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Research Article

Sacred Groves: Myths, Beliefs, and Biodiversity Conservation—A Case Study from Western Himalaya, India

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Religious and traditional beliefs, cultural mores, and practices play a crucial role in the conservation of environment and biodiversity. The present paper describes a case study of two sacred groves in Western Himalaya. Sacred groves (SGs) are patches of land that are communally protected with religious zeal. A preliminary survey was conducted in these SGs to study their role in biodiversity conservation. The data collected included the general information regarding the SGs and the associated deity, nearest human habitation, access to them, and their floral and faunal diversity. Ethnomedicinal property of plants was collected from the indigenous communities. Many taboos are associated with both the SGs, which help in managing resources well through ritual representation. Different festivals are organized, where the local communities reaffirm their commitment to the forest and the deity. Sacred groves, in general, are a valuable tool of biodiversity conservation. But people's changing attitudes, erosion of traditional beliefs, and human impact have caused degradation of sacred groves over the years. Their conservation would not be possible without the active participation of the local people. By improving their living standards and by giving benefits of conservation to them, long-term conservation goals in these SGs can be achieved.

1. Introduction

Conservation of nature and natural resources has been an important part of cultural ethos, especially in remote rural and indigenous communities in many parts of the world, including India. These communities consider themselves connected with their biophysical environment in a web of spiritual relationship. These rural communities consider specific plants, animals, or even rivers and mountains as their ancestors and protect them. In India, nature worship dates back to the pre-Vedic period (5000 B.C.) and is based on the proposition that all creations of nature have to be protected. The forefathers of these communities were fully aware of the importance and significance of natural resources and the necessity of their conservation for the sustenance of future generations. They lived in harmony with nature and thereby played an important role in conservation of biodiversity [1]. One of the important traditions of nature reverence is to conserve those patches of forest that have been dedicated to a god or goddess or ancestral spirits as *"sacred groves."* According to Hughes and Chandran [2], sacred groves (SGs) are defined as *"segments of landscape containing vegetation, life forms and geographical features, delimited and protected by human societies under the belief that to keep them in a relatively undisturbed state is expression of an important relationship of humans with the divine or with nature."* In short, SGs are the relic forest segments preserved in the name of religion and culture. These groves are mostly associated with temples and are also culturally important. They manifest the spiritual and ecological ethos of rural indigenous communities. Various cultural and religious festivals are often arranged by local people within these patches, which they call *"Mela."* As a way of conservation of nature, SGs have proven to be a well-tried and tested method over thousands of years [3].

Mostly found in Africa and Asia, SGs also exist in Europe and the Americas. Around 100000 to 150000 sacred groves

Table 1: Locations of the studied sacred groves (SGs).

Site	Altitude (m asl)	Geographic coordinates
Hariyali Devi (HD)	1500–2800	N30°19′48.18″; E 79°00′24.77″
Tungnath (TN)	3000–4000	N30°29′13.07″; E 79°13′16.16″

have been reported from India [4]. In India, SGs are especially present in the Himalayan region, Western and Eastern Ghats, Coastal Region, Central Indian Plateau, and Western Desert.

The SGs play an important role in ensuring smooth ecosystem services such as clean environment, that is, air, soil, and water conservation, flora and fauna conservation, carbon sequestration, temperature control, and conservation of traditional knowledge. They are, therefore, of central importance as far as the ecological conservation and policy regarding conservation and management of forest at state and national levels are concerned [5]. Sacred groves serve as a home for birds and mammals, and hence they indirectly help in the conservation of biodiversity [3]. There are several studies carried out by various researchers on this subject, highlighting significant role and potential of the SGs [1, 5, 6]. The present paper presents a case study of two SGs of Western (Garhwal) Himalaya and the aim of the study was to document (i) the floral and faunal diversity of these SGs and (ii) the myths, beliefs, and taboos related to biodiversity conservation in these SGs.

2. Materials and Methods

2.1. Study Area. The present paper describes a case study of two sacred groves from the Western Himalaya. The study was carried out in Uttarakhand, also known as *Dev Bhumi* (abode or home of gods). Uttarakhand is very rich in biodiversity and there are many SGs for the conservation of this biodiversity. SGs like Chipla Kedar, Tarkeshwar, Hariyali Devi, Binsar, Kot, Kalimath, Goldev, Tapovan, Chandrabadani, Tungnath, and Triyuginarayan are some of the important SGs of *Dev Bhumi*. The present study was carried out in two SGs, Hariyali Devi and Tungnath, both of which are located in Rudraprayag district (Figure 1 and Table 1).

