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ECOSYSTEM SERVICES OF SACRED GROVES IN WESTERN MAHARASHTRA THROUGH MULTIPLE FACETS

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ABSTRACT:

Forest preserved on religious grounds is known as Deorai or Deo rahati or Sacred grove. It is a traditional heritage of nature conservation in Indian culture and civilization. Generally, sacred groves are classified into different forest types and they preserve climax vegetation. These sacred groves are conserved with varied degree of ecological and socio-cultural dimensions. It may be noted that even as the social changes occur, the rejuvenation of cultural heritage –one of the important ecosystem services of sacred groves, can act to support the conservation and restoration of groves. It may also be pointed out that cultural heritage and forest vegetation are complementary to each other in determining ecosystem health of community –based bio-diversity conservation institutions like sacred groves. Imbalance of these components can severely affect all other ecosystem services.

Present ecosystem service are directly or indirectly responsible for regulating floods, purifying water, maintaining the temperature, botanical garden for students and plant lovers, bank of wild relatives of cultivated plants, treasure trove of wild medicinal and edible plants, shelter for birds and insects, areas of regional environmental studies, house of microbes and fungi, etc. Biological processes occurred in sacred groves are responsible for recycling nutrients, soil formation and providing the supporting services to the human societies.

Experience of Floristic studies on sacred groves in Western Ghats of Maharashtra and efforts of eco-restoration in selected sacred groves from Maharashtra are presented in the paper.

KEY WORDS : *Sacred groves, Ecosystem services, Maharashtra State.*

INTRODUCTION:

The ancient Indian civilization was cradled in our forests and abodes of saints and sages were epitomes of man's inherent concern for other forms of life. The groves, pools and ponds were sanctified in ancient time and are still revered and venerated as religious symbols of the past (Kulkarni, 2006, Nipunage and Kulkarni, 2010).

The term "remnant vegetation" is broadly used to traditional conservation of native vegetation that occurs within fragmented landscapes. Remnants are generally small to medium sized patches of vegetation surrounded by highly modified land, such as cropping or grazing lands. Remnants are often thought of as patches of trees, shrubs and huge climbers (Carle & Mike,1997). However, remnants may also be used to describe any fragmented native ecosystem preserved on religious aspect. The flora and fauna of these sacred groves are protected under sanctions and taboos which provide limits to over exploitation (Lebbie and Guires, 1995, Kulkarni and Upadhye, 2006).

The ecosystem service has been directly or indirectly responsible for regulating floods, purifying water, maintaining the temperature, botanical garden for students and plant lovers, bank of wild relatives of cultivated plants, treasure trove of wild medicinal and edible plants, shelter for birds and insects, areas of regional environmental studies, house of microbes and fungi, etc. Biological processes occurred in sacred groves are responsible for recycling nutrients, soil formation and providing the supporting services to the human societies. These human societies are also culturally dependent on the ecosystems for spiritual, aesthetic and recreational purposes. (Gokhale and Pala, 2011, Bhusare and Kulkarni 2013).

Maharashtra Association for the cultivation of Science,(renamed as Agharkar Research Institute) Pune, carried out Floristic studies of sacred groves in Western Ghats of Maharashtra from 1983-1986. Detailed studies were undertaken in hilly regions of Thane, Raigad, Ratnagiri, Sindhudurg, Ahmadnagar, Nasik, Pune Satara, Sangli and Kolhapur districts. During the survey specially prepared forms were filled up to understand environmental impact caused by the sacred groves, valuable germplasm of rare and endangered species, plants of economic importance and ethno-botanically important plants. Emphasis was also laid to collect information on use of sacred groves in soil and water conservation. As a result of these observations 228 sacred groves were recorded out of which 177 were visited. Recorded information laid us to believe that these well protected forests can be utilized in the ecosystem services in the best possible way for national endeavour without loosing their originality and status. (Anonymous, 1986) .

BAIF development Research Foundation, Pune, Praj Industries & Foundation and Okios for Ecological Services, Pune have made collaborative efforts for eco-restoration of sacred groves from Junnar Taluka of Pune and Jawhar taluka of Thane Districts from 2011 to 2013 and expected results are incorporated in the present ecosystem services.

