

Original Research Article

Ecosystem services of Sacred Groves in West Kameng district of Arunachal Pradesh

Lobsang Tashi Thungon*, O.P.Tripathi, L.B Singha

Department of Forestry, North Eastern Regional Institute of Science and Technology (Deemed University),
Nirjuli, Arunachal Pradesh-791109

*Corresponding author: lobsangnunu1010@gmail.com

Received: June 12, 2016; revised: November 20, 2016; accepted: November 26, 2016

Abstract: Present study was conducted keeping in view the importance of ecosystem services of sacred groves particularly in the conservation of biodiversity. Inventory of sacred groves distributed in varied locations of West Kameng districts in Arunachal Pradesh was undertaken during the year 2013-2015 and assessment of a few ecosystems was done following standard methodologies. Altogether 17 sacred groves were reported from West Kameng district and most of them are associated with the Buddhist temple called *Gompa*. Size of the sacred groves ranges between 0.001ha and > 3ha. These groves are maintained by a family or group of clan or by the whole community. Shergaon sacred grove supports more species diversity than the Morshing sacred grove. Large numbers of important plant species like *Rhododendron arboreum*, *Paris polyphylla*, *Valeriana jatamansi*, *Artemesia vulgaris*, *Swertia chirayita*, *Daphne papyracea* etc. were present in the groves. Seven species has been identified from the groves having various religious roles in the society. About 10 species had healing properties, 2 species for agricultural tools, 17 species for food, 2 species for fodder, 4 species for fire-wood, 5 species for rituals and multipurpose. Sacred groves are the repository of diverse natural resources having robust traditions of nature conservation practices which in result supports varied medicinal and other valuable species. However, increasing threats to these groves demand new conservation approaches enabling fair share of the wider values of conservation to the local communities and positive local attitudes towards conservation goals, hence present study aims to identify their services and role play by the traditional cultural practices in conserving the biodiversity.

Key words: Biodiversity conservation, Ecosystem services, Sacred groves, Threats

Introduction

Conservation of biodiversity remains a key issue in the global conservation programme hence many conservation strategies have taken birth to overcome the undesirable environmental problems. Of many, in-situ conservation of biodiversity has been successful in many ways and has witnessed the present conservation demand. Sacred groves can be recommended as one of the best leading refuge place in this classification. Sacred groves are the forest fragments of varying sizes, having a significant religious belief on community deities by the

particular community preventing any anthropogenic activities hampering the nature structures of the forest. Sacred groves are sometime associated with monasteries or temples. These groves are important repositories of floral and faunal diversity that have been conserved by local communities in a sustainable manner. They are regarded often the last natural home of endemic species in the geographical region. The significance of sacred groves in the conservation of biodiversity has long been recognized by many researchers (Kosambi 1962; Gadgil

and Vartak 1976; Haridasan and Rao 1985; Khan *et al.*, 1997). Protecting a patch of plants community by the local community of an area with the faith that their deities reside in it is not a new concept. Existence of sacred groves on this earth was identified and documented by many researchers from local to global levels. Hughes and Chandran (1997), Khiewtam and Ramakrishnan (1989) and Ramakrishnan (1996) have reported sacred groves from different parts of India, known by the different names given to them in ethnic terms. Also a large number of sacred groves were reported from the northeastern states of India viz., Meghalaya, Manipur and Karbi Anglong area of Assam (Tripathi 2001) and Arunachal Pradesh (Barbhuiya *et al.*, 2008).

Materials and methods

Inventory of Sacred groves: An inventory of sacred groves distributed in varied locations in the West Kameng districts of Arunachal Pradesh was carried out during the year 2013-2015. Before going for survey, records of the government and literature were referred as per the historical evidence. Most of the data were collected from primary sources from village head, monks and aged-old persons and local hunters during the study. Also priests locally known as *Bonpu/ Framin/ Yumin* in Monpa dialect and *Chhizi* in Sherdukpen community plays a vital role in performing rituals for the deities and from whom maximum information were recorded.