Hariyali Devi is located above Kodima village at an altitude of 1400 m in Rudraprayag. The temple contains a bejeweled idol of *Ma Hariyali Devi* astride a lion. The temple houses chiefly three idols, namely, *Ma Hariyali Devi*, *Kshatrapal*, and *Heet Devi*. The temple is open throughout the year but it is more festive at the time of Janmashtami, Navratri, and Deepawali.

Tungnath lies in the upper catchment of the Alaknanda River and the Mandakini River, two major tributaries of the Ganges at an altitude of about 2800–3300 m. Tungnath temple is dedicated to Lord Shiva and is the highest Shiva shrine among the *Panch Kedar*, 3 km uphill form Chopta.

2.2. Geology, Soil, and Climate. The rocks of study area are mainly mylonitized gneisses, augen gneisses, schists, and granites constituting Munsiyari Formation [8]. The weathering bedrocks, which provide the bulk of the loose material in these mountains, are crystalline and metamorphic, with sedimentary deposits of Paleozoic age [9]. The soil texture is sandy loam, light grey to brown in color and acidic in nature, with a pH range between 4 and 5 [10].

Four distinct seasons are observed in the study area: short summer (May-June), Monsoon (July–mid-September), autumn (mid-September-October), and long winter (November–April). The snow cover lasts for about 4-5 months and melts during April–May, which marks the arrival of favorable conditions for plant growth. The growth period lasts for about 5–7 months only [10].

2.3. Sampling Procedures (Methodology). To study the role of the SGs in biodiversity conservation mentioned in Table 1, a preliminary survey was conducted in these areas. Information about these SGs was collected by consulting the elderly people of the villages, governmental and nongovernmental agencies, after receiving prior informed consent, and literature sources (books and scientific journal articles). The data collected included the general information regarding the SGs and the associated deity, nearest human habitation, access to them, and their floral and faunal diversity. Information regarding the ethnomedicinal property of different plants was also collected from the surrounding indigenous communities.

3. Results and Discussion

3.1. Biodiversity of Hariyali Devi Sacred Grove. Hariyali Devi SG is rich in floral and faunal diversity (Tables 2, 3, 4, 5, and 6). A total of 80, 12, 9, and 7 species of plants, mammals, birds, and butterflies, respectively, were recorded from this SG (Tables 2, 3, 4, 5, and 6). The 80 plant species represented 75 genera and 44 families with different economic values. Rosaceae, with the highest number of species (8), was found to be the dominant family. The number of species varied in different life forms like herbs (37), shrubs (23), and trees (20). Most of the plant species in the SG had one or other ethnomedicinal importance (Tables 2, 3, and 4). The predominant vegetation is represented by *Quercus semecarpifolia* (kharsu), *Quercus leucotrichophora* (banj), *Rhododendron arboreum* (burans), and *Lyonia ovalifolia* (anyar).

Hariyali Devi forest harbors many sacred animal and butterfly species (Tables 5 and 6). *Capricornis sumatraensis*, *Cervus unicolor*, and *Felis bengalensis* are some common mammalian species. In addition to these, some reptile species were recorded from this SG.

3.2. Biodiversity of Tungnath Sacred Grove. Apart from being a sacred grove, Tungnath is also a part of Kedarnath Wildlife Sanctuary and hence is an important region as far as the conservation of biodiversity is concerned. Tungnath is a home to many rare, threatened, and endangered medicinal

