INNOVATIVE ENERGY TECHNOLOGY SYSTEMS AND ENVIRONMENTAL CONCERNS: A SUSTAINABLE APPROACH
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Ecosystem Conservation through Sacred Groves

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Abstract

Sacred groves represent an ancient Indian conservation tradition, protected by local people out of reverence and respect, fear and sentiment. They are the home of the local flora and fauna, a veritable gene pool and a mini-biosphere reserve. Within these groves are locked ancient secrets of herbs and traditional medicine, primitive practices of sorcery and magic. Sacred natural sites such as forest groves, mountains and rivers are arguably the world's oldest form of protected areas. These sites can be found in almost every country and culture, and they play a vital role in the informal conservation of both biological and cultural diversity. Although these sacred groves were on average only partially representative of forest vegetation, their stronger sustainability compared with unprotected tree stands may be important to consider in detail for conservation.

1. Introduction

The studies have shown that as nodes of energy and material consumption, cities are causally linked to accelerating global ecological decline due to that they are not by themselves sustainable. At the same time, cities and their inhabitants can play a major role in helping to achieve global sustainability (William Rees ,Mathis Wackernagei , 1996) as around 50 percent of global population resides in urban areas. Over the next 25 years, rural populations are expected to decline, meaning that all population growth will occur in urban areas (UNFPA, 2007). Proper management of cities will ensure that they are ecologically, economically, and socially more sustainable places to live in the future (Mădălina Dociu, Anca Dunărințu, 2011). Communities have been playing a crucial role in conservation of natural resources since time immemorial in India their association with nature is not merely utilitarian, but rooted in deep veneration and cultural ethos. Instances of community led conservation practices in India include maintenance of sacred groves, ponds, wetlands, animal habitats etc. One such significant tradition of nature worship is that of providing protection to patches of forests dedicated to deities or ancestral spirits. These vegetation patches have been designated as sacred groves. Although different authors have described these groves in different ways, most scholars emphasize the natural or near-natural state of vegetation in the sacred groves, and the preservation of these groves by local communities through social taboos and sanctions that reflect spiritual and ecological ethos of these communities. Thus sacred groves (SGs) are segments 'of landscape, containing vegetation and other forms of life and geographical features that are delimited and protected by human societies under the belief that to keep them in a relatively undisturbed state is expressive of an important relationship of humans with the divine or with nature (Fikret Berkes, Johan Colding, Carl Folke, 2003). These sacred groves

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are sometimes within the urban agglomeration or are present nearby to it. These are also sensitive ecosystem patches with multiple environmental benefits.

2. Environmental benefits from Sacred Groves

Conservation of water resources: Many Sacred Grooves hold water resource in the form of springs, ponds, lakes, streams or rivers. Not only that, but the vegetative mass of the grove itself retains water, soaking it up like a sponge during wet periods and releasing it slowly in times of drought. It is evident that one of the important ecological roles of these groves is to provide a more dependable source of water for the organisms living in and around the Sacred Grooves (Malhotra, 2001). The ponds and streams adjoining the groves are often perennial and in some cases, act as the last resorts to many of the animals and birds for their water requirements, especially during dry seasons. Another function may be to reduce the incidence and intensity of forest fire, at least in some climates. In addition, transpiration from the SGs vegetation would increase atmospheric humidity and reduce temperature in the immediate vicinity and produce a more favourable microclimate for many organisms.

Biodiversity enhancement: Sacred groves serve as repositories of genetic diversity and are provided with comprehensive and rich ecological niche. Many SGs constitute pristine vegetation, and are particularly rich in trees and associate groups of organisms, like epiphytes, amphibia, reptiles, birds, butterflies etc. (M.L. KHAN, 2008)

Conservation of rare and endemics plant species: A number of studies have emphasized that many sacred groves are repositories of rare species. Haridasan and Rao (1985) have reported at least 50 endangered and rare species in sacred groves of Meghalaya. Kunsteria keralensis, a climbling legume, reported from a sacred grove in southern Kerala, is confined to that sacred grove (Priyanka Agnihotri, July 2012). A number of studies have emphasized that many SGs are climax forests, and probably constitute the only representative of near-natural vegetation in many parts of India. (M.L. KHAN, 2008)

