

Nature Conservation Legacy in Western Ghats

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Abstract— Sacred groves in the Western Ghats are integral part of the traditional community life. The raising interest on biodiversity hotspots and its ecosystem services prompted a good number of studies on sacred grove system in the region. However, the scattered nature of the studies and limited availability of the information are major constraints to develop an effective management plan for sacred grove conservation in Western Ghats region. This work attempts to compile all available studies on sacred groves of Western Ghats and emphasizes on their potential for informal agents of biodiversity conservation.

INTRODUCTION

Human – nature interaction has been manifested in various forms throughout the world. The nature of the relation is very much subjective depending on short- or long- term goal of the community concerned. Sacred Natural Sites are defined as areas of land or water having special spiritual significance to people and communities (Wild & McLeod, 2008). These sites existed in the past or continue to exist today in many parts of the world (Hughes & Chandran, 1998; Bhagwat & Rutte, 2005). Sacred Natural Sites occur at a variety of scales ranging from single tree/rock formation to an entire mountain range (Wild & McLeod, 2008). Sacred groves, a subset of Sacred Natural Sites, are segments of landscape that were left untouched by indigenous communities (Khan et al., 2008). They may be considered as keystone structures for biodiversity in traditional landscapes around the world.

In India, sacred grove culture has pre-Vedic roots. The Vedic people personified elemental forces of nature as divinities but had no association with sacred grove culture of non-Vedic inhabitants (Chandran, 2005). The pan-Indian distribution of groves is a subject of great interest to biologists, social scientists, anthropologists and policy makers because groves represent a variety of ecosystems, social and ethnic identities, management regimes, legal tenures, and cultural traditions (Ray et al., 2014). The scientific community today recognizes this tradition as one of the tenets of sustainable use of natural resources. Sacred groves are found in a wide range of ecological situations from estuaries to mountain localities. Gadgil and Vartak (1976)

recorded that the important regions with sacred groves in India are the North Eastern Himalayas (Khasi-Garo hills), Western Ghats, Aravalli Hills of Rajasthan and Sarguja, Chandes and Bastar area in Central India.

Western Ghats, one of the global hotspots of biodiversity and also most densely populated place in comparison to other hotspots (Cincotta et al., 2000). This region which forms the “Malabar Botanical Province” according to phyto-geographers is a narrow stretch running from the hills south of Tapati river in the north to Kanyakumari in the south along the west coast of India covering the states of southern Gujarat, Goa, Maharashtra, Karnataka, Tamil Nadu and Kerala. The narrow stretch of Western Ghats running approximately 1600 km covering an area of approximately 1,64,000 km² with an elevation range of 300-2700 m encompasses a considerable gradient of climatic conditions which have resulted in the diverse ecosystems and life forms.

It is because of high population density, the natural vegetation in many places has been destroyed, degraded or fragmented, and only 6% of the land is currently under primary vegetation (Sloan et al., 2014). Large tracts of the Western Ghats are currently planted with tea, coffee, cardamom, eucalyptus and other crops, and much of the forest remains only as small fragments (Menon & Bawa, 1997; Bawa et al., 2007). However, even these fragments can support a high diversity of species, including endemic plants, mammals, birds and herpetofauna as well as large predators and Asian elephants, most of which also use agricultural areas (Mudappa & Raman, 2007; Sridhar et al., 2008; Anand et al., 2010; Ray et al., 2014).

The region has diverse socio-religious spectrum across the coastal extent and the imprint can be found in sacred grove tradition too. Apart from oral descriptions, folklore and socio-religious scripts, this age long tradition was first documented by colonial rulers of the region. The current impetus on this tradition can be traced back in 70's when Gadgil and his associates studied the system with an emphasis on their environmental, ecological and social importance

(Gadgil and Vartak 1976). Their studies in northern Western Ghats (Maharashtra region) were followed by a large number of literatures across India which is continuing even today. A thorough screening of the available studies from Western Ghats has shown the gradual change from inventory and observation based accounts to species and habitat ecology, ecosystem services, population dynamics, disturbance assessment and conservation status (Ray et al. 2014). However, these studies are concentrating on certain areas therefore, application across Western Ghats is not beyond controversy/confusion. To create an effective conservation framework across the Western Ghats, it is necessary to consider both the formal and informal mode of protection measures, so that all stakeholders can participate actively in the endeavor. Sacred grove promises potential in this regard as people centric decision making is the key factor here thus decentralize and democratize the conservation planning further. The present study aims to make a comprehensive understanding on sacred grove systems in Western Ghats emphasizing on their mapping and distribution pattern, biodiversity and ecological potential, their role in biodiversity conservation and possibilities to include the tradition in Western Ghats conservation planning.