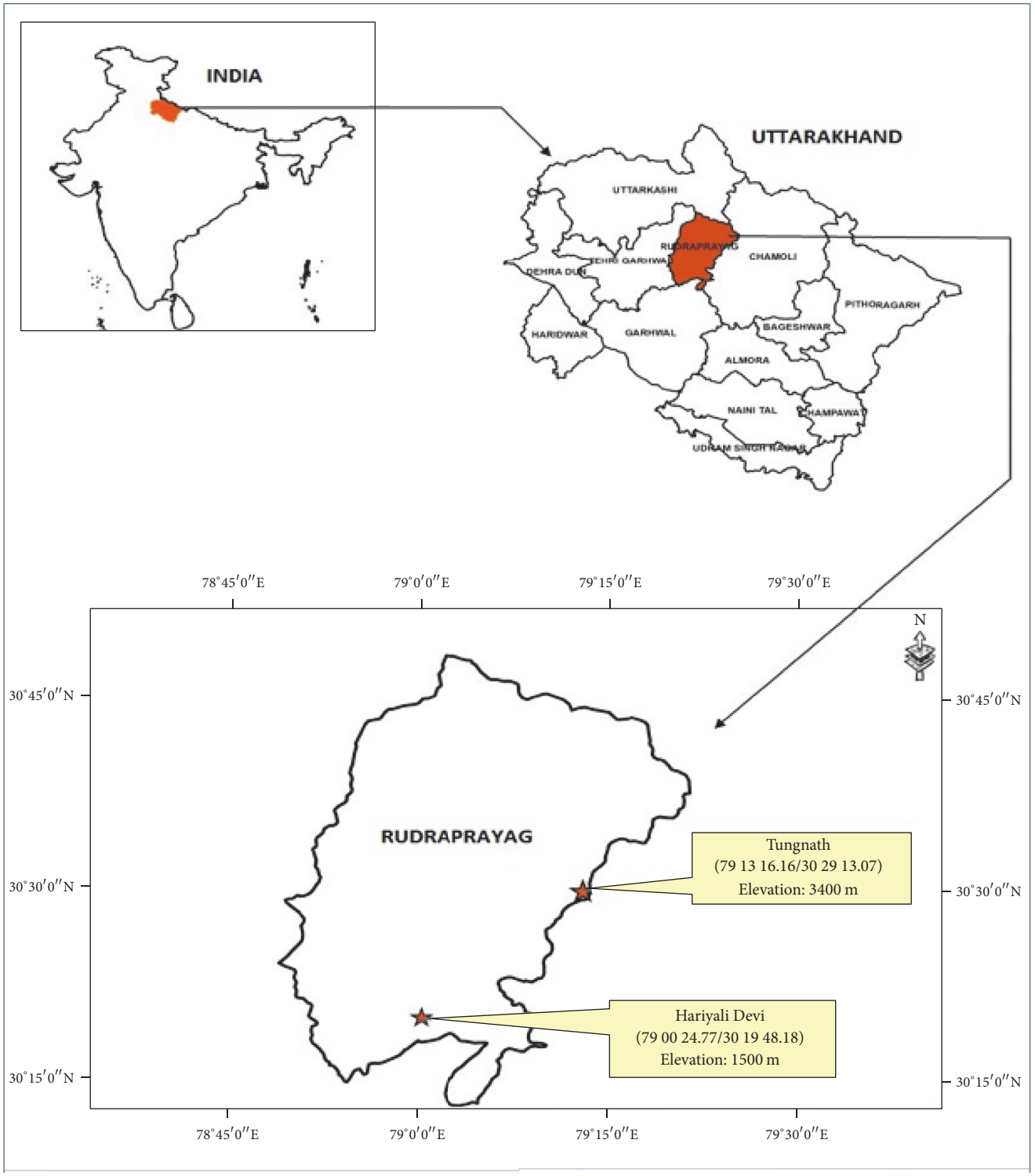

Figure 1: Location of the Hariyali Devi and Tungnath sacred groves in Uttarakhand.

plants like *Picrorhiza kurroa* and *Nardostachys jatamansi* (Tables 7 and 8). A total of 27 plant species were reported from this SG, which include 8 trees, 10 herbs, and 9 shrubs. Some endangered animals like musk deer, black bear, and so forth are also found there in good numbers (Table 9). Many rare and threatened birds and reptiles are also found there (Table 10).

3.3. Taboos as a Means of Plant and Animal Conservation. Taboos are the unwritten, orally transmitted traditional and

Table 2: List of *Tree* species (with ethnomedicinal properties) found in Hariyali Devi SG.