Biomass: While in some sacred groves the biomass is not harvested (Gadgil and Vartak (1976), Roy Burman (1995) and Godbole et al. (1998) report such groves in the Western Ghats of Maharashtra) there are some where there is a defined extraction (Singh and Saxena 1998) and Jha et al. (1998) report that in many orans people graze their animals; Godbole et al. (1998) report collection of dead wood and dried leaf litter and harvesting of certain species of trees (Caryota urens and Mangifera indica) from groves in Ratnagiri district of Maharashtra; communities derive certain direct economic benefits from the groves (Hangarge L. M., 2012).

Soil conservation and nutrient cycling : Sacred groves play a crucial role in soil and water conservation (Anubhav et al, sacred grove). With a rapid litter decomposition rate, nutrient release in the soil of these groves is very high. The soil itself has little nutrients to support a large biomass of the sacred grove. Studies show that the fine root mat developed on the surface layers of the soil is important for supporting the large above-ground biomass and for tight cycling of nutrients. Many microorganisms, invertebrates, fungi, etc. flourish and a vast array of species not hitherto indigenous to the groves may also colonise and thrive (Malhotra, 2001).The root mat prevents the nutrients from leaching out. The land surrounding the SGs in this area, which is devoid of necessary root mat and litter decomposition, can no longer sustain

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vegetation. Thus it has been seen that these forest patched prevent soil erosion and also maintain soil nutrients.

3. Methodology

Case study method was applied for the study. An examination on status and presence of this institution in Mandla, Dindori and Amarkantak districts of Madhya Pradesh was done vis a vis on ecosystem of these areas. These districts are located in the upper region of River Narmada; there is a significant tribal population in this area. These tribals have a great reverence to the landscape around. River Narmada is worshipped and cultures and tradition revolve around the natural landscape of the Narmada valley. The groves have flora with ethno botanical significance.

Field visits were conducted in the year 2013 in the month of December to study the present status of these groves. Available literature was also referred for the above study.

A. Case study -1 Amarkantak Achanakmar bioreserve

Amarkantak is situated in Anuppur district of Madhya Pradesh. It is the town from where lifeline of central India River Narmada originates. The forests also house the origin of river Sone and Johilla. The forest groves in this region are centuries old and are managed by local communities, mostly by the Baiga tribes. Hence there are numerous sacred groves in this region which are managed locally.

The presiding deity varies in each case. Some deities of these groves are Goddess Narmada , Vandevi, Lingodev , Maikaleshwar, Sone, Goddess Johilla etc.

These forests have thus been given a status of bio reserve in the year 2005. It is also one of the most dramatic and ecologically diverse landscape in the Chhattisgarh and Madhya Pradesh states of India. It is one of the less developed and least disturbed areas in both the states as community had deep respect for it. It encompasses most of the original natural and cultural features.

Importance: The area is "Genetic Express Highway" linking two biological Hot Spots namely Western Ghats and Eastern Himalayas. A total of more than thousand species spread over 151 plant families have been reported from the area. (EPCO study 2005)

It is home of 67 threatened faunal species, belonging to various categories of global threats as per IUCN 2001 categorization like Four horned antelope (Tetracerus quadricornis), Indian wild dog (Cuon alpinus), Saras crane (Grus antigone), Asian white-backed vulture (Gyps bengalensis), Sacred grove bush frog (Philautus sanctisilvaticus). One of the species Hedanium Coronarium (Gulbakavli) is critically endangered in India which is found in Mai Ki Bagiya, Sone Muda, Kabir Chabutra etc. in Amarkantak.

