Small sacred groves in local landscape: are they really worthy for conservation?

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Sacred groves are communally-protected forest fragments with significant religious connotations. These community lands attain significance due to biodiversity conservation and provide ecological services in local landscapes. However, it has often been found that interests related to sacred groves are often concentrated towards the groves with conspicuous presence, i.e. in terms of expanse, economic importance or presence of charismatic species, etc. This undermines the role played by the small groves (mostly < 1 ha) and also lead to degradation over time. This commentary analyses the role and need for conservation of small groves in local landscape scenario.

Sacred groves are 'natural areas of special spiritual significance to peoples and communities. They include natural areas recognized as sacred by indigenous and traditional peoples, as well as natural areas recognized by institutionalized religions or faiths as places for worship and remembrance'[1]. They are characterized as relics of past vegetation and remnants of large ancient forest lands[2]. Studies substantiate the presence of rich endemism and biodiversity in grove areas apart from highlighting their ecological services and their role in livelihood development[3–8]. Present day groves are the epicentres of ecological research, conservation policy and management planning at state and national level[9,10]. However, in recent times sacred groves are threatened due to unplanned developmental activities apart from various biological (invasive species, soil erosion, land-use change, etc.) and social (loss of belief, violation of social taboos, change in religious and cultural life, population increment, etc.) threats.

Sacred groves vary in size from < 1 to > 100 ha, depending on their location and management profile. Larger groves, which are usually part of reserve/protected forest or under strong community management, are usually in conservation and management agenda for their expanse, rich biodiversity, heritage and cultural values. Nevertheless, changing social and cultural perspectives have altered the grove management system, thus influencing their existence. The fate is severe for the smaller groves or cluster of trees (especially < 1 ha) at sacred places, due to either disturbances (biological/social/developmental) or indifference because of their negligible spatial extent. Often, these are considered as vegetation patches without any biological and ecological significance, and provide meagre monetary benefits. In this context, question arises whether these small degrading groves or sometimes clusters of a few trees are really insignificant? Do they have any role to play in the local landscape? Whether or not conservation is necessary to protect them from further degradation?

Seeking an answer to these questions would be easier if we consider/conceptualize grove as a small fragment of forest or remnants of a past forest landscape. Forest fragmentation is the process whereby a large, continuous area of forest is both reduced in area and divided into two or more fragments. The decline in size of the forest and the increasing isolation between two remnant patches of the forest have been cited as one of the major causes of declining biodiversity[11]. Once a vast forest tract is fragmented, organisms have to face many adverse situations. These include opening up of habitat to the outer world, exposure to harsher climatic conditions, resource crunch, immigration of new members/competitors, etc., which ultimately lead to migration or extinction of a good number of species from the area. Therefore, ideally fragmentation is not desirable at any level. However, practically fragmentation is an obvious fact and is gaining momentum day by day all over the world. Therefore, how the species survive in a fragmented landscape, what are the adaptations taking place to the community due to fragmentation and conservation importance of fragmented landscape, are some of the burning issues in fragmentation research.

Fragmented patches serve as an integral part of the local landscape matrix[12]. Amidst the agriculture field and monoculture plantations, forest patches maintain the local biodiversity by increasing the likelihood of the survival of the indigenous members. For a sacred grove which is nothing but a fragmented forest patch nowadays, this biodiversity value is more significant as they contain many primary forest species due to their antiquity in origin[5]. Although secondary forest species as well as introduced species are also available due to higher order effect, primary members are noticed because of their longer life span. However small a grove could be, it influences the local biodiversity by providing shelter to a large number of small organisms such as arthropods, insects, microbes, amphibians along with the charismatic larger ones. It is evident that a couple of trees or even a single tree can support other life forms efficiently[13].

Scientific literature and reports from India suggest that groves support a variety of plant and animal species among the heterogeneous landscape matrix. However, documentation pertaining to small groves (< 1 ha) or a cluster of trees is either scanty or rare. Studies on selected groves in West Bengal show that groves within a size range of 0.04–1 ha harbour 114 species of flowering plants distributed in 52 different families whose ethnobotanical usage is noteworthy[14]. Similarly, 30 species of medicinal plants have been reported from three small groves (0.6–0.8 ha) in Midnapur district of West Bengal[15]. Sukumaran *et al.*[8,16] highlighted the floristic richness of 201 (13.1 ha area) and 11 (2.6 ha) miniature sacred groves of Kanyakumari district in Tamil Nadu. Collectively, these groves represent a good number of endemic, rare, endangered and economically

important plants of the region. In Kerala, Sujana and Sivaperuman[17] have reported the presence of rare threatened flora in small sacred groves (0.08–0.33 ha) with an emphasis on their conservation importance.

The strategic locations of small fragments and their connectivity in landscape have paramount importance for maintaining ecological activities as well as local biodiversity. Ecological services like pollination and seed dispersal are mostly dependent on available faunal diversity whose survival is controlled by availability of favourable habitat. Bodin *et al.*[18] studied the importance of small patches (which are mostly preserved by local taboos) and the consequences of their sequential removal on pollination and seed dispersal in agricultural fields of southern Madagascar. Simulation models have shown the consequences of the removal of small patches (≤ 3 ha) thus, affecting overall pollination activity in the study region. Similarly, seed dispersal by ring tail lemur was also affected by the removal of small patches as it affected their habitat/resting places or transport corridor. Moreover, result also shows that it is the position rather than size of the patch which plays an important role in pollination and seed dispersal services. Tambat *et al.*[19] studied the effect of grove area on seedling mortality of two species *Artocarpus hirsutus* (Moraceae) and *Canarium strictum* (Burseraceae). It has been found that, seedling fitness decreases as the grove area reduced which could be due to inbreeding among the fewer individuals and accumulation of lethal characters. The distance between the groves (average of 6.5 km) imposes constraint on pollination activities and also leads to inbreeding depression, reducing the survival capacity of individuals in the long run. This emphasizes the need to protect groves against fragmentation to ensure the conservation of threatened flora and fauna.

