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Research Article

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Role of Traditional Knowledge in Conserving Biodiversity: A Case Study from Patal Bhuvneshwar Sacred Grove, Kumaon Himalaya, India

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Abstract

The paper deals with the inventory of sacred groves and its phytodiversity from Kumaon Himalaya. These groves are well recognized in the world in terms of biodiversity conservation. Kumaon Himalayan region comprises many sacred groves, different ethnic cultures, traditional way of conserving biota. Realizing the importance, the study was conducted in Patal Bhuvneshwar sacred grove conserved by *Rawal, Bhandari* and *Guro* local communities. This grove provide excellent micro-climatic habitat for the luxuriant growth of flowering and non-flowering taxa and covered by dense forest of *Cedrus deodara*. Total 65 species under 61 genera and 47 families of both flowering and non-flowering plants were recorded. In which, lichens are represented by 13 species, bryophytes (8 species), pteridophyte (7 species) and gymnosperm (1 species). 43 species belonging to 38 genera and 28 families are ethnobotanically used by local communities for various purposes. Although the grove is conserved on religious beliefs, but facing several threats such as anthropogenic pressure and socio-economic pressure.

Keywords

Kumaon Himalaya; Patal Bhuvneshwar Sacred Grove; Phytodiversity; Threat; Conservation

Introduction

Traditional knowledge is a collectively owned property and is integral to the cultural or spiritual identity of the social group in which it operates and is preserved. In traditional societies, sustainable natural resource management is driven by the beliefs and behaviours of human communities, and local cultures are strengthened by their intimate connections to the natural environment that sustains them [1]. The UNESCO-MAB biosphere reserve concept clearly recognizes the importance of sacred sites, sacred groves and places in context of sustainable utilization and development of natural resources. These groves conserve valuable biodiversity and are protected by the local community for centuries on the basis of cultural, religious and spiritual beliefs and taboos that the deities reside in them and protect the villages from different calamities [2].

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Unique assemblage of flora and fauna in Himalayan region makes it one of the important biodiversity hotspot on the Indian subcontinent. The people of this area have great affection to the nature and their indigenous knowledge of conserving ecosystem is a proof to their close relationship with nature. This indigenous conservationism or knowledge has often been attributed to a spiritual and religious respect for, and a practical understanding of the natural world [3-5]. Many rare and endemic plant species also found its refuge in these groves and thus serve as gene pool for many taxa [6]. The sacred groves are in fact the reserve forests of the local tribes or communities who conserve these patches of plants in a religious manner. They serve as an example of habitat preservation through community participation [7]. Realizing its role in conserving biodiversity, some serious efforts have been conducted in the recent past to document, inventory and map of their distribution across the country etc [8-23]. Sacred groves need to be urgently inventoried and mapped to document their precise locations and conservation status across the country.

In Uttarakhand, Hariyali, Tarkeshwar, Thal kedar, Nakuleshwar, Haat Kali, Vashnio and Chamunda sacred groves have been identified [24-28]. Since then no work on sacred grove has been carried out in this area. Thus, realizing the fact and significance of these sacred patches, the study was undertaken in the area of Pithoragarh District, to describe the floristic diversity of sacred grove of Patal Bhuvneshwar.

Study Area

Patal Bhuvaneshwar sacred grove is the hidden pilgrimage centre, near Berinag tehsil in Pithoragarh district of Uttarakhand [Figure 1A and 1B]. This grove is situated 90 km from Pithoragarh and 13 km north of Gangolihat region at an altitude of 1618 m (N 29° 41.295′, E 080° 05.510′) covering an area of 3 km^2 approximately. The holy cave is present in the middle of the grove possesses thousands stone images of deities, ancestors and gods (lord Shiva along with Garuda, Ganesha, Sheshnag etc). According to the local people beliefs, this sacred grove is about more than 2000 years old and it has been described in the Manas Khand of Skand Puran. "*Adii Shankaracharya*" selected this place for his prayer. There was a huge whitish in colour stalactites believe to be the Jatas of Lord Shiva, located inside the cave. The priest families, the *Bhandaris* are performing religious rites at the grove. But, *Guro* and *Rawal* communities are also involved in various rituals

Figure 1A: Patal Bhuvneshwar Sacred Grove.