The geology of the area is unique and varied from schists and gneisses with granite intrusions, to sand stones, shales, limestone, basaltic lava and bauxite. The soil varies in composition and texture from sandy to loamy-clays, generally light brown to brownish and olive green clay at some places. Red soil due to presence of iron oxide which is porous and fertile, alluvial soil on the banks of numerous streams in the tract and black cotton soil in many areas, support a large number of ecosystem and species.

Socio-Economic Characteristics

Twenty-seven tribal and non-tribal communities inhabit 418 villages. The total population of the area belonging to 27 communities as per the last census (2001) is 436,128 habitants. The

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main occupation is agriculture (including production of medicinal plants), bamboo handicraft and non-timber products produced in the buffer zone and transition areas. (Unesco)

Case study -2 Mai ki Bagiya (Goddess garden)

A grove of trees in dense forests 1 km from Narmadakund is named "Mai ki Bagiya" in honour of the goddess Narmada. In this natural forest patch are many floral species such as mango, banana and other fruit trees along with Gulbakavli, roses and other flower plants. The grove has predominantly lush mango trees amongst other species. One of the most important and disturbed groves is the Mai ki Bagiya where River Narmada is supposed to originate. It has five kundas where the river emerges as springs and then has an underground flow.

Findings: Anthropogenic activities in the area have increased in the last ten years. Contributing to rapid deforestation, site degradation and fragmentation of natural habitats of wild animals. Some disturbances noted in these groves were

1. Heavy vehicles move around day and night through this area. Many plant species have disappeared while many more are getting threatened (Prasd, Ram, Tropical forestry 1987).
2. Religious tourism: Religious tourism has expanded manifolds in the last three decades. The five kunds are now enlclosed in a temple complex now. The naturalness is under threat by the expansion of the temple premises. The original marshy land of the grove which had thick bamboo plantation is now replaced by stone floorings and concrete structure of temple complex.
    a) A new rcc construction to house ‘Kriya Ashram’ near to the Udgam is happening in the grove; which has created disturbances by means of road layout, felling of trees, increased movement etc
    b) As a result of the increased paved area within the grove natural runoff is getting affected. Soil erosion is evident in Hanuman Dhara as a consequence, there are also cases of roots exposure within the groves of very old trees. The forest department has taken few measures to revert them.
3. Threat of invasive species: Invasive weeds such as vanchana, pine, lantana species etc are occupying the forest floor and preventing other native species to grow. Presence of new species alter the soil ph and present unfavourable conditions for natural regeneration of native species.
4. Extraction of biomass: Cucuma angustifolia, Chlorophytum tuberosum, Asparagus recomosus, Bahuinia vahlii and Emblica ribes are in decreasing trends in both occurrence and dominance due to over exploitation and unscientific collection. Continuous trampling of forest floor is also threatening many plant species.
5. Grazing and collection of tender leaves of sal, saja, tinsa, dhawa, kosum, char and aonla also poses serious threats for regeneration.

B. Case study -3 (Mandla district)

Mandla is a tribal district situated in the east-central part of Madhya Pradesh. The district lies almost entirely in the catchment of river Narmada & its tributaries. A district with a glorious history, Mandla comprises of numerous rivers and endowed with rich forests. The city was a capital of the Gond dynasty who built a palace and a fort, which in the absence of proper care have gone to ruins.

People: Mandla had a population of 45,907. Scheduled tribes dominate the population, so there is a Special education programs to promote them. The Baigas are the most primitive and interesting forest tribal of the district;

Believes and tradition: The Baigas, being an indigenous tribe, were always close to nature. A Baiga cannot without offence lacerate the breast of mother Earth with the plough; and hence it is said they took to bewar, their typical form of cultivation. However, over a period of time, with increase in population more forest area was converted into agricultural land and residential area. Bija Puja is carried out in the forest wherein people assemble at a sacred place before the sowing season and offer different varieties of seeds to the nature goddess and pray for a good harvest. Thereafter, seeds are taken back and sown in the village. The community also celebrates Nav Varsh Puja once every nine years. In this, honeybees are worshipped in the village gothan (cattle sheds). All the households prepare khir and offer millet to nature goddess and vow not to extract honey from the forest.