Floristic composition: Extensive field survey and detail study was carried out in two selected study sites viz., Zengbulok in Shergaon and Lhagyala Gonpa sacred groves in Morshing village of West kameng district. Random quadrat sampling method was used for the floristic field sampling. These groves were grouped keeping crown cover in account. In each forest type 30 quadrats were studied. For the woody species (>15 cm gbh), sampling quadrats of 20m x 20m were laid randomly. All woody individuals were tagged and measured. Similarly, 20 quadrats of 5m x 5m were laid randomly for shrubs/ saplings and 20 quadrats of 1m x 1m for ground vegetation (herbs/seedlings). All the plant materials present in the

quadrats were collected/ photographed for identification. Collected plant materials were dried, mounted, preserved and identified using standard methods. Identification of the plants was done using published literatures, flora and herbarium of forestry department. They were identified with the help of the Flora of Assam (Kanjilal *et al.*, 1940), Flora of Meghalaya (Haridasan and Rao, 1987) and materials for the flora of Arunachal Pradesh (Hajra *et al.*, 1996). Herbarium was also compared with the identified collections of Forestry department, NERIST. Dominance, abundance and dispersion of the species were determined by method outlined by Misra (1968) and Mueller-Dombois and Ellenberg (1974).

Ethnobotanical services: The services on ethnobotany of the sacred groves were studied and recorded based on suitable questionnaire, interviews and discussions among villagers. They were asked in details and describe the methods usually adopt for utilization. Almost 26 knowledgeable local persons were interviewed which included traditional healers, village head men, women farmers, hunters, craftsmen having age between 38-75 years. Design of questionnaire helped to know information about the different part used for ethnomedicines, fuel-wood, economically important plant resources, different tools used in agricultural purposes, uses of leaf litters and plants used for performing rituals.

Results

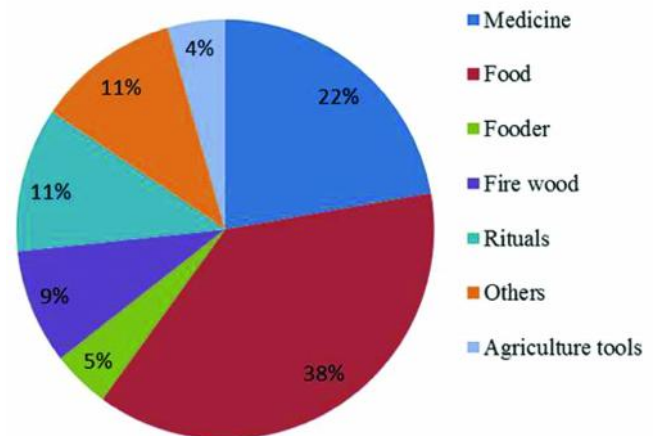
Through several queries it was noted that many of the sacred groves were associated with the Buddhist temple called *Gompa* which were build many years before and the villagers started to believe that the whole area is a sacred place. To very interesting, deities are mainly served by the local priest called as *Chhizi*. A total of 17 sacred groves were recorded in West Kameng district of Arunachal Pradesh which was maintained by a family or group of clan or by the whole community (Table 1). Among these sacred groves; 4 were found gradually disturbed by anthropogenic activities of collecting fuel-wood, grazing by the cattles mainly due to the diminishing of indigenous faiths on deities.

Table 1. Sacred groves, area (ha), location and management status in West Kameng district.