METHOD

Compilation of information: Both primary and secondary source of information have been compiled for the study. For primary information, field work was conducted in central Western Ghats region in Karnataka, Kolhapur and Radhanagari districts of Maharashtra and Palakkad region of Kerala. As a part of long term research plan on sacred grove system, works conducted on genetic diversity assessment of critically endangered species as well as land use dynamics analysis have also been considered here. Secondary information was based on literature review (both online and offline resources) and data retrieval from regional database systems. Literature review included available published documents (viz. research paper, popular article, scientific report, technical report, dissertations, books, forest working plan, and village level documents) and database search (viz. ENVIS centre, CPREE, Chennai and CES, IISc).

Mapping and documentation of the sacred groves: The documented groves from the Western Ghats region were digitised from available resources and mapped. Mapping was done using GIS software like Q-GIS and MapInfo. It was due to the availability of wide range of areas (≤ 1 ha to ≥ 100 ha), categorization of the grove based on equal interval (an interval of 5 ha) was a mammoth task and available categories have shown biased nature of the dataset. Therefore, to

maintain an uniformity among the grove numbers, medium to high categories were clubbed to form bigger size classes, which results into a total number of six classes (i.e. <1 ha, ≥ 1 to <5 ha, ≥ 5 to <10 ha, ≥ 10 to <20 ha, ≥ 20 to <50 ha & ≥ 50 ha).

Documentation on biodiversity and ecological characteristics: Quantitative information on flora and fauna has been collected from field data and secondary resources. Habitat characteristics, ecosystem services and other related information were compiled from available documents. To characterize the sacred groves (area > 5 ha.) in terms of forest structure and proximity to water bodies, analysis were conducted by using the forest maps of South-India (1:250000) (KIF, Pondicherry, 1982,1984) and regional hydrology map (1:50000). Proximity of the grove to forest and waterbodies was calculated by taking buffer zone of 1000m around the grove.

RESULT

Mapping and distribution pattern: The sacred groves distribution in Western Ghats can be seen in six states namely Gujarat, Goa, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu. On the basis of available data a total of 1905 groves have been recorded from the study area with 1477 (77.5%) groves lying within the boundaries of Western Ghats (Fig 1). The total area of the sacred groves across the Ghats ranges from 0.001798 ha (Hulibesi Bhutappa Bana in Sagar taluk of Shimoga district of Karnataka) to 665.708 ha (Duglihosuru in Sagar taluk of Shimoga district of Karnataka). Donunduru sacred grove in Sagar taluk of Shimoga district of Karnataka has the maximum area of 464.988 ha within the boundary of the Western Ghats. State wise, Gujarat has lowest number of sacred grove (4%) within Western Ghats territory, followed by Kerala (53%), Goa (74%), Tamil Nadu (77%), Maharashtra (89%) and Karnataka (94%). Due to unavailability of much information about the size and extent of the groves from Gujarat, Goa and Tamil Nadu they have not been added in the area analysis. The available information on the groves documented from Tamil Nadu reported that the range area is from 0.4 ha to 202.343 ha (CPREE, 2015). Out of 1477 sacred groves across the Ghats, area information was available for 808, among which Karnataka has maximum representation in higher size groups (10 ha. - > 50 ha.). On the other hand, lower size categories were dominated by both Kerala and Maharashtra.