1. Importance of sacred groves as sanctum sanctorum for rare, threatened and endangered species

Sacred groves serve the vital function of preservation of plants which have become very rare and extinct elsewhere. Kulkarni and Nipunage (2009) recorded floristic diversity and ecological studies of Dhup-Rahat from Bhor region in Pune district. It is situated near village Hirdoshi on Bhor-Mahad road. It is named after magnificent trees of Dhup i.e. *Canarium strictum* Roxb. It covers an area of 5 hectares along a gentle slope near Varandha pass, only a few km away from the origin of Nira river. The tree is very rare in Western ghats of Maharashtra and hence Dhup rahat should be preserved as a national monument.

Two sacred groves from Pune district namely Sagadara and Navaliachi rai were studied for their monotypic plants. In Sagdara sacred grove, trees of *Tectona grandis* L. are dominant while Navaliachi rai harbours *Miliusa tomentosa* (Roxb.) Sinclair in higher numbers (Kulkarni et al 2013).

Nine sacred groves from Bhudargad taluka of Kolhapur district were surveyed for rare and endemic plants. Village Patgaon has two sacred groves namely Swayambhuchi rai and Hanumantachi rai, Shivdav village has two groves namely Shivadchi rai and Maharthak rai. Tirwade village has three groves namely Khetarpalchi rai, Tondalichi rai and Nagnatchi rai, Kadgaon village has Tambayachi rai and Pal village has Palchai rai having predominant unique tree species in the sacred grove namely *Bischofia javanica* Bl having 200 trees. From these nine sacred groves rare and endemic plants are reported as per IUCN and BSI records like *Holigarna grahamii* Kurz., *Garcinia indica* Choiss, *Ancistroclades heyneanus* Wall, *Senecio dalzellii* Clarke, *Aystasia chelonoides* Nees, *Hydnocarpus pentandra* Oken *and Cissus elongate* Roxb. (Nipunage et al 2010).

Konkan area of Maharashtra was surveyed to carry out status of rare, endangered plants from preserved forests for medicine and food resources. The field visits were made in 4 talukas of Ratnagiri districts and data on 35 preserved forests have been documented for their IUCN status.. The local informants were interviewed to document the medicine and food resources which are used in their daily life. The CAMP exercise was carried out by Noroji Godrej Centre for Plant Research (NGCPR) in Collaboration with Department of Botany University of Pune for threatened medicinal plants of Maharashtra in September 1998. Another Conservation Assessment and Management plan exercise was carried out by FRLHT in year 2000. These documents of species richness ,rare, endangered, vulnerable etc, were evaluated as per IUCN guidelines. 15 plants were evaluated as endangered, vulnerable, least concern, threatened, critically endangered and near threatened categories (Upadhye et al 2004). In addition to rare ,endemic and endangered plants available in sacred groves are reported for ethnobotanical point of view (Upadhye et al 2010).

Phansalkar and Kulkarni (2014) conducted ecological survey in Ajnawale sacred grove in Junnar taluka of Pune district. Floristic diversity of plants was recorded in sacred grove. It includes maximum population of *Memecylon umbellatum* Burm.f.-311**,** *Ixora brachiata* Roxb.- 110, *Olea dioica* Roxb-55, *Canthium dicoccum* Teys & Binn.-56 and others 118. The numbering on each tree species has been made. During first shower of monsoon some ephemerals are occurring in the core zone. Maximum populations of *Nervilia aragoana* Gaud, *Dioscorea pentaphylla* L., *Dioscorea belophylla* Haines, *Curcuma inodora* Blatt., *Zingiber purpureum* Rosc. *Zingiber nassanum* (Grah.) Ramam., *Zingiber cernuum* Dalz. *Arisaema tortuosum* Schott & Endl. and *Malaxis rheedii* Sw. This indicates that ephemeral composition is found in core zone due to habitat conservation and no external biotic pressure.

Balanophora abbreviata Bl. has been observed on *Memecylon umbellatum* Burm.f. plant in the core area. There are several reports of the host plant, but in Junnar area it is the first ever report on *Memecylon umbellatum***.**

2. **Botanical garden for students and plant lovers**

We have seen that natural biodiversity occurs in sacred groves. Protection of sacred groves is necessary for our future generations. Sacred grove is a link between old tribal culture and new modern culture. The traditional knowledge, cultural and ecological aspect of sacred grove teaches lot of things to the students. This Informal method is an example of environmental education which is required for sustainable development of rural areas. (Kamble and Kulkarni, 2010)

Awareness and education about our environment is a need of the day. From this point of view, we have undertaken sacred grove training workshop for school students. In this informal method of education we have conducted various activities related to field knowledge and scientific study of nature.

On 3rd and 4th Dec 2013 we organizd a training workshop of sacred groves for teachers and students under the scheme of Western Ghat Eco Club Scheme (WGECS). In this workshop 25 School students of Jayeshwar Vidya Mandir, Dengachimet and in-charge teacher of eco club participated. The workshop was held in ‘wagobachi rai’ which is situated in Kalamvihira village in tehsil Jawhar Dist.-Thane. The villagers undertaken some conservative and protective measures for sacred grove. This is an example of people’s participation for conservation of sacred groves.

In this workshop activities like bird watching, identification of plants, quadrat method for biodiversity study and discussion with villagers were arranged. In this workshop students visited sacred grove and they observed flora. The sacred grove was divided into 2 patches so both patches were observed by students and they also understood the conservation measures like fencing, stone lining and trenches. Mr.Ananta Topale (villager of Kalmvihira) explained the conservational activities in sacred grove.

Students measured height and girth of large trees in this session. In last session experts gave information about medicinal plants.

On 4th Dec 2013 students got information about biodiversity counting methods. These methods were explained to students for understanding biodiversity e.g. quadrate method. They measured flow rate of stream and observed avifauna.

It is great opportunity to students how villagers are involved in conservational activities under the technical guidance of BAIF and Oikos.

3. **Natural regeneration and nursery of wild plant species**

Natural regeneration (NR) involves enrichment and protection of forests and assisted natural regeneration (ANR) involves protection, soil and water conservation measures and the planting of some desired tree species to enhance the biomass. NR can be taken up in the dense forests and ANR in the open forests. Considering the extent of dense forest area of NR, measures can be initiated in 35 M ha to enhance Carbon sequestration. (Mohapatra,2008).

Regeneration of plants plays a very important role in the forest ecosystem. The importance of the regeneration has been recognized and studies were undertaken to understand the forest species regeneration. It determines floral composition of the forest and consequently the faunal and microbial composition of the area. Phenomenon of flowering and fruiting may affect the regeneration of forest seeds in tropical forest ecosystem.(Burgess, 1972).

Sacred groves in Maharashtra are located in heavy rainfall areas in western ghats and low rainfall or rain shadow areas in eastern parts. Climatic conditions are varied and naturally affect the regeneration of plant species. Nipunage and Kulkarni (2011) carried out natural regeneration studies in 20 sacred groves situated in Ambegaon taluka of Pune district. Natural regeneration of many plant species is observed during the monsoon season up to winter season in Vanadevache ban, Wachape village. In Pokahari village it was observed in two sacred groves namely Marutche ban and Kalmaajaichri rai. These sacred groves are having natural regeneration of *Terminalia alata* Heyne ex Roth., *Syzygium cuminii* Skeel, *Terminalia chebula* Retz. and *Clematis gouriana* Roxb. The bovine populations from the villages are seen in the sacred groves for fodder purpose. Naturally saplings of trees, shrubs are trampled or crushed. Sacred groves are basically natural nurseries of wild plant species. These sources of saplings will be useful for plantation on barren land near the sacred groves (ANR).

Sacred groves from Bhor region were surveyed for natural regeneration. It was observed that in Dhamunshichi rai – *Entada rheedei* Spreng. seedlings observed, Baneshwar rai –*Pongamia pinnata* (L.) Pierre , *Holoptelia integrifolia* (Roxb.) Planch. and *Mallotus philippensis* (Lam.) Muell.-Arg., Andharwachi rai *Memecylon umbellatum* Burm. f. and *Zanthoxylon rhetsa* (Roxb.) DC. Dhup rathat *Canarium strictrum* Roxb. showed natural regeneration and Maulidevachi rai *Smilax zeylanica* L. *Teramnus labialis* (L. f.) Spreng. and *Hemidesmus indicus* (L.) R.Br. were observed.