Sacred Groves	Size	Location	Management	Status
LhagyalaGompa		Morshing	Buddhist community	Un disturbed
TaklungGompa	0.01	Sanglem	Buddhist community	
Kro	0.01	Shergaon	Buddhist community	
Shepchang	-	Phudung	Buddhist community	
Nakjee	-	Phudung	Buddhist community	
Diphung	0.25	Phudung	Buddhist community	
Dungphu	-	Dirangbasti	Buddhist community	
Thangshakpatho (Chhu)	-	Dirang	Buddhist community	
Changorjamin	-	Sangti	Buddhist community	
Khunchuwangchhu	-	Dirangbasti	Buddhist community	
SheraBasti	0.26	SheraBasti	Buddhist community	
Lisomu	-	Thungri	Buddhist community	
Karpu	-	Thungri	Buddhist community	
Zengbulok	15-16	Shergaon	Buddhist community	Disturbed (Collection of fire wood, medicinal plant and other NTFPs)
Thukmaan	0.01	Shergaon	Buddhist community	
BomdilaMonastery	0.5	Bomdila	Buddhist community	
Aamsenthung	0.01	Shergaon	Buddhist community	

Floristic composition: In the study site of Shergaon sacred grove, a total of 86 species were recorded from 72 genera and 36 families. However in the Morshing sacred forest, 52 species from 42 genera and 24 families were recorded. It was found that in Zengbulok sacred grove (Shergaon), species like *Quercus serreta* and *Rhododendron arboreum* were among the most dominant species and *A. pectinatum* and *Litsea cubeba* were the least dominant species. The most dominant shrubs/saplings include *Acer pectinatum*, *Q. serreta* and *Lyonia ovalifolia*. On the ground layer (herbs/seedlings), *Centella asiatica* and *Potentilla micrantha* were among the most dominant species while species such *Commelina paludosa*, *Dicentra scandens* and *Lycopodium clavatum* were among the least important in the sacred grove. In Lhagyala sacred grove (Morshing), *Lyonia ovalifolia* and *Rhododendron arboreum* were among the most dominant woody species and *Schefflera impressa*, *Litsea cubeba* and *Juglans regia* were represented by only a few individuals. The most dominant shrubs/saplings include *Rubus niveus* and *Daphne papyraceae* and *Colebrookea oppositifolia*, *Brassaiopsis mitis* and *L. ovalifolia* were among the least important species. On the ground layer (herbs/seedlings), *Usnea baileyi*, *Lobaria aisdosa* and *P. micrantha* were among the most dominant species.

Sacred religious role: Based on the species collected from the sites during the field study its religious role has been quantified and it was observed that seven species has been identified having various religious roles (decoration, local flag, inscent stick, demon idol, drive evil sprits) in the society. *Daphne papyraceae* (flowers are used in decoration purpose), *Pinus wallichiana* (local flag, inscent sticks), *Cornus capitata* (leaves used in making local demon idol), *Artemisia vulgaris* (leaves used as inscent sticks and small flag by the priest), *Zanthoxylum armatum* (leaves are burn to drive away the evil sprits), *Rhododendron arboreum* (leaves are used to burn as inscent sticks and flowers are used for decoration) and *Lycopodium clavatum*.

**Fig. 1** Utilization pattern of plants species of sacred groves.

Services in terms of NTFPs: The study reveals that the local community relies on the forest resources in various types of NTFPs, which can be categorised as medicinal, rituals, food, social fencing, spices, decoration, firewood, wine, dye purposes. From both sacred groves, a total of 37 plants species were recorded of which 10 species had healing properties, 2 species for agricultural tools, 17 species for food, 2 species for fodder, 4 species for fire-wood, 5 species for performing indigenous rituals and 5 species were commonly used in terms of other purposes like decoration, dyes, fish poison etc. (Fig. 1). Of these plants species, 13 species each were of tree and herbs habit, 7 species of shrub, 2 species of climbers and 1 species

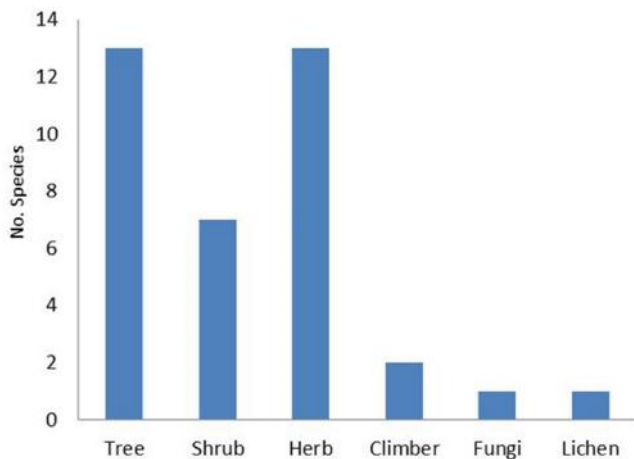


Fig. 2 Habitat-wise species distribution of plants in the sacred groves.