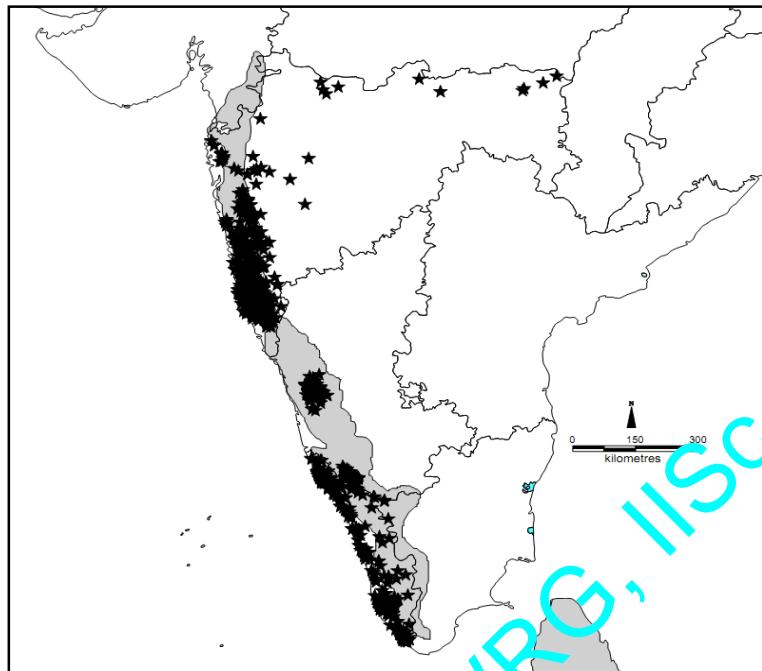
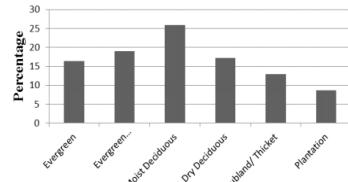


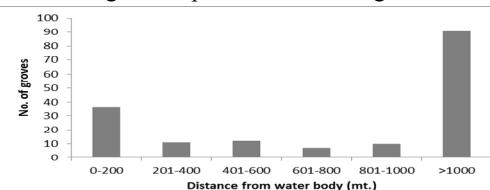
Fig 1. Location of sacred groves across Western Ghats states

Vegetation type and proximity to waterbody analysis: Sacred groves with > 5ha. area were considered for this analysis. According to the forest map of South India, majority of the groves belong to moist deciduous forest category followed by evergreen and semi-evergreen forest types. Apart from forest types, a good number of groves have been reported from scrublands and plantations. Observations related to smaller groves (i.e. < 5ha. area) have revealed that a good number of them are present in agriculture-plantation dominated lands and unique habitat systems like Myristica swamps (Fig. 2 a). Sacred groves association with water body was analysed by putting 1km buffer around the grove area with an assumption that maximum impact can be reached upto that level considering the local nature of the water bodies. Water-bodies mostly consist of small ponds, well, streams and rivers. 76 out of 167 groves (spanning across 3 states) from all the four categories have proximity to water body. 36 groves come within the 200m buffer range from the grove, 11 groves fall under the range 201 to 400m and 17 groves come under the buffer range of 600 to 1000m (Fig. 2 b). In Maharashtra, rivers Kalu, Muchkundi, Gharkond, Devgad, Vashishti, Vaghottan and Karli

lie in close proximity with the groves that is within 1000 m. 36 groves in Maharashtra state are near water body with 10 sacred groves being near to rivers, 16 being close to constructed dams and rest are near water bodies. Construction of dam also possesses threat to sacred groves. Available documents mentioned about submergence of the villages under dam water thus groves associated with them.



2 a. Vegetation patterns in sacred groves

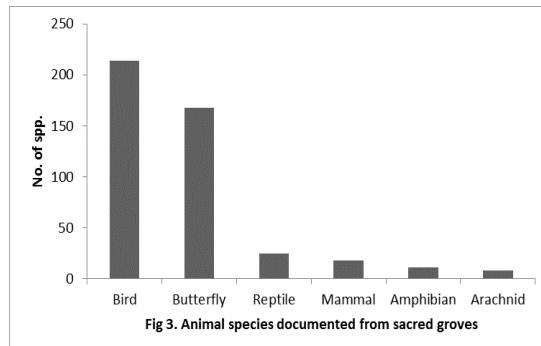


2 b. sacred grove-water body association result

Reservoirs like Linganamakki, Savekhalu and Mani surround many sacred groves in Karnataka state. For instance, Kesare & Baiduru sacred groves of Sagar taluk lie within 50m range from Linganamakki Reservoir. Rivers like Lakshmana Theerta and Kaveri have been found to flow through groves of Kodagu. 25 groves in this state are found to lie within the range of 1000 m from water-bodies with 3 lying near rivers and 22 lying near dams. In Kerala, rivers like Kakkatar, Bharathappuzha and Vallappatham have been found to lie within 1000m buffer zone from the groves. A total of 4 groves show proximity to water-body in this state with 1 and 3 groves lying near river and dams respectively.