Figure 1B: Grove covered with *Cedrus deodara*.

and cultural activities of the grove.

Climate and soil

The temperature of the area is moderate; summer season is quite short and sometimes reaches 30°C while winter season is long for five months starting from October to February (temperature ranging from 3° to 0° C). Raining season starts on May mid to August last with an average rainfall of 55.56 mm. The nature of soil is acidic due to the presence and abundance of *Cedrus deodara* trees. Sometimes the colour of the soil is changing from reddish to black.

Methodology

Extensive surveys and collections of plants were conducted in the study area to document the whole plant diversity including lower and higher plants of the grove, in all four seasons *viz.*, spring, summer, rainy and winter during the years 2007-2010. Critical field observations on each plant species were made and samples of plant specimens were collected either in flowering or fruiting stage from the grove. Specimens were processed as per routine herbarium techniques recommended [29] and were deposited in LWG herbarium at CSIR-National Botanical Research Institute, Lucknow. The specimens were identified on the basis of morphological as well as micro-morphological characters and by making use of different floras, monographs, revisions and other available literatures.

For field data, random stratified sampling was followed [30]. Quadrates of 20×20 m were plotted to measure the frequency and density [31-33].

Results and Discussion

This grove provides an excellent microclimatic habitat for growth of both flowering and non-flowering plants (lichen, bryophyte, pteridophyte, and gymnosperm). It harbors 66 species under 61 genera and 47 families of plant species, out of which 37 species from 35 genera and 27 families were angiosperms. Herbaceous plants are dominant over other life-forms, representing 22 species followed by shrubs (8 species), climbers (2) and trees (5 species). Lichens are represented by 13 species under 12 genera and 6 families, bryophytes with 8 species under 8 genera and 8 families. Pteridophytes are represented by 7 species under 6 genera and 6 families, while gymnosperms have only 1 species [Figure 3]. In Herbs, *Impatiens balsamina* shows highest frequency while *Chaerophyllum acuminatum* minimum Among the trees, *Cedrus deodara* frequently distributed in the grove and showing highest frequency of 100% followed by *Quercus leucotricophora* (75%). In pteridophytes *Selaginella bryopteris* are frequently distributed in any substratum and represent 60% frequency. Similarly in bryophytes *Cratoneuron filicinum* and in lichens *Cetrelia cetrarioides* represent highest frequency (Table 1).

The cretaceous shrub species *viz.*, *Berberis asiatica*, *Pyracantha crenulata*, etc. and large trees *Quercus leucotrichophora* and *Cedrus deodara* providing excellent substratum for parmeliod lichens (*Everniastrum cirrahatum, Flavoparmelia caperata, Parmotrema tinctorium, Ramalina condupicans, Parmotrema reticulata, Usnea pseudosinensis*) and several epiphytic mosses (*Campylopus goughii, Barbula sp., Meterorium buchannii, Thuidium assimile, Trachypodopsis sp.*, etc). *Ficus sarmentosa* is the common climber frequently growing epiphytically on rocks and trees. *Berberis asiatica, Bergenia ciliata,* and *Valeriana jatamansi* are the important medicinal plants from the grove (Figure 2A-2C).

Traditional beliefs

The local communities of the sacred grove are much feared to the local deity and they believe that most of the diseases occurred due to the unfriendly behavior with nature and their ancestors. They tribute this grove to Lord '*Shiva*' and whole grove even a single wood is dedicated to him. Local communities believed that cutting and lopping of the plants will annoy the deity to punish them. Whenever these plant species are required, local people first pray to the deity and take permission for the use of these plants for a particular use. All the vegetation is used only in local rituals of the grove. For the pray, they often used '*Dhuni*' (wood of *Cedrus deodara* and *Quercus leucotrichophora* are used in making fire in the sacred part of the temple) in the main portion outside of the cave. People believe that '*Dhuni*' make their village evil free. Hence, traditional knowledge among these communities has great deal with nature to not only preserve their ecosystem but also provide excellent examples among the world.