each from lichen and climbers have been recored (Fig. 2). However many plants species found in the groves were highly traded for commercial purposes which are found outside this forest. Observation also found that among all these species *Rhododendron* sp. and *Quercus* sp. have multiple uses which were commonly used by both the communities (Table 2). These may be the reason behind fast diminishing of such species in the natural forest of that region.

Discussion

The records of 17 sacred groves from the West Kameng district have directly or indirectly provide a potential ecological service to the biodiversity of the area. The occurrence of higher species diversity in the sacred groves of both the study area has provided a favorable microclimate for the flora and fauna. Khiewtam and Ramakrishnan, (1989) also reported the increase atmospheric humidity and reduce temperature in the immediate vicinity and produce a more favourable microclimate for many organisms. Records of rare and endangered species in the sacred groves and their sustenance where reported by Boojh and Ramakrishnan (1983) and Ramakrishnan and Ram, (1988). The presence of rare and economically important medicinal plant species like *Acorus calamus*, *Paris polyphylla*, *Swertia chirayita* and *Valeriana jatamansi* in the study area of Zengbulok sacred groves has complimented the themes of conservation. The conservation of medicinal plants species in the sacred groves of Meghalaya

was also reported by Tiwari *et al.* (1998). The presence of NTFPs plants depicts the potentiality of such forest which are conserved mainly due to believes and faiths of the local communities upon their dieties or the protectors. Moreover, among the 37 NTFPs recorded from both the sacred groves, tree species like *Rhododerndron arboreum* and *Quercus serreta* which are the dominant species in the forest of the region were found in a very healthy population in both the study site. Unfortunately, the gradual changes in the people' attitudes towards beliefs and faith along with the urbanization the biodiversity of the area has adversely affected. These turned up into very hazardous consequences for such conserved forest. As observed in the present study that out of 17 sacred groves 4 where found disturbed. The disturbances in sacred groves were also reported by Khiewtum and Ramakrishnan (1989) and Boojh and Ramakrishnan (1983) of Cherrapunjee and adjoining areas in the Khasi hills of Meghalaya. Untransferable knowledge of priest is also affecting the rituals to perform which indirectly affect the forest. Apart from these, natural calamities like landslides, heavy snowfalls, storms and other human-oriented anthropogenic disturbances like home building, road construction, timber and fuel-wood collection and other developmental activities compel to alter vegetation structure of the many sacred groves.

From the study some important issues which hinder the presence of sacred groves are social status of the local communities which make them rely very much on the resources of sacred groves or nearby area. Which are complimented by the natural calamities like forest fire, landslide and earthquake, etc. stating the above mention issue, some important points must be focus on such as to stimulis the traditional beliefs related with the activities of conservation or maintaining forest resources. To conduct awareness cum religious workshops, that will highlights the concept of respecting and conserving forest and its resources. Promoting the values of ecosystem services played by sacred groves to the local communities therefore emphasis must be for conserving these groves. Promotion of sacred groves to include under the chain of protected areas. Introduction sustainable

Table 2. Plant species, habit, part used and utilization of plant resources.