Biodiversity and ecosystem service assessment: Grove biodiversity studies mostly encompass flora and that is also concentrated on angiosperms only. However, the enumeration of floral assemblage across the Ghats supports their role to maintain regional species pool in this highly threatened hotspot. Although the current list is not exhaustive, a total of 804 species under 101 different families, have been recorded so far with 8.33% endemic ones. There are few reports on lower group members' viz. macro-fungus from Kodagu, Lichen from central Western Ghats, micro-fungus from Goa, Western Ghats (although not from sacred grove) etc. Similarly, studies have done based on unique habitats like Myristica swamps, mangroves etc. Apart from species inventory, ecological aspects like population status, reproductive ecology, rare/endemic species survival, pollination, seed dispersal and regeneration are covered but clustered in certain areas. Compare to flora, faunal enumeration has shown better representation from multiple classes. Maximum species have been recorded from avian group (>200 spp.) followed by butterfly (>150 spp.), reptiles, mammals, amphibians, arachnids subsequently (Fig 3). Like floral aspects, hardly studies have been conducted on broader ecological perspectives except few scattered ones.

Diversity at other scale has not been studied much except two cases. In Kodagu, genetic diversity of *Litsea floribunda* and *Mangifera indica* have been assessed for sacred grove populations and result has shown both smaller and larger groves have important role in maintaining genetically diverse populations. Another study on *Syzygium travancoricum* Gamble, a critically endangered species, has revealed that grove specific populations have unique genetic characteristics thus expanding the genetic spectrum of the species across the Ghats (unpublished data).



Ecosystem services from sacred groves mostly dealt with water conservation, carbon sequestration, medicinal plant richness, non-timber products availability, nutrient cycling and biodiversity maintenance. However, considering the expanse of Western Ghats, these studies are very few and scattered in their distribution. Moreover, quantitative estimations are fewer than descriptive accounts.

DISCUSSION

This study is an attempt to develop a comprehensive idea on ecological perspective of sacred groves of Western Ghats. This informal mode of conservation tradition has a long and diverse community involvement history and important role in regional land use planning. Among the six Western Ghats states, Maharashtra, Karnataka and Kerala share major information on sacred groves in comparison to other three states. The geographical extent of these three states across Western Ghats certainly is a major factor in this regard along with attention from the researchers due to its' international repute. Moreover, major part of the Western Ghats forests is in these three states a part of which comes under sacred grove category, therefore, prompted further investigation in that direction. Western Ghats occupy minimum space within administrative boundary of Gujarat, the semi-evergreen dry forests although noted for its distinct community composition, sacred grove information yet to be find out. On the other hand, Goa and part of Tamil Nadu mostly come under core area of Western Ghats however, scientifically validated information are rare although informal accounts are available.

The nature of studies clearly shows prevalence of biodiversity enumeration. A good number of flora and fauna has been documented from the region which is no doubt a valuable resource for understanding species distribution extent, their habitat preference and response towards human intervention. However, same cannot be said for ecosystem related studies. Inadequate representation, locality specific interactions and smaller spatial



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extent are few factors impede general implementation of the findings. Despite this limitation, the interesting outcomes from these studies encourage future endeavor in this direction across the region.

The recent emerging interest on landscape research has important role in sacred grove system. Majority of the sacred groves in Western Ghats are associated with villages i.e. close to human settlements. Although studies pointed out their role as a connective link between forest tracts and shelter for endemic species, the scenario still needs to be improved.

CONCLUSION

Sacred groves are integral part of the Western Ghats landscape. These people centric nature conservation practices provide a vital link between human and its surroundings. It is because of sacred groves still a good number of organisms are under social protection outside the formal protected area network in Western Ghats. This social protection practice may provide a vital way out for biodiversity protection under regional land use scenario. If the people centric practice is officially recognized under village development program and integrated within regional land use planning the biodiversity conservation agenda will have far reaching impact on the society and nature.

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