For faunal populations it has been found that, despite the absence of large predators, small mammals and other groups adapt to sustain the impact of fragmentation[20–22]. Gascon and Lovejoy[23] reviewed effects of fragmentation in Amazon. The study showed that edge effect is species specific – the diversity of birds and ants was found to decrease after fragmentation whereas frogs, small mammals and butterflies showed increase in diversity. Studies also indicate that survival of species in a fragment is more dependent on fragment quality rather than size. Fragment quality includes better management of fragment vegetation and its surroundings[24]. Considering avifauna, groves are already established as refugia for them[25,26]. In an agriculture-dominated landscape they provide the necessary microenvironment required for the local avifauna.

There is a need to explore and understand the role of these small patches in ecosystem services like carbon sequestration, temperature control and water conservation. Few studies in this direction however endorse the role and potential of groves. Being a part of relic forests, groves are repositories of ancient trees and undisturbed soils which play a pivotal role in sequestering considerable amount of carbon, which is evident from a study in Nagoni sacred grove, Garhwal Himalaya[27]. It is seen that carbon stock in vegetation and in soil is significantly higher in grove area compared to other forest ecosystems. Isolated small fragments may not have greater impact on temperature control in large scale but their role in local level cannot be ignored. Studies on scattered trees in African savanna have shown that due to interception of radiation and precipitation, they offer cooler microclimate in their surroundings[28], which act as shelter for many small organisms. Similarly in Australian woodland, it has been pointed out that, through stem flow and water uptake by root system and infiltration, water concentration is higher near the given tree as compared to the surrounding dry environment[29]. Considering the extreme small populations in degraded groves (as seen in many places of central and eastern India), these studies on temperature and water control could be useful to find out the local ecological importance of these scattered vegetations in an area.

It is important to remember that present day grove is a part of the local landscape matrix. Its unique biological diversity and ecological services are dependent on the complex interaction of organisms and environmental factors for which entire landscape matrix is involved. Fencing the grove for protection against grazing or cultivation of rare species for saving biodiversity may fulfil the short-term objectives but for long-term achievements landscape level management planning is necessary. It is an obvious fact that most of the surrounding landscapes in grove are economically productive areas (agriculture, plantation, construction, etc.). Therefore, any decision or planning towards landscape level conservation is extremely controversial and difficult to materialize[30]. However, concepts such as retention harvesting, agroforestry and green tree retention can be considered for this purpose as these are dealing with sustainable utilization of resources and integrated management of different land use forms. It is a common perception that large groves are worthy of conservation because of their species richness, probable ecological significance and their magnitude. On the contrary, smaller groves or cluster of trees at sacred places are often neglected due to their smallness and lack of knowledge about their potential. Although few studies have already pointed out their role in biodiversity and ecosystem maintenance, more detailed study is yet to be done at national and local levels. It should be kept in mind that these small patches can serve at a local level in a more efficient way in terms of management, cost and acceptance. For conservation purposes, these small patches usually require good monitoring to prevent further degradation and a certain minimum resource input for maintenance. In recent years, peoples' participation in conservation activity and planning is increasing positively. In fact the most important inherent law of successful conservation planning is how much it is acceptable to the local inhabitants. For a sacred grove, this issue is pivotal one as the concept is intermingled with peoples' cultural and religious life. Although sacred grove conservation is a known issue now, there is a possibility that the maximum positive effects could not come out due to some misconceptions. It is a popular idea that unless there is some minimum threshold size, the vegetation patch has no special significance in terms of biodiversity and ecology which eventually leads the farmer or villager to remove the patch[20]. For a single event or at a very small scale it may not have much impact but repeated occurrence of the same incidence gradually leads to altered landscape and ecosystem functioning. Alternatively, if the local people are informed about the biological/ecological significance of these small patches and are encouraged to protect them, conservation activity would be more accepted and widespread than the current extent.

Biodiversity encompasses a wide spectrum of life forms, from microbial to large vertebrates and giant trees, all contribute significantly to make our planet a hospitable place. However, it is our better understanding of some members and their magnificent presence (e.g. tiger, elephant, etc.), conservation activities are often inclined towards them at the cost of comparatively silent less charismatic members. An ideal conservation approach should treat every organism with same importance which we may find difficult to follow in reality but the goal must be set in that direction. The increment of fragmented forest lands in recent times compels ecologists and conservationists to reorient their thinking towards maximum utilization of minimum lands available for biodiversity and ecosystem conservation in a heterogeneous landscape. The importance of small groves or a cluster of trees in protecting various life forms outside the forest has already been established. The need of the hour is to generate awareness among people and proper planning to conserve these small patches at a local level. Ideas such as 'community reserve' as mentioned in the Wild Life (Protection) Amendment Act, 2002 can be utilized for favourable policy development to provide legal framework for these small patches apart from usual social protection from community. The timely acknowledgement of their invaluable services may help us to preserve biodiversity at humanized landscape.

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