Ajnawale and Kalamvihira sacred groves were studied for natural regeneration. Due to protection and community participation no one enters in the sacred groves. It resulted into profuse natural regeneration of wild plants. Seeds of plant species dropped by birds in the same region and *Milliusa tomentosa* (Roxb.) Sinclair, *Ventilago maderaspatana* Gaertn., *Madhuca longifolia* (Koen.) Mac., *Stereospermum chelenoides* (L.f.) DC., *Holostemma annulare* (Roxb.) K. Schum. *Lagerstroemia parviflora* Roxb., *Oroxylum indicum* (L.) Vent. *Zanthoxylum rhetsa* (Roxb.) DC., *Pogostemon purpurascens* Dalz. are naturally regenerated.

4. **Treasure house of wild edible, medicinal and ornamental plants**

There is wealth of information on use of wild plants in ancient indian literature. Aborigines knew about the snake root plants, Sarpangandha (Rauvolfia serpentina (L) Benth ex Kurz.) at least 3000 years ago and used to treat several diseases such as mental disorders, insomnia and snakebite (Sinha, 1998).

In recent years, there is a threat to plant species, which has been used in some way or the other by local people. There is a need to carry out floristic analysis of the area where utility species occur. In this respect, 102 sacred groves from Pune districts for utility purpose were studied Sacred groves from Mulshi -38, Velhe-12, Bhor-6, Maval -7, Ambegaon- 35 and Junnar-4. Utility wise break of species is as wild edible plants-22, Plants used for folk medicine-18, fodder plants- 24, rare plants 34 and majestic arboreal plants 24. (Upadhye et al. 2004).

5. **Bank of wild relatives of cultivated plants**

India's biodiversity of higher plants consists of more than 15,000 species of flowering plants which include about 9000 economically useful species. Of these, over 1000 species are of edible utility and 1500-2000 species are of medicinal value. Amongst the medicinal plant group, 540 are used as herbal drugs and only about 200 species are used commercially (Arora, 1997). Many indigenous species are widely distributed and show high genetic variability which is linked with geographic variability found within its natural distribution. A vast potential of wild germplasm of economically important trees, shrubs and herbs are preserved in sacred groves. Documentation of these indigenous resources and knowledge is to be collected from local informants. It must be restored in succeeding generations by educating young people at grass root level. Local people have been maintaining such forest patches for several decades, though their exploration is far from complete. Study of the biological diversity within these groves is of great social significance.

Economically important germplasm of wild fruits /seed plants

Botanical name	Part used	Habit
Syzygium cumini Skeel.	Fruits	Tree
Buchanania cochinchinensis (Lour) Almeida	Seed	Tree
Carissa congesta Wt.	Fruits	Shrub
Dillenia pentagyna Roxb	Fruits	Tree
Firmiana colorata R.Br.	Seeds	Tree

Mimusops elengi L.	Fruits	Tree
Mangifera indica L.	Fruits	Tree
Trewia nudiflora L.	Fruits	Tree
Garcinia indica Choisy	Fruits	Tree
Ziziphus rugosa Lamk.	Fruits	Tree
Ziziphus mauritiana Lamk.	Fruits	Tree
Meyna laxiflora Robyns	Fruits	Shrub
Sterculia guttata Roxb.	Seeds	Tree

Germplasm of commercially useful plants in Sacred groves

Botanical name	Family	Habit	Part used
Terminalia bellirica Roxb.	Combretaceae	Tree	Bark/fruit
Mimusops elengi L.	Sapotaceae	Tree	Bark
Oroxylum I ndicum Vent.	Bignoniaceae	Tree	Root
Holarrhena pubescens (Buch.-Ham) Wall. Ex G. Don	Apocynaceae	Shrub	Bark/seed
Cassia fistula L.	Caesalpinaceae	Tree	Fruits
Pramignya monophylla Wight.	Rutaceae	Shrub	Bark
Strychnos nux-vomica L.	Loganiaceae	Tree	Seed
Mallotus philippensis Muell.-Arg.	Euphorbiaceae	Tree	Fruit
Zanthoxylum rhetsa DC.	Rutaceae	Tree	Fruit
Maesa indica DC.	Myrsinaceae	Shrub	Fruit
Catunaregam spinosa (Thunb.) Tirveng..	Rubiaceae	Shrub	Fruit
Helicteres isora L.	Sterculiaceae	Shrub	Fruit
Pongamia pinnata Pierr.	Fabaceae	Tree	Seed
Stereospermum personatum Chatterjee	Bignoniaceae	Tree	Root
Smilax zeylanica L.	Smilacaceae	Climber	Root
Moullava spicata (Dalz.) Nicols.	Caesalpiniaceae	Climber	Root
Hygrophila auriculata Heine	Acanthaceae	Shrub	Seed
Costus speciosus Smith.	Zingiberaceae	Herb	Rhizome
Ervatamia heyneana Cooke	Apocynaceae	Tree	Bark