Plant species	Family	Local name	Habit	Part used	Utilization pattern
<i>Acoruscalamus</i>	Araceae	Raanji	Herb	Rhizoms	Medicine
<i>Artemisia vulgaris</i>	Asteraceae		Herb	Whole parts	Medicine & rituals
Bamboo sps.	Poaceae	Ma	Shrub	culm	Fence
<i>Chenopodium album</i>	Chenopodiaceae	Jomoyaling	Herb	Leaves	Food
<i>Cornuscapitata</i>	Cornaceae	maanchele	Tree	Fruits, leaves	Food & ritual value
<i>Corylopsis himalayana</i>	Hamamelidaceae	-	Tree	Stem	Garden fence
<i>Daphne papyraceae</i>	Thymelaeaceae	Siggimintohing	Shrub	Flower & bark	Decoration & paper
<i>Elaeagnus parvifolia</i>	Elaeagnaceae	Maanjele	Shrub	Fruits	Food
<i>Elaeagnus umbellata</i>	Elaeagnaceae	Maanjele	Shrub	Fruits	Food
<i>Fragaria daltoniana</i>	Rosaceae	Gochhonmalang	Herb	Fruits	Food
<i>Fragaria nubicola</i>	Rosaceae	Gochhonmalang	Herb	Fruits	Food
<i>Goultheria fragrantissima</i>	Ericaceae	Zehnyamalang	Shrub	Fruits	Food
<i>Hedera helix</i>	Araliaceae	-	Climber	Leaves	Fodder
<i>Hedera nepalensis</i>	Araliaceae	-	Climber	Leaves	Fodder
<i>Houttuynia cordata</i>	Saururaceae	Chhomong	Herb	Leaves	Food
<i>Juglans regia</i>	Juglandaceae	Mukhu	Tree	Fruits, bark & Stem	Food, fish poisoning
<i>Lycopodium clavatum</i>	Lycopodiaceae	-	Herb	Whole parts	decoration
<i>Lyonia ovalifolia</i>	Ericaceae	Hingzehn	Tree	Stems & branches	Fire wood
<i>Malus sikkimensis</i>	Rosaceae	I-komalang	Tree	fruits	Food
<i>Morchella esculenta</i>	Morchellaceae	Nubungsuruk	Fungi	Whole parts	Food
<i>Paris polyphylla</i>	trilliaceae	I- changmu	Herb	rhizoms	Medicine
<i>Pinus roxburgii</i>	Pinaceae	Bichihing	Tree	Leaves & cone	Rituals & fire
<i>Planta goerosa</i>	Plantaginaceae	Noso jar	Herb	Leaves	medicine
<i>Primula denticulata</i>	Primulaceae	Gratumuinto	Herb	Flower	decoration
<i>Prunus persica</i>	Rosaceae	Mekhle	Tree	Fruits & leaves	Food, medicine, wine
<i>Pyrus pashia</i>	Rosaceae	Tangkungmalang	Tree	Fruits & bark	Food & colour for tea
<i>Quercus serreta</i>	Fagaceae	Hingpuhing	Tree	Whole parts	Firewood, fruits, fish poisoning & fodder
<i>Rhododendron arboreum</i>	Ericaceae	Khandakhing	Tree	Whole parts	Fire wood, medicine, ritual values
<i>Rhododendron fulgens</i>	Ericaceae	Khandakhing	Tree	Whole parts	Fire wood, medicine, ritual values
<i>Rubus nepalensis</i>	Rosaceae	Gochonmalang	Tree	fruits	food
<i>Solanum khasianum</i>	Solanaceae	Stongkhangji	Herb	fruits	medicine
<i>Swertia chirayita</i>	Gentianaceae	chirota	Herb	Whole parts	medicine
<i>Tsuga dumosa</i>	Pinaceae	-	Tree	Stems & branches	firewood
<i>Usnea baileyi</i>	Parmeliaceae	Punpun	Lichen	Whole	food
<i>Valeriana jatamansi</i>	Caprifoliaceae	Pangposi	Herb	Whole parts	medicine
<i>Viburnum cylindricum</i>	Adoxaceae	-	Shrub	Stems & branches	Fire wood
<i>Viburnum foetidum</i>	Adoxaceae	-	Shrub	Fruits & stems	Food & ritual value

harvesting/management should be promoted, as to lesser the impact on sacred groves. Further research on changes of floral composition and its dynamics in sacred groves should be promoted.

Acknowledgements

Authors are thankful to the MOEF & CC and UGC for financial assistance, staffs of Shergaon forest Division and local villagers of Shergaon and Morshing for their generous

support. Also special thanks to the field assistant who was with us in all necessary hours.

References

Barbhuiya, A. R., Khan, M. L., Arunachalam, A., Prabhu, S. D. and Chavan, V. 2008. Sacred Groves: Informal protected areas in the high altitudes of eastern Himalaya, Arunachal Pradesh, North east India: Traditional beliefs, biodiversity and conservation. In: National Parks:

- Biodiversity, conservation and tourism. (Reilly, A.O'. and Murphy, D. eds.), Nova Science Publishers, Inc. US. Pp: 131-146.
- Boojh, R. and Ramakrbhnan, P. S. 1983.** Sacred groves and their role in environmental conservation. In: Strategies for environmental management souvenir, department of science and environment, Govt. of Uttar Pradesh, Lucknow. Pp: 6-8.
- Gadgil, M. and Vartak, V. D. 1976.** Sacred groves of Western Ghats of India. *Ecological Botany*. 30: 152-160.
- Hajra, P. K., Verma, D. M. and Giri, G. S. 1996.** In: Materials for the Flora of Arunachal Pradesh, Vol I. Botanical Survey of India, Calcutta.
- Haridasan, K. and Rao, R. R. 1985.** Forest Flora of Meghalaya. Vols I. Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Haridasan, K. and Rao, R. R. 1987.** Forest Flora of Meghalaya. Vol. 2. Bishen Singh and Mahendrapal Singh, Dehradun.
- Hughes, D. J. and Chandran, S. M. D. 1997.** Role of sacred groves in conservation and management of biological resources, KFRI, Peechi.
- Kanjilal, U. N., Kanjilal, P. C., Das, A. and De, R. N. 1940.** Flora of Assam. Vols I-IV. Government of Assam, Shillong.
- Khan, M. L., Menon, S. and Bawa, K. S. 1997.** Effectiveness of the protected area network in biodiversity conservation, a case study of Meghalaya, India. *Biodiversity and Conservation*. 6: 853- 868.
- Khiewtam, R. S. and Ramakrishnan, P. S. 1989.** Socio-cultural studies of the sacred groves at Cherrapunjee and adjoining areas in north-eastern India. *Man in India*. 69: 64-71.
- Kosambi, D. D. 1962.** Myth and reality: studies in the formation of indian culture, Popular press, Bombay.
- Misra, R. 1968.** Ecology work book. Oxford and IBH Publishing company, Calcutta.
- Mueller-Dombois, D. and Ellenberg, H. 1974.** Aims and methods of vegetation ecology. New York, Wiley.
- Pushpangadan, P., Rajendraprasad, M. and Krishnan, R. N. 1998.** Sacred groves of Kerala : A synthesis on the state of art of knowledge, In: Conserving the Sacred for Biodiversity Management. (Ramakrishnan, P.S., Saxena, K.G. and Chandrashekara, U.M. eds.), Oxford and IBH Publishing Co., New Delhi. Pp: 193-210.
- Ramakrishnan, P. S. 1996.** Conserving the sacred: from species to landscapes. *Nature and Resources; UNESCO*. 32: 11-19.
- Ramakrishnan, P. S. and Ram, S. C. 1988.** Vegetation biomass and productivity of seral grasslands of Cherrapunjee in north-east India. *Vegetati*. 74: 47-54.
- Tiwari, B. K., Barik, S. K. and Tripathi, R. S. 1998.** Biodiversity value, status, and strategies for conservation of sacred groves of Meghalaya, India. *Ecosystem Health*. 4(1): 20-32.
- Tripathi, R. S. 2001.** Sacred groves: Community biodiversity conservation model in north-east India. In: *Tropical Ecosystems: Structure, Diversity and Human Welfare (Supplement)*. (Ganeshiah, K.N., Uma Shaanker, R. and Bawa, K.S. eds.), Ashoka trust for research in ecology and environment, Bangalore. Pp: 104-107.