Botanical name	Vernacular name	Family	Ethnomedicinal property
Ilex dipyrena Wall.	Kandara	Aquifoliaceae	Agriculture implements, fuel, fodder
Alnus nepalensis D.Don	Utees	Betulaceae	Fuel, soil binder
Betula alnoides Buch.-Ham. ex D.Don	Bhuja patra	Betulaceae	Wood, fodder, medicine (rheumatism)
Benthamidia capitata (Wall.) H. Hara	Bhamora	Cornaceae	Edible (fruit), wood/tiber
Cupressus torulosa D.Don ex Lamb.	Surai	Cupressaceae	Wood, medicine (cough, cold, and bronchitis)
Lyonia ovalifolia (Wall.) Drude	Anyar	Ericaceae	Fuel, medicine (wounds and boils)
Rhododendron arboreum Sm.	Burans	Ericaceae	Fuel, edible flowers, medicinal (headache, diarrhea, and dysentery)
Quercus floribunda Lind. ex A. Camus	Tilonj	Fagaceae	Timber, fodder, fuel
Quercus leucotrichophora A. Camus	Banj	Fagaceae	Timber, fodder, fuel
Quercus semecarpifolia Sm.	Kharsu	Fagaceae	Fuel/timber and fodder
Aesculus indica (Wall. ex Cambess.) Hook.	Pangar	Hippocastanaceae	Fuel, fodder, medicine (rheumatism)
Juglans regia L.	Akhrot	Juglandaceae	Edible fruit, dye, medicine (antiseptic, astringent)
Lindera pulcherrima (Nees) Hook. f.	Cheri	Lauraceae	Wood/fuel, manure
Persea gamblei (King ex Hook. f.) Kosterm.	Kauwla	Lauraceae	Agricultural implements/fuel
Myrica esculenta Buch.-Ham. ex D.Don	Kaphal	Myricaceae	Edible fruit, medicine (cough, fever, and asthma)
Abies spectabilis (D.Don) Spach.	Morinda	Pinaceae	Timber/fuel, medicine (fever and antiseptic)
Picea smithiana (Wall.) Boiss.	Rai, spruce	Pinaceae	Wood/timber, medicine (cuts and sores)
Pinus wallichiana A. B Jacks.	Kail	Pinaceae	Fuel, paint, medicine (antiseptic)
Prunus cornuta (Wall. ex Royle) Steud.	Jamma	Rosaceae	Fuel, fodder, medicine (antipyretic)
Pyrus pashia Buch-Ham. ex D.Don	Mehal	Rosaceae	Fuel, fodder, edible, medicine (diabetes)

social rules that regulate human behaviour [11]. In rural areas of India like Garhwal (Uttarakhand), there are a number of plants, animals, and even lakes and rivers that are considered sacred and hence no felling or exploitation is being carried out. As a result of this consecration, different species of trees and animals that are economically important or threatened in other areas are preserved and can form a genetic reservoir and serve as a guide against extinction of these species [12]. *For example,* Dodital and Devariya Tal, two lakes in Uttarkashi and Rudraprayag district of Uttarakhand, are considered sacred, so fishing is completely restricted. There is a taboo that if fishing is done in these lakes, the fisherman will suffer from leprosy [13]. Therefore, the religious belief serves as an instrument of protection of rare and threatened species. Religious beliefs, tradition, and culture are the products of logical internalization of human experience and learning. These practices help in managing resources well through religious or ritual representation.

Trees have a very special role in the ethos of the people in Uttarakhand. Species of trees are worshipped as (1) manifestation of gods, (2) representatives of particular stars and planets, and (3) symbols of the natural elements (energy, water, land, and air), each of which has its own independent and rational meanings [12]. *For example,* in Garhwal Himalaya, *Ficus religiosa* is considered to be sacred. There are many instances where communities control the excess use of resource by confining the approach to resources and enforcing compliance through religious belief, rituals, and social convention which at last result in biodiversity conservation in such communities. The roles of religious and cultural beliefs in protecting trees have been observed by other researchers also [1, 12]. Species such as sacred fig *(Ficus religiosa)*, mountain lion *(Felis concolor)*, and southern pocket gopher *(Thomomys umbrinus emotus)* are protected by Hindus' taboo all across the Indian subcontinent [13]. In the present study also, we reported some taboos associated

Table 3: List of *Shrub* species (with ethnomedicinal properties) found in Hariyali Devi SG.