Sacred groves: The sacred groves in the district occupy an area of approximate 0.28 hectare. These groves also had several keystone species. The region is very rich in flora and fauna due to its tropical moist deciduous vegetation which covers the majority of the area and tropical dry deciduous vegetation to its southern part, minimum disturbed landscapes, endemism and genetic variation. It has nearly 1498 plant species belonging to 799 plant genera from thallophytes, bryophytes, pteridophytes, gymnosperms and angiosperms. There are 3 endemic and 282 regionally rare species and 39 different categories of globally threatened floral species. In animals, there are 327 species belonging to 256 genera of invertebrate and vertebrate fauna besides many taxonomically undescribed species.

Case study -4 (Dindori district)

The Karopani village is located in the Dindori block of the Dindori district of Madhya Pradesh. Dindori district is situated at the eastern part of the state touching Chattisgarh state. Dindori district is surrounded by Shahdol district to its east, Umaria district to its north and the Bilaspur district of Chattisgarh to its south. The Karopani Community Conserved Area (CCA) falls under northern tropical grasslands, which is interspersed with agricultural land and fallow land. This CCA is especially reserved for the Antilope cervicapra or the Blackbuck that lives on the village grassland and land left fallow by the community.

People: The Karopani village is a revenue village comprising five villages and is home to 70 households. The caste composition is heterogeneous and includes Dalits, Thakurs, Paras and Sonwani community. Agriculture is the main source of livelihood. Landless families depend on agricultural labour.

Beliefs and tradition: The Karopani Community conserved area is an important site because of its rich faunal significance. The presence of Blackbuck holds great mythological and traditional importance. According to the Hindu mythology the Blackbuck is considered to be the vehicle (vahan) of the Moon-God (Chandrama) and bestows prosperity on the areas of their habitation. The community believes that all those who encounter the Blackbuck on their way to important events are granted success.

Sacred grooves: The status of floral -A total of 38 species belonging to 33 genera and 21 families were recorded in the Community conserved area. Among these, tree form was

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dominant with 15 species. The other species encountered were 12 herb species, seven grass species and four shrub species. Since the entire area is used for agriculture, floral diversity is negligible.

The Status of Fauna-It exhibited richness of nine species of butterflies belonging to six genera and three families in its landscape. Overall 16 species of birds belonging 13 genera and 12 families, and six species of mammals belonging to six genera and five families were recorded during the forest survey.

4. Findings

The presence of sacred groves has indirectly conserved the rich flora and fauna of the region.

However these sacred groves are now facing urbanization pressures.

Growth of tourism, expanding urban region, shifting traditions are developing / creating huge stress in the ecosystem. These groves are under pressure of changing societies.

Possible reasons of the pressure over this system are

1. Shift in belief systems :Local traditions are being challenged by westernised urban cultures. Modern education system fails to instil respect for local traditions. As a result, the institution of sacred groves is losing its cultural importance for the younger generation of local people.
2. Lack of a comprehensive policy to manage such institutions is seen. There is a lack of database on the presence of the institution. Documentation of these groves to be done and need to be incorporated in the protected area should be applied to this region.
3. A lack of awareness about the ecological and environmental role of these groves amongst the local people. Knowledge should be disseminated as why these groves should be conserved.
4. Extraction of biomass for economic gains is in increasing trends which is affecting the natural regeneration.
5. Religious tourism: The integrity of many groves with regional or pan-Indian character, has suffered due to the influx of large number of pilgrims and tourists.
6. Urban development: these groves are now potential hubs for ecotourism and are under threat of being encroached by local communities and/or by various government line departments as well as by people migrating.

5. Conclusion

The sacred groves are very sensitive and fragile ecosystems which should be taken care of. They are climax ecosystems which deliver numerous ecosystem services. Urbanisation pressures are resulting in weakening of these community managed models of environmental protection. These sacred groves although very small in distribution are accountable for preservation of many rare and endemic species. Unchecked development might result in severe consequences. These preservation models should be strengthened.

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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