Wild bamboo diversity is observed in sacred groves. In this respect, 12 sacred groves from Pune district were surveyed for bamboo diversity (*Bambusa arundinaceae* L. and *Dendrocalamus strictus* Nees.. Natural genetic resources of crop plants and wild relatives of economic species are preserved on religious ground. These resources should be evaluated in scientific way to know their importance from conservation point of view. On the other hand these resources should be tapped for further studies like vegetative propagation, breeding and molecular studies (Kulkarni *et. al;* 2010).

Sacred groves have presently attracted attention of the environmentalists, geneticists, botanists for their undisturbed natural conditions, which enable them to become repositories of valuable germplasm of food,

fodder, medicinal plants and other utility point of view, The groves create microclimate which permits regeneration and sustenance of biotic species which are not usually found in the surroundings. (Kumbhojkar *et. al;* 1996).

6. **Shelter for birds and insects**

Vegetation in sacred groves provide habitat and food for many species of birds, insects, reptiles and mammals that help to control pest population in the agro-ecosystem, Promote regeneration of plant species by dispersing seeds and facilitate cross pollination of many plant species. This indicates that sacred groves are playing a dynamic role in balancing the ecosystem. Insect biodiversity was recorded from Ajnawale Sacred grove and 17 types of insects belonging to grass hoppers, mantis, moths, homopteran bugs and lestes species. The micro-climate in the region harbours many insects which feed on forest species.

Few spider species are also recorded like Giant Wood Spider, Giant Crab Spider, Common Two Tailed Spider, Daddy Long Legg spider, Wolf Spider, Funnel Web Spider.

It is very interesting to document butterflies in sacred grove. Common Grass Yellow, Danaid Eggfly ,Mottled Emigrant, Chocolate Pansy, Glassy Tiger, are few of them.

Avifauna from sacred grove compresses of Plum Judy, Common Crow, Common Mormon, Large Billed, Crow House Sparrow, Purple Sunbird, Purple Rumped, Sunbird Black Drongo ,Greater Coucal, Rufous Treepie, Black Lored ,Tit Orange, Headed Ground Thrush Red, Throated Flycatcher Paradise Flycatcher, Large Green Barbet, Golden Fronted Leaf Bird, Pied Bushchat, Coppersmith, Barbet Black shouldered Kite, Rufous tailed Lark Green Bee, Eater Spotted Dove ,Common Chiffchaff Long Tailed Shrike, Common Wood shrike.

Floristic appraisal of the sacred grove near Koynanagar known as '*Ambaichirai*' in Patan Taluka, Satara district was done in March 2009. However, some ecologically significant observations were recorded simultaneously. The first record of an insect *Cyclopelta siccifolia* on a host plant tree *Holigarna grahamii.* (Wt,) Kurz is from this grove. This tree belonging to family Anacardiaceae, bears a lush green loft broad leaves and black bark. It is a member of moist tropical forest. The trunk and fruit yield a black viscid juice containing oleoresin which is irritant and produces blisters. (Kulkarni et al 2012)

7. **Soil, water and mycological conservation**

In this respect, Shirkai sacred grove in Pune district was evaluated for its plant diversity by Kulkarni and Shindikar (2005). An environmental impact of sacred groves on flora and fauna as well as conservation of water streams are reported from Western ghats. (Kulkarni and Kumbhojkar, 1999; Kumbhojkar and kulkarni 1998). The tree species in the sacred groves will improve the physical properties of soil through elimination of surface soil disturbance. Presence of leaf litter encourages activity of soil fauna and through augmentative effects of root channels on total and macro-porosity. There is an appreciable influence of

trees on habitat; the effect of physical properties of soil differ with the kind of vegetation it supports. Nipunage, *et. al;* (2009) carried out ecological survey of sacred groves from Malshej ghat, Pune district and recorded floristics, soil analysis and myco-flora from five sacred groves. From Ajnawale sacred grove in Junnnar taluka 40 different types of fungi were recorded and identified which are belonging to Ascomycetes, Basidiomycetes and Deuteromycetes. Some special fungi were recorded on *Cassia fistula* L.- *Xylaria*, *Ixora brachiate* Roxb - *Phyllachora* sp.

Many sacred groves are associated with ponds, streams, springs or rivers and they serve as micro-watersheds. There are so many temples near ponds and rivers, which are excellent water reservoirs to preserve rain water and thus maintain the water table throughout the year. Sacred groves trap the ground water.

In Pune district, Jakhanichi rai near Chikalgaon village in Mulshi taluka has two water streams which are useful for local people and livestock during summer season. In Bhor taluka of Pune district, Nageshwar sacred grove is present near river Nira. Natural water sources are present inside the grove. Old Nageshwar temple and thick vegetation attracts visitors to enjoy it as picnic spot.(Kulkarni et al 2010).

Spark fellows of BAIF Development Research Foundation have been working on eco-restoration project operated at Village Kalamvihira. Soil and water conservation has been carried out by preparing bunds, small ponds and plantation of indigenous species. The impact of eco-restoration has been documented for last three years. A well, near the sacred grove has been re-charged due to eco-restoration activity and stream near the sacred grove remains full of water till March (Bhusare, 2013).

8 **Tree base for carbon sequestration**.

Role of sacred groves in carbon credit:

Carbon sequestration is an important aspect from the environmental point of view because all living and non-living organic matter contains approximately 50% carbon. Carbon exists in various forms and is cycled between several biotic and abiotic pools including oceans, terrestrial biota and atmosphere. Plants are important sinks for atmospheric carbon since 50% of their standing biomass is carbon itself. About 22 species including 54 individuals have been recorded from *Kalamvihira* sacred grove. Total number of trees of each species and total number of trees present in sacred grove were also recorded. It also indicates the average GBH in cm and average tree heights in meters. The mean above ground organic carbon (AGC) per tree (t/tree); mean of below ground organic carbon (BGC) per tree (t/tree); the total organic carbon of each species in tones and the total organic carbon sequestrated in 54 trees have been summarized. The organic carbon sequestrated in per species is shown for comparison purpose. The estimated organic carbon (biomass) has been compared with allometric model. *Terminalia alata* Heyne ex Roth. species are dominant in sacred grove having 16 trees and sequestrated 293.12 tons of carbon in its standing biomass, followed by *Ixora brachiate* Roxb. (96.2 tons). The other major carbon sequestrating

species were *Gaurga pinnata* Roxb. (48.75 tons), *Terminalia bellierica* (Garten.) Roxb. (37.96 tons), *Madhuca longifolia* (Koen.) Macbr. (36.42), *Schleichera oleosa* (Lour) Oken. (36.4 tons), *Stereospermum chelenoides* (L.f.) DC. (23.68 tons), *Lagerstoemia microcarpa* Wt.(28.5 tons), *Carallia brachiata* (Lour.) Merr. (11.52 tons), *Miliusa tomentosa* (Roxb.) Sinclair.(17.62 tons),*Heterophragma quadriloculare* (Roxb.) K,.Schum.(15.22 tons) ,*Ficus racemosa* L.((15.22 tons). The remaining tree species were having organic carbon content below 10 tons/species. The *Lannea coromandelica* (Hourt.) Merr. has lowest carbon sequestration potential 2.41 tons and the second lowest carbon sequestrating species was *Syzygium cumini* (L.) Skeel.. having carbon content 2.3 tons. (Kulkarni and Kulkarni, 2013)

In Somjaichi rai sacred grove, there are 31 species and 4000 individuals but in Kalamvihira sacred grove. There are 22 species and 54 individuals so the carbon sequestration of Somajaichi rai is more as compared to the Kalamvihira. In Kalamvihira sacred grove the dominant plants are *Terminalia elliptica* Willd. and *Ixora brachiata* Roxb. while in *Somjaichi rai* the dominant species are *Dendrocalamus strictus* (Roxb.) Nees, *Bombax ceiba* L. (Hangarge *et. al;* 2012)

9 **Ecosystems for spiritual, aesthetic and recreation purposes**

A random literature search reveals that by and large a majority of the sacred groves are associated with female deities in India. (Malhotra *et. al;* 2001) The deities to whom the groves are dedicated are of ferocious nature and their names being something like Bapujiboova, Kalubai, Navlaidevi, Mariai, Andharidevi, Kadjai, Dongraidevi, Jakuradevi, Kalkai, Kalbhairi, Vanghrunjai, Gulumbai, Chiraidevi are just to name a few in Maharashtra. However there are sacred groves, which are dedicated to deities that are not thought to be of ferocious nature such as Maruti, Ganpati and Khandoba etc. (Nipunage, et al 1991). Different species of trees also have special association with particular deities. Such as Bel (*Aegle marmelos* (L.) Corr), Rudrasksha (*Eleocarpus tubercultaus* Roxb.-Seeds) and Ber (*Ziziphus mauritiana* Lamk.) are considered dear to Lord Shiva, Sal (*Shorea robusta* L.) and Pipal (*Ficus religiosa* L.) to Lord Vishnu, Kadamba (*Neolamarckia cadamba* (Roxb.) Bosser) to Lord Krishna, Amba (*Mangifera indica* L.) to Lord Hanuman, Ashoka (*Saraca asoca* (Roxb.) Willd.) to Lord Kamadeva, Semur or Kate Savar (*Bombax ceiba* L.) to Lord Goddess Lakshmi and Shriphala or coconut (*Cocos nucifera* L.) to Lord Varuna (Venkatachalam *et. al;* 2005) .

The protection to the sacred groves was offered by beliefs in omniscience and power of local deities, Complemented by enforcement of the deity's will as interpreted by priests, locally called Bhagats. The beliefs in supernatural powers and the local deities are weakening due to developmental activities. Some local communities like Mahadeokoli predominantly reside in Ambegaon, Junnar and Rajgurunagre talukas of Pune District. They are socially homogeneous and they believe in the supernatural power of local deities which conserve sacred groves in the region (Kumbhojkar et al. 1996). Certain stories also reveal the links between sacred groves and historical events and personalities. Names of the sacred groves are derived from the geographic features or associated vegetation. Sagdara in Pune district, is a religious

forest preserved for the village deity Khanoba. The older villagers are unable to predict the precise age of the grove. They could only say that it is being preserved for generations without any disturbance. The deity Khandoba was established by a monk at Sagdara in the ravine under to sag (*Tectona grandis* L.) seedling growing side by side. Due to the sacred congenial environment in the ravine, other seedlings of sag started growing and now the forest predominantly consists of more than 200 sag trees (Nipunage et al 1988). In this connection, two monotypic sacred groves, Sagdara and Navalichi rai were surveyed for quantitative analysis (Kanhere, et al 2008, Kulkarni *et. al;* 2013). These are still protected by local communities and they are not felled either by political pressure or by other authorities. (Nipunage, et al 1993).

The village Kalamvihira is culturally sound. People celebrate various festivals like Bohade, Sathichi puja, Bolavati, Kavali Bhaji, Khadichadev, Dev Diwali, etc. The village has tradition of various dances for every cultural activity. Traditional dances like Tarpa, Dholinaach, Gaurinaach, Kamadinaach, etc. The cultural aspect includes traditional festivals celebrated in village. Traditional dances with musical instruments are performed during entertainment.

Tribals of Jawhar region celebrate festivals in each month. During dances they use musical instruments made from locally available plant resources. This unique features of Kalamvihira village were documented as traditional heritage associated in sacred groves. (Sampada *et. al;* 2014.)

10. Threats to sacred grove and need for conservation efforts

Sacred groves are basically useful for conserving diversity of natural wealth and ethno-botanical knowledge associated with local inhabitants/tribals because of rituals, beliefs and taboos. Groves are conserved through conventional, social, cultural and environmental values since ancient past. Conventional norms for nature conservation are associated with their society. Folklores associated with sacred groves have pointed out rewards and blessing for good behaviour or heavy punishment for the atheist or infidel. A team of scientists in Agharkar Research Institute have made elaborative survey of flora and socio-cultural, rituals associated with deity, degradation of sacred groves and social values with developmental activities. Developmental activities in the last 60 years after independence were dams, roads and consequent settlement of displaced local people. The traditional concept of forest preservation on religious ground is under threat. In western Maharashtra 130 major and minor irrigation projects have been completed or are under construction. More than 59 sacred groves from very high rainfall zone with lateritic soils and transition zone with average rainfall of 1950-2000 mm were submerged along with biodiversity. It includes western hilly parts of Pune, Satara, Kolhapur and eastern hilly parts of Sindhudurg districts (Deshmukh 1999).

In this respect, Vartak and Gadgil (1981) reported sacred groves from Panshet dam, Tetali and Gunale (1990) recorded status of sacred groves from Tanajisagar dam catchment area of Pune district. Kulkarni

and Kumbhojkar (1999) reported 25 sacred groves submerged in Varasgaon dam site in Pune district. Kulkarni (2005) recorded more than 35 submerged sacred groves from Rajgurunagar, Ambegaon and Junnar taluka of Pune district. There are about 299 villages in three talukas which were affected by Kukadi and Chasakman dams.

Most of these dams were constructed to meet the requirements of electricity, irrigation and industries. These sites are suitable for water reservoirs with minimum cost of construction and comparatively limited displacement of population from hilly regions to plains of command area.

There are six major factors identified for the degradation of sacred groves. Among them ,damage by trespassing and trampling of understorey vegetation, particularly to the tree seedling population, followed by illegal biomass harvest are the major factors. The severity of damage both the seedlings and saplings was fount to be more during festival season as a large number of people walked in the forest. The damage to seedlings led to poor regeneration of forest species and invasion of exotic weeds and light tolerant under-storey plants. It is also observed that the practice of illegal collection and removal of fire wood and small timbers was in vogue. Even though, the quantity and frequency of biomass removal were relatively less, such activities need to be stopped for allowing the disturbed forest to undergo progressive succession. (Chandrashekara, 2011)

Efforts by Government and research organizations in our country, have pointed out that just declaring an area as Hotspot and conserving certain habitats of natural reserves will not provide sustainable survival of human being. People's participation play a key role in genuine biodiversity conservation especially in sacred groves. In spite of several identified obstacles for ensuring such participation, there is also an ethical , cultural and traditional heritage of India, which promotes biodiversity conservation with concrete efforts.

11. Role of NGO in conservation of sacred grove

NGO groups create awareness for conserving the environment very effectively and making people to strive in environmental up keeping activities like plantation of forest species under various schemes sponsored by government agencies or by participatory approach by industries. This will go long way to protect the environment for sustainable development of our country.

Sacred grove conservation with conventional values/indigenous knowledge will be achieved through participation of students , teachers and local inhabitants. Due to anthropogenic disturbance and fragmentation of many sacred groves, they are showing different degrees of degradation. It is necessary to undertake ecological restoration measures-the intentional activities to initiate or accelerate the recovery of sacred groves with respect to their health, integrity and sustainability. The ecological measures identified for sacred grove conservation are different. It will be useful for prevention of sacred grove degradation and restoration with plantation of indigenous useful tree species.

BAIF has made efforts to document traditional knowledge of biodiversity periodically and created awareness among local people for conservation of sacred groves. People's participation for stone bunds, plantation of indigenous species, nursery development, community mobilization, participation of school children and youngsters has been very effective in sacred grove conservation.(Godbole et al 1998)

CONCLUSION:

The most important justification for nature conservation is that it provides an insurance policy for the future. It preserves a reservoir of continually evolving genetic material, representative of natural ecosystem being protected. It preserves a reservoir of rare, endangered and endemic plants and animals, which may enable them to be cropped in the surrounding area. These groves are viewed as traditional method of *in situ* conservation. Nevertheless, the sacred groves are threatened due to the developmental activities and changing socio-economic values. Hence there is a constant and urgent need for their systematic inventorization and assessment in all disciplines.

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