Botanical name	Vernacular name	Family	Ethnomedicinal property
Hedera nepalensis (K. Koch)	Laguli	Araliaceae	Medicinal (expectorant, whooping cough)
Berberis asiatica Roxb.	Kilmora	Berberidaceae	Fuel/fodder and medicinal (ophthalmic, conjunctivitis, and gastritis)
Sarcococca saligna (D.Don) Mull. Arg.	Piruli	Buxaceae	Sticks, soil binder, medicinal (joint pains and fever)
Abelia triflora R. Br.	Gogti	Caprifolaceae	Walking sticks, fodder
Lonicera quinquelocularis Hard.	Taknoi	Caprifolaceae	Edible, walking sticks
Viburnum cordifolium Wall. ex DC.	Bhatnoi, guya	Caprifolaceae	Edible fruits, medicinal (against menorrhagia-excessive menstruation)
Elaeagnus parvifolia Wall. ex Royle	Giwain, kanal	Elaeagnaceae	Medicine (treatment of bloody dysentery, cardiac tonic, cough, treatment of afflictions of lungs, cancer treatment), edible fruits, fodder
Indigofera heterantha Wall. ex Brandis	Sakina	Fabaceae	Medicinal (burns, skin diseases, and ulcers), fodder, edible
Desmodium elegans DC.	Chamali	Fagaceae	Medicine (antipyretic, vomiting)
Deutzia compacta Craib.	Mhujvar	Hydrangeaceae	Medicinal (diuretic)
Elsholtzia fruticosa (D.Don) Rehder	Pothi	Lamiaceae	Medicinal (abdominal pain and nausea)
Zanthoxylum armatum DC.	Timur	Rutaceae	Medicinal (toothache)
Myrsine africana L.	Chupra	Myricaceae	Medicinal (anthelmintic, antispasmodic, skin infections)
Boenninghausenia albiflora (Hook.) Rchb. ex Meisn.	Pishumar	Rutaceae	Medicinal (treatment of malaria, headache, treatment of scabies)
Rhamnus virgatus Roxb.	Chentuli	Rhamnaceae	Fuel, medicinal (eczema and ringworms)
Rosa brunonii Lindl.	Kunja	Rosaceae	Medicinal (cuts, wounds, and sprains), soil binder
Rosa sericea Lindl.	Dhurkunja	Rosaceae	Fodder, edible fruit rich in vitamin C
Rubus foliolosus D.Don	Kala hisar	Rosaceae	Edible fruits, medicinal (dysentery and whooping cough)
Spiraea bella Sims	Kuji	Rosaceae	Medicinal (wash sores and wounds), brooms
Leptodermis lanceolata Wall.	Padera	Rubiaceae	Medicinal (migraines), fodder
Randia tetrasperma (Wall. ex Roxb.) Benth. & Hook. f. ex Brandis	Kamoli	Rubiaceae	Fuel, walking sticks, medicinal (astringent, diuretic, and diarrhea)
Skimmia anquetilia Tayl. & Airy Shaw	Nairpatti	Rutaceae	Agricultural use, sticks, medicinal (treatment of headache and smallpox)
Debregeasia longifolia (Burm. F.)Wedd.	Tusara	Urticaceae	Fodder, used for making ropes, medicine (treatment of scabies)

with *Hariyali Devi* and *Tungnath* sacred groves. According to villagers, these taboos need to be followed by all. These include the following:

(a) Women are strictly prohibited from entering the sacred forest due to the belief that they are impure.

(b) Fetching/collection of fodder and fuelwood and the movement of women and *Shudras* (scheduled castes) have been strictly prohibited in this grove since the Mahabharata period. A temple of the goddess Hariyali Devi is located in this forest patch.

(c) Use of tools in any form (knife, sickle, etc.) on the plants and animals will be a step to hurt the sentiments of *Devi* (goddess). The forest fairies in turn are angered and their wrath can make person mad or deformed and also can lead to disaster in the family of offender.

(d) For a person who starts his journey, if a snake comes across his way, then he has to stop the journey and has to restart only after worshipping the god after an interval of a week.

(e) One week before pilgrimage, the villagers stop eating onion, garlic, egg, and meat.

(f) Anything that is made up of leather is prohibited in the temple and grove.

Table 4: List of *Herbaceous* species (with ethnomedicinal properties) found in Hariyali Devi SG.

Botanical name	Vernacular name	Family	Ethnomedicinal property
Barleria cristata L.	Kala bansa	Acanthaceae	Medicinal (anemia, toothache), soil binder
Peristrophe paniculata (Forssk.) Brummitt	Kaknado	Acanthaceae	Medicinal (used against TB)
Achyranthes aspera L.	Latjiri	Amaranthaceae	Medicinal (malarial fever and muscular sprains)
Heracleum lanatum Michx.	Kakriya	Apiaceae	Medicinal (nervine and tonic), edible
Pimpinella diversifolia DC.	Teroi	Apiaceae	Medicinal (respiratory diseases)
Arisaema intermedium Blume	Meen/magmungari	Araceae	Medicinal (burns)
Arisaema jacquemontii Blume	Khaprya	Araceae	Medicinal (antidote of poisonous mushrooms and snake bite, cough, kidney, skin diseases)
Impatiens sulcata Wall.	Chaul	Araliaceae	Medicinal (antirheumatic and burns), edible
Ageratum conyzoides L.	Gundrya	Asteraceae	Medicinal (anti-inflammatory, antibacterial)
Anaphalis triplinervis (Sims) C. B. Clarke	Bugla	Asteraceae	Medicinal (cuts and wounds, antiseptic)
Cynoglossum glochidiatum Wall. ex Benth.	Lichkura	Boraginaceae	Medicinal (dyspepsia and digestive disorder), vegetable
Silene edgeworthii Bocquet	Bakroyla	Caryophyllaceae	Medicinal (eye infections)
Stellaria media (L.) Vill.	Badyalu	Caryophyllaceae	Medicinal (antirheumatic, anti-inflammatory), vegetable, fodder
Bryophyllum pinnatum (Lam.) Oken.	Bish-khapura	Crassulaceae	Medicinal (burns, wounds, and swellings)
Dipsacus inermis Wall.	Phulee	Dipsacaceae	Medicinal (leucoderma and contusions), edible fruits
Lathyrus aphaca L.	Kurphail	Fabaceae	Fodder
Swertia angustifolia Buch.-Ham. ex. D.Don	Chirata	Gentianaceae	Medicinal (febrifuge)
Geranium nepalense Sweet	Phori	Geraniaceae	Medicinal (diarrhea, ulcers, and wounds), tennin
Hypericum elodeoides Choisy	Basanti	Hypericaceae	Medicinal (antidepressant, sedative, rheumatism)
Micromeria biflora (Buch.-Ham. ex D.Don) Benth.	Gorakhopan	Lamiaceae	Medicinal (carminative)
Origanum vulgare L.	Ban tulsi	Lamiaceae	Medicinal (antispasmodic, carminative), vegetable
Prunella vulgaris L.	Self-heal	Lamiaceae	Medicinal (wound healing, expectorant, antiseptic)
Salvia lanata Roxb.	Ghanyajhar	Lamiaceae	Vegetable and bee-forage source
Oxalis corniculata DC.	Bhilmoro	Oxalidaceae	Medicinal (headache, indigestion, and diarrhea), vegetable
Peperomia tetraphylla Hook. & Arn.	Tirpirya	Piperaceae	Medicinal (treatment of convulsions, skin diseases, cough, asthma, kidney disorders)
Rumex hastatus D.Don	Almoru	Polygonaceae	Medicinal (astringent)
Rumex nepalensis Spreng.	Khatura	Polygonaceae	Medicinal (purgative), vegetable
Anemone obtusiloba D.Don	Kanchphool	Ranunculaceae	Medicinal (nervine and sedative)
Thalictrum javanicum Blume	Mamiri	Ranunculaceae	Medicinal (febrifuge, antirheumatic, and antigout)
Fragaria nubicola (Hook. f.) Lindl. ex Lacaita	Gand-kaphal	Rosaceae	Medicinal (earache)
Potentilla fulgens Wall. ex Hook.	Bajardantu	Rosaceae	Medicinal (antidiarrheal, toothache), edible
Galium aparine L.	Khuskusa	Rubiaceae	Medicinal (diuretic and anti-inflammatory)

Table 4: Continued.

Botanical name	Vernacular name	Family	Ethnomedicinal property
Solanum erietinum D.Don	Ban-tambakhu	Solanaceae	Medicinal (vaginal discharges, inflammation), edible fruits
Solanum nigrum L.	Banbhatuja	Solanaceae	Medicinal (cough, cold, diuretic)
Selinum vaginatum C. B. Clark	Butkeshi	Spigeliaceae	Medicinal (nervine, sedative, and analgesic)
Girardinia diversifolia (Link) Friis	Bhainsya	Urticaceae	Medicinal (fever, headache, and swollen joints), fibers, ropes
Hedychium spicatum Buch.-Ham. ex Sm.	Banhaldi	Zingiberaceae	Medicinal (analgesic, anti-inflammatory)

Table 5: List of sacred animal species (with IUCN conservation status) found in Hariyali Devi.

Scientific name	Common name	Family	IUCN status*
Aonyx cinerea	Asian small-clawed otter	Mustelidae	Vulnerable
Capricornis sumatraensis	Serow	Bovidae	Vulnerable
Cervus unicolor	Sambar (jado)	Cervidae	Vulnerable
Felis bengalensis	Leopard cat	Felidae	Least concern
Felis chaus	Jungle cat	Felidae	Least concern
Hemitragus jemlahicus	Himalayan tahr	Bovidae	Near threatened
Martes flavigula	Himalayan marten (khursyala)	Mustelidae	Least concern
Panthera pardus	African leopard	Felidae	Vulnerable
Panthera uncia	Leopard (guldar)	Felidae	Endangered
Rattus nitidus	Himalayan field rat	Muridae	Least concern
Sus scrofa	Wild boar	Suidae	Least concern
Ursus arctos	Brown bear	Ursidae	Least concern

*http://www.iucnredlist.org/search.

Table 6: List of birds and butterflies (with IUCN conservation status) found in Hariyali Devi.

Scientific name	Common name	Family	IUCN status*
	Birds		
Columba eversmanni	Yellow-eyed pigeon	Columbidae	Vulnerable
Columba rupestris	Hill pigeon	Columbidae	Least concern
Dicrurus macrocercus	Black drongo	Dicruridae	Least concern
Gallus gallus	Red junglefowl	Phasianidae	Least concern
Streptopelia orientalis	Oriental turtle dove	Columbidae	Least concern
Pycnonotus leucogenys	Himalayan bulbul	Pycnonotidae	Least concern
Turdoides striata	Jungle babbler	Leiothrichidae	Least concern
Dendricitta vagabunda	Rufous treepie	Corvidae	Least concern
Urocissa flavirostris	Yellow-billed blue magpie	Corvidae	Least concern
	Butterflies		
Acraea issoria	Yellow coster	Nymphalidae	Least concern
Argynnis kamala	Common silverstripe	Nymphalidae	Least concern
Delias belladonna horsfieldi	Hill jezebel	Papilionidae	Least concern
Kallima inachus huegelii	Orange oakleaf	Lycaenidae	Least concern
Polyura dolon	Stately nawab	Lycaenidae	Least concern
Pseudergolis wedah	Tabby	Nymphalidae	Least concern
Ypthima sakra	Himalayan five-ring	Lycaenidae	Least concern

*http://www.iucnredlist.org/search.

Table 7: List of *Tree* species (with ethnomedicinal properties) found in Tungnath SG.

Botanical name	Vernacular name	Family	Ethnomedicinal property
Acer caesium Wall. ex Brandis	Indian maple	Aceraceae	Fuel, medicinal (for muscular swelling)
Ilex dipyrena Wall.	Himalayan holly	Aquifoliaceae	Fuel, fodder, agricultural implements
Betula utilis D.Don	Bhojpatra	Betulaceae	Medicinal (diuretic, skin infections)
Euonymus tingens Wall.	Spindle tree (kasuree)	Celastraceae	Fuel, also used as dyes
Rhododendron arboreum Sm.	Burans	Ericaceae	Fuel, flowers for squash
Quercus semecarpifolia Sm.	Kharsu	Fagaceae	Fuel, fodder, and timber
Prunus cornuta (Wall. ex Royle) Steud.	Himalayan bird cherry	Rosaceae	Fuel and fodder
Taxus wallichiana Zucc.	Himalayan yew	Taxaceae	Medicinal (anticancerous), fuel, timber

Table 8: List of *Herbaceous* and *Shrub* species (with ethnomedicinal properties) found in Tungnath SG.

Botanical name	Vernacular name	Family	Ethnomedicinal property
		Herbs	
Selinum candolle Edgew.	Muur	Apiaceae	Medicinal (analgesic, cough, fever)
Silene conoidea L.	Chota takla, thumriya	Caryophyllaceae	Medicinal (eye infections, treatment of ophthalmia)
Morina longifolia Wall.	Kathi, kathoj, sakina	Caprifoliaceae	Medicinal (wounds and incense, burns, and boils)
Polygonatum verticillatum (L.) All.	Mitha dudhiya	Asparagaceae	Medicinal (used in treatment of emaciation, senility, gastric diseases)
Corydalis govaniana Wall.	Inderajatta	Papaveraceae	Medicinal (fever, liver diseases, and eye infections)
Cynodon dactylon (L.) Pers.	Dhub	Poaceae	Medicinal (cuts, wounds, piles, inflammation, skin diseases)
Rubus nepalensis (Hook. f.) Kