noted.

Density, frequency and dominance and their relative values were worked out following Philips (1959) and Misra (1968). Importance Value Index (IVI) was arrived by summing up relative density, relative frequency and relative dominance (Curtis, 1959). On the basis of IVI values, dominant, co-dominant and main associate species were recognized (Mueller-Dombois and Ellenberg, 1974).

The distribution pattern of species was studied using the ratio of abundance to frequency (Whiteford, 1949). Similarity index between different sacred groves was studied following Sorenson (1948). Simpson Index (Simpson, 1949) and Shannon-Wiener Index (Shannon and Wiener, 1963) were worked out to understand the species diversity (Magurran, 1998). Relative proportions of girth classes for various species were used to understand the population structure.

Results and Discussion

Number and extent of sacred groves

A total of 1128 sacred groves have been recorded during the extensive field survey undertaken throughout the district covering all the 91 villages within the six taluks. Considerable variation was observed with reference to the area of the groves and it varied from 0.003 to 36 acres. Around 57 per cent of the groves (648) measured an area of less than 5 cents (200 m^2). Two-hundred and thirty six groves (21%) were small groves having an area of 5 to 10 cents. Ten per cent of the groves (116) fell under the medium category. Eighty-one groves (7%) were identified as moderately large. Large (28) and very large groves (19) accounted only for 3 and 2 per cent respectively. Mohanan and Prasad (2004) identified 61 important sacred groves from Alappuzha district whereas Induchoodan (1996) recorded 49 groves measuring an area of more than 200 m^2. However, the

present study revealed the presence of 480 groves with an area of more than 200 m^2 and it highlights the importance of having a comprehensive data base.

Floristic studies

Floristic inventory carried out in all the sacred groves recorded a total number of 687 plant species belonging to 493 genera and 127 families. These 687 species included 275 species of herbs (40.02%), 107 species of shrubs (15.57%), 194 species of trees (28.24%) and 111 species of climbers including 03 species of lianas. The family having the maximum number of genera (38) and species (54) was Poaceae followed by Euphorbiaceae (27 genera and 43 species) and Fabaceae (21 genera and 34 species). Ramachandran and Mohanan (1989) pointed out that generally, southern districts in Kerala particularly, Kollam, Pathanamthitta and Alappuzha have maximum concentration of sacred groves. Although these have limited areal extent, they are rich in floristic diversity. On the other hand, the sacred groves of the northern districts - Kannur, Kasaragod and Kozhikode – are generally larger in size, but less diverse, floristically.

Endangered and endemic species

Twenty-seven species (4%) were found to be endemic to Western Ghats of which two species, *Syzygium travancoricum* Gamble and *Vateria indica* L. are critically endangered. *Hopea parviflora* Bedd. and *Hopea ponga* (Dennst.) Mabb. are the two endangered tree species recorded. A rare climbing legume, *Kunstleria keralensis* C.N. Mohanan & N.C. Nair was identified from Mavelikkara Taluk. Four vulnerable tree species namely, *Buchanania lanceolata* Wight, *Dalbergia latifolia* Roxb., *Santalum album* L., and *Saraca asoca* (Roxb.) de Wilde have also been recorded from the sacred groves of the

Table 1 : Important species identified from the sacred groves of Alappuzha district

Species	Family	Habit
Critically Endangered and Endemic to Southern Western Ghats		
Syzygium travancoricum Gamble	Myrtaceae	Tree
Vateria indica L.	Dipterocarpaceae	Tree
Endangered and Endemic to Southern Western Ghats		
Hopea parviflora Bedd.	Dipterocarpaceae	Tree
Hopea ponga (Dennst.) Mabb.	Dipterocarpaceae	Tree
Rare and Endemic to Southern Western Ghats		
Kunstleria keralensis C.N. Mohanan & N.C. Nair	Fabaceae	Climber
Vulnerable		
Buchanania lanceolata Wight	Anacardiaceae	Tree
Dalbergia latifolia Roxb.	Fabaceae	Tree
Santalum album L.	Santalaceae	Tree
Saraca asoca (Roxb.) de Wilde	Caesalpiniaceae	Tree
Endemic to Southern Western Ghats		
Artocarpus hirsutus Lam.	Moraceae	Tree
Bulbophyllum rheedei Manilal & Sathish	Orchidaceae	Herb
Casearia rubescens Dalz.	Flacourtiaceae	Tree
Cinnamomum malabatrum (Burm. f.) Blume	Lauraceae	Tree
Dalbergia horrida (Dennst.) Mabb.	Fabaceae	Climber
Holigarna arnottiana Hook. f.	Anacardiaceae	Tree
Lagenandra toxicaria Dalz.	Araceae	Herb
Mallotus atrovirens Muell.	Euphorbiaceae	Tree
Tabernaemontana alternifolia L.	Apocynaceae	Tree
Theriophonum infaustum N.E. Br.	Araceae	Herb
Endemic to Western Ghats		
Calamus rotang L.	Arecaceae	Climber
Calophyllum calaba L.	Clusiaceae	Tree
Gnetum edule (Willd.) Blume	Gnetaceae	Liana
Helicanthes elastica (Desr.) Danser	Loranthaceae	Shrub
Hydnocarpus pentandra (Buch.-Ham.) Oken	Flacourtiaceae	Tree
Lagerstroemia microcarpa Wight	Lythraceae	Tree
Memecylon randerianum SM & MR Almeida	Melastomataceae	Shrub
Myristica malabarica Lam.	Myristicaceae	Tree
Osbeckia muralis Naud.	Melastomataceae	Herb
Salacia fruticosa Heyne ex Lawson	Hippocrateaceae	Climber
Syzygium caryophyllatum (L.) Alston	Myrtaceae	Tree
Xanthophyllum arnottianum Wight	Polygalaceae	Tree

district (Table 1). Presence of many endemic species in a small area is indicative of its phyto-geographical significance.

Most of the groves had at least one individual of *Vateria indica,* a critically endangered species. *Hopea ponga*, another endangered species was also present in many groves. On the other hand, *Syzygium travancoricum* and *Kunstleria keralensis* could only be located from two separate groves associated with private temples in Mavelikkara taluk. With reference to a vulnerable species *Buchanania lanceolata*, its distribution in Kerala is mostly limited within certain sacred groves only (Induchoodan, 1996). Outside sacred groves, it had been reported only by Mohanan (1986) from two localities in Kollam district in Kerala. In the present study, this species was found only in two groves of Chengannur and Mavelikkara taluks. These results emphasize the need for protecting these groves. Sacred groves which support endemic species should be declared as *'Hot Spots'* for conservation.

Economic importance

Among the 687 species of plants, 281 are known to possess medicinal values. Among the 194 tree species, 57 are being used as timber, 26 as small timber and 68 yields non-wood forest produce (other than medicinal).

Other species of importance

The only one species of gymnosperm reported from this area is *Gnetum edule* (Willd.) Blume belonging to the family Gnetaceae and this plant was present in several groves throughout the district. An insectivorous plant, *Drosera indica* L. of the family Droseraceae could also be located.

Phytosociological studies

Phytosociological studies were conducted separately for the agro-ecological zones. Among the four agro-ecological zones namely, Coastal sandy, Onattukara, Southern midlands and Kuttanad, groves suitable for these studies could not be found in the Kuttanad region.

In the Coastal sandy region, *Calophyllum calaba* registered the maximum value for IVI followed by *Artocarpus hirsutus*, *Quassia indica*, *Holigarna arnottiana* and *Vateria indica.* Simpson's index and Shannon Wiener's index estimated from this region were 0.078 and 3.004 respectively. *Hopea ponga* ranked first with reference to IVI in the Onattukara region followed by *Vateria indica*, *Artocarpus hirsutus* and *Holigarna arnottiana*. Proportion of lianas was also significant. Simpson's index worked out for Onattukara region was 0.121. The value for Shannon Wiener's index was 2.587. The maximum value for IVI was registered by *Hopea ponga* with reference to the Southern midlands also, followed by *Vateria indica*, *Calophyllum calaba*, *Alstonia scholaris* and *Holigarna arnottiana*. The values worked out for Simpson's index and Shannon Wiener's index for the Southern midlands were 0.117 and 2.751 respectively. Natural regeneration was mainly observed in *Artocarpus hirsutus, Caryota urens, Cinnamomum malabatrum, Holigarna arnottiana, Hydnocarpus pentandra, Quassia indica, Strychnos nux-vomica, Vateria indica, Adenanthera pavonina* and *Calamus rotang.*

A view of a sacred grove in Alappuzha district

Reasons for deterioration of sacred groves

The major reasons observed causing deterioration of the sacred groves in the study area are detailed below.

Destruction by sacred ways : Many sacred groves in the district face threat due to the dense human population and change in land use pattern. Break up of ancestral joint family system to nuclear families is the major reason for deterioration of these valuable resources. The family member who receives the portion of the land harbouring sacred grove would clear the vegetation by transferring the deities of the grove to selected temples in the State after offering expensive special rituals. Sacred groves are hence destroyed by sacred ways.

Changes in beliefs : People strongly prefer to follow idol worship and for them, most of the tree species or vegetation in the groves are of no economic use. Weakening of beliefs, faiths and taboos associated with these groves has added to the destruction. However, there are exceptions where the natural vegetation is preserved understanding its ecological importance.

Sanskritisation : Sanskritisation also attribute to this denudation. During the process of sanskritisation, many sacred groves were converted into shrines or temples were built by clearing the lion's share of the grove. In many groves, idols called 'Chithrakoodam' were

constructed within the grove and over a period of time, when they develop cracks due to the pressure exerted by roots of trees, the owner of the grove cut the trees to save the idols from getting damaged!

Overexploitation of resources : 'Ulladans', the tribal community of the district who are permitted to access the groves, collect canes and firewood indiscriminately. Overexploitation of the resources by them has lead to its retrogression to a great extent. As they are not allowed to cut live trees, they kill the trees by girdling. Once the tree is dead, they cut it for fuelwood purposes. 'Ulladans' also hunt tortoises from the sacred ponds and adjoining areas.

Removal of litter : Removal of litter alongwith the seeds from the floor has also resulted in retrogression by hindering the natural regeneration process in many groves in the coastal region.

Invasion of exotic species : Exotic weeds namely, *Mikania micrantha, Lantana camera* and *Chromolaena odorata* overgrow the native species and play a major role in degradation. Profuse regeneration by exotic species like *Acacia auriculiformis* and *Leucaena leucocephala* hamper the natural regeneration of native species in the groves.

Invasion of *Acacia torta* : Invasion of an indigenous climber, *Acacia torta* also has lead to the degradation of a number of groves in the district.

Conservation strategy

- Sacred groves require complete protection from human interferences and is the only way to preserve these priceless treasures of nature.
- The small number of 'Ulladans' settled in the district generally do not maintain their traditional tribal way of life and have become one with the rest of the society. Hence, they can be made aware of the importance of the vegetation system and the rational and sustainable exploitation of the resources.
- People who clear the grove after transferring the deities to the serpent worship temples for various developmental activities should also be sensitized to avoid further damage.
- Officials of forest department, research organizations, NGOs and educational institutions should take lead in imparting knowledge on the functional role and importance of sacred groves. They should also help in ecological restoration of the retrogressing sacred groves by way of selecting and planting suitable plant species.
- The temple authorities can play a major role in conserving the existing sacred groves by not accepting the transfer of deities from these groves to the temple.
- In general, each sacred grove was found to possess its own unique biological, ecological, cultural and economic dimensions. A detailed database on important sacred groves containing all the vital information including soil type, nutritional status, flora, fauna, plant associations, population structure, cultural and religious aspects and management operations will help in prescribing site specific conservation strategy.
- Like any growing natural vegetation, sacred groves can also perform the function of carbon sequestration and contribute substantially towards the reversing the process of climate change. Financial supports / rewards to the individuals and trusts maintaining these groves will go a long way in preserving them intact for posterity.

केरल, भारत के एक गैर वनीकृत क्षेत्र के संकटापन्न पवित्र बाग और इनके संरक्षण के लिए रणनीतियां

कान्नन सी.एस. वारियर, सी. कुन्हीकानन एवं के.आर. शशिधरन

सारांश

केरल राज्य में अलपूझा केवल ऐसा जिला है, जो बिना प्राकृतिक वनों के है। इसलिए इस क्षेत्र के पवित्र बाग अत्याधिक ध्यान आकर्षित करते हैं क्योंकि ये प्राकृतिक वनों के केवल अवशिष्ट अंश है, जो कभी मौजूद थे। अलपूझा जिले में किए गए एक गहन सर्वेक्षण से अलग-अलग मात्रा में 1128 पवित्र बागों की उपस्थिति का पता चला। अलपूझा जिले के 83.55 हैक्टेयर क्षेत्रफल को कवर करके पवित्र बागों से 687 पादप प्रजातियां अभिलिखित की गई। ये 493 वंश और 127 कुलों से संबंधित है। अनेकों उपयोगी औषधीय पादपों और कृष्ट प्रजातियों के जंगली संबंधियों को अभिलिखित किया गया, जो प्रजाति सुधार कार्यक्रमों में महत्वपूर्ण हैं। सत्ताइस प्रजातियों को पश्चिमी घाटों के लिए स्थानिक पाया गया। अलपूझा में अधिकांश पवित्र बाग पादपी विविधता के अमूल्य संसाधन पाकेट्स सिद्ध हुए हैं। जिले में अधिकांश पवित्र बाग सामाजिक-आर्थिक स्तर में परिवर्तन और सघन मानवीय आबादी के कारण संकट का सामना कर रहे हैं। पैतृक संयुक्त पारिवारिक प्रणालियों का एकल परिवारों में विघटित होना इन बहुमूल्य संसाधनों की अवनति के लिए प्रमुख कारण है। 'उल्लाडन्स' एक जनजातीय समुदाय, बेंतों और जलाऊकाष्ठ को अन्धाधुन्ध एकत्र करते हैं। इनके द्वारा संसाधनों के अति दोहन के फलस्वरूप एक बड़ी सीमा तक इनका ह्रास होता है। धरातल से बीजों के साथ-साथ खरपतवार हटाने के

परिणामस्वरूप प्राकृतिक पुनर्जनन प्रक्रिया में अवरोध पैदा होने से अवनति होती है। विदेशज़ खरपतवार जैसे *मिकानिया मिक्रेन्था, लैण्टाना कमारा* और *क्रोमोलीयाना ओडोराटा* देशज प्रजातियों को ढ़क देती है और निम्नीकरण में एक अहम भूमिका अदा करती हैं। मृदा किस्म, पोषणिक स्तर, वनस्पति, प्राणिजात, पादप संबंध, आबादी संरचना सांस्कृतिक एवं धार्मिक पहलू और प्रबंध सक्रियाओं सहित सभी अहम सूचनाओं के साथ महत्वपूर्ण पवित्र बागों पर एक विस्तृत आँकड़ा आधार स्थल विशेष संरक्षण रणनीति बताने में सहायता करेगा।

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