No. of informants

Total 405 persons were interviewed, out of which 375 were responded and remaining does not share their knowledge. Out of 375,

Figure 2: Important medicinal plants in Patal Bhuvneshwar sacred grove 2A *Bergenia ciliata*; 2B *Berberis asiatica*; 2C *Valeriana Jatamansi*.

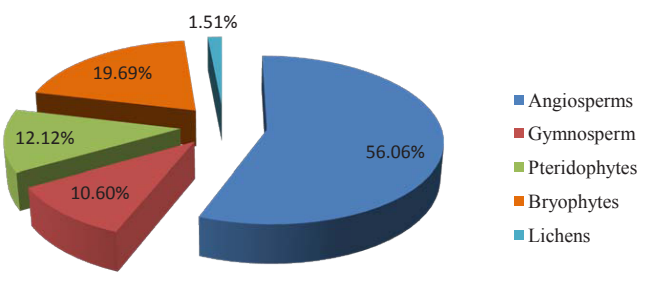

Figure 3: Represent the percentage of plant group present.

Table 1: Showing phytodiversity of Patal Bhuvneshwar Sacred Grove, Pithoragarh.

S. No.	Botanical Name of Plants	Family	Habit (life form/ growth form)	Frequency	Density
	List of Angiosperm				
	Anaphalis contorta (D. Don.) Hook. f.	Asteraceae	Herb	25%	0.5
	Arisaema jacquemontii Blume	Araceae	Herb	30%	0.35
	Berberis asiatica Roxb. ex DC	Berberidaceae	Shrub	40%	0.6
	Berberis chitria Buch.-Ham. ex Lindl.	Berberidaceae	Shrub	15%	0.35
	Bergenia ciliata (Haw.) Sternb.	Saxifragraceae	Herb	55%	0.75
	Bidens pilosa L.	Asteraceae	Herb	45%	0.95
	Chaerophyllum acuminatum Lindl.	Apiaceae	Herb	10%	0.15
	Cirsium wallichii DC.	Asteraceae	Herb	25%	0.3
	Cynodon dactylon (L.) Pers.	Poaceae	Herb	35%	0.65
	Duchesnea indica (Andrews) Focke	Rosaceae	Herb	70%	0.95
	Eupatorium adenophorum Spreng.	Asteraceae	Herb	45%	0.8
	Ficus sarmentosa Buch.-Ham. ex Sm.	Moraceae	Climber	25%	0.35
	Galium aparine L.	Rubiaceae	Herb	40%	0.65
	Gentiana capitata Buch.-Ham. ex D. Don	Gentianaceae	Herb	30%	0.85
	Geranium ocellatum Jacq.	Geraniaceae	Herb	25%	0.75
	Goldfussia dalhousiana Nees	Acanthaceae	Herb	65%	1
	Impatiens balsamina L.	Balsaminaceae	Herb	80%	0.8
	Leucas lanata Benth.	Lamiaceae	Herb	15%	0.6
	Mazus surculosus D. Don	Scrophulariaceae	Herb	40%	0.75
	Myrica esculenta Buch.-Ham. ex D. Don	Myricaceae	Tree	20%	0.3
	Osbeckia stellata Buch.-Ham. ex Ker Gawl.	Melastomataceae	Shrub	35%	0.35
	Oxalis corniculata L.	Oxalidaceae	Herb	15%	0.7
	Prinsepia utilis Royle	Rosaceae	Shrub	25%	0.4
	Pyracantha crenulata (Roxb.) M. Roem.	Rosaceae	Shrub	15%	0.35
	Quercus leucotrichophora A. Camus	Fagaceae	Tree	75%	0.9
	Rhododendron arboreum Smith	Ericaceae	Tree	35%	0.4
	Rubia manjith Roxb.	Rubiaceae	Climber	30%	0.35
	Rubus ellipticus Smith	Rosaceae	Shrub	25%	0.3
	Rum ex hastatus D. Don	Polygonaceae	Herb	15%	0.9
	Scutellaria scandens D. Don	Lamiaceae	Herb	15%	0.6
	Taraxacum officinale Wigg.	Asteraceae	Herb	45%	0.85
	Urena lobata L.	Malvaceae	Shrub	25%	0.25
	Urtica parviflora Roxb.	Urticaceae	Herb	55%	0.75
	Valeriana jatamansi Jones	Valerianaceae	Herb	40%	0.7
	Viburnum cotinifolium D. Don	Caprifoliaceae	Tree	25%	0.25
	Viburnum mullaha Buch.-Ham. ex D. Don	Caprifoliaceae	Tree	30%	0.3
	Woodfordia fructicosa (L.) Kurz	Lythraceae	Shrub	40%	0.3
	List of Gymnosperm				
	Cedrus deodara (Roxb.) G. Don	Pinaceae	Tree	100%	3
	List of Pteridophyte				
	Asplenium dalhousiae Hook.	Aspleniaceae	Fern	55%	0.75
	Adiantum capillus-veneris L.	Adiantaceae	Fern	50%	1.05
	Adiantum lunulatum Burm.	Adiantaceae	Fern	45%	0.45
	Lygodium flexuosum (L.) Swartz	Lygodiaceae	Fern	50%	0.65
	Selaginella bryopteris (L.) Bak.	Selaginellaceae	Fern-allies	60%	1.1
	Pteris stenophylla Wall. ex Hook. & Grev.	Pteridaceae	Fern	25%	1.15
	Cheilanthes dalhousiae Hook.	Polypodiaceae	Fern	35%	1.2
	List of Bryophyte				
	Campylopus goughii (Mitt.) A. Jaeg.	Dicranaceae	Moss	50%	0.7
	Cratoneuron filicinum (Hedw.) Spruce	Amblystegiaceae	Moss	55%	0.9
	Entodon sp.	Entodontaceae	Moss	40%	1.0
	Meteorium buchananii (Brid.) Broth.	Meteoriaceae	Moss	35%	1.1
	Pogonatum microstomum (Schwaegr.) Brid.	Polytrichaceae	Moss	40%	1.25
	Ptychanthus striatus (Lehm. & Lindenb.) Steph.	Lejeuneaceae	Moss	10%	0.4
	Thuidium assimile (Mitt.) Jaeg.	Thuidiaceae	Moss	20%	1.0
	Trachypodopsis serrulata (P.Beauv.) Fleisch.	Trachypodaceae	Moss	40%	1.4

	List of Lichen				
	Bulbothrix isidiza (Nyl.) Hale	Parmeliaceae	Foliose	20%	1.0
	Cetrelia cetrarioides (Delise ex Duby) W. L. Culb. & C.F. Culb	Parmeliaceae	Foliose	50%	0.4
	Chrysothrix candelaris (L.) J.R. Laundon	Chrysothricaceae	Crustose	20%	1.25
	Everniastrum cirrhatum (Fr.) Hale ex Sipman	Parmeliaceae	Foliose	40%	1.0
	Flavoparmelia caperata (L.) Hale	Parmeliaceae	Foliose	35%	0.9
	Graphis anfractuosa (Eschw.) Eschw.	Graphidaceae	Crustose	40%	1.0
	Heterodermia albidiflava (Kurok.) D. D. Awasthi	Physciaceae	Foliose	20%	0.75
	Hypotrachyna flexilis (Kurok.) Hale	Parmeliaceae	Foliose	20%	0.65
	Parmotrema reticulatum (Taylor) M. Choisy	Parmeliaceae	Foliose	20%	1.0
	Parmotrema tinctorum (Despr. ex Nyl.) Hale	Parmeliaceae	Foliose	20%	0.75
	Pertusaria rigida Müll.-Arg.	Pertusariaceae	Crustose	25%	0.6
	Ramalina conduplicans Vain.	Ramaliaceae	Fruticose	40%	0.4
	Usnea pseudosinensis Asahina	Parmeliaceae	Fruticose	20%	1.0

328 have beliefs on their customs and they strictly follow the rules of the grove. 225 are males and 150 were females in different age groups (20-25 age=15 persons; 25-35 age=72 persons; 35-35 age=80 persons; 45-55 age=88 persons; 55-75 age=95 persons; above 75=25 persons).

Ethnobotany

Remedy preparations often involved some sort of spiritual or ritual procedures. They used the plants/parts after taking the permission of the local deity or ancestors reside in the sacred grove. For any treatments, they first offered it to the deity and then treated the patient. Older people (age group of 60-75) of the communities have good knowledge about their traditions and cultures, they get all knowledge from their parents but, the youth doesn't have such knowledge due the modernization.

Angiosperm (16 species belonging to 16 genera), lichens (5 species in 5 genera), pteridophytes (3 species under 2 genera and 1 species) and gymnosperm (only1 genus) are used ethnobotanically for the treatment of various ailments. Family Parmeliaceae (lichen) is the dominant family with 5 species followed by Apiaceae, Rosaceae (angiosperm) and Adiantaceae (pteridophyte) (2 species each), and while other families contributes only 1 species. *Pimpinella diversifolia, Chaerophyllum acuminatum* (cold and stomach problem), *Viola canescans* (cold and fever), *Arisaema jacquemontii* (snake bite), *Geranium ocellatum* (fever), *Osbeckia stellata* (skin diseases), *Berberis asiatica* (diabetes), *Quercus leucotrichophora* (tonic), *Prinsepia utilis* (skin disease), *Duchesnea indica* (stomach problem), *Oxalis corniculata* (vegetable), *Pyracantha crenulata* (stomach problem, agricultural tools), *Valeriana jatamansi* (fever), *Bidens pilosa* (toothache), *Taraxacum officinale* (kidney problem) are used ethnobotanically for the treatment of various ailments and as fodder, fuel, timber, household goods, etc. Parmeliod lichens (*Usnea pseudosinensis, Parmotrema tinctorum, Ramalina conduplicans, Parmotrema reticulata, Everniastrum cirrahatum, Flavoparmelia caperata* (L.) Hale) are used as spices and in cold/fever and mixture of these parmeliod lichens are locally known as *Jhulla*. Similarly, pteridophytes *Adiantum capillus-veneris* and *A. lunulatum* are used as cold and fever.

In spite of its rich and unique phytodiversity in the area, this grove is facing several kinds of threats, mainly biotic. Since, this is one of the main pilgrimage, number of tourists visit the grove every year and load burden on the plant diversity and other natural resources. Due to excessive tourism throughout the year (especially in April to June and then September to December) the local vegetation is disturbed, they do not respect the rules and customs of the grove. About 12,000 tourists are visit per year in the grove to see the beautiful architecture of the cave. Poaching of medicinal plants and other economically valuable plant species are another factor which degrades the floristic composition of the grove, etc. Number of valuable plants species (*Bergenia ciliata, Valeriana jatamansi,* etc) are confined in the grove and could not be observed in the surrounding area in the same altitude. The reorientation of local indigenous communities towards restoration of traditional knowledge through environmental awareness programme by the Government of India will be an effective strategy for conservation of plant resources to a desired extent. Management of existing village and community forests may be improved through adequate funding to village durbars and through appropriate management interventions by the government using participatory approach. This will help in meeting the biomass needs of the villagers, which in turn will reduce the anthropogenic pressures on sacred groves and finally, these groves are small in size but has excellent role to conserve biodiversity in one hand and in another hand maintain strong culture and ethnic religious as well as moral value irrespective of caste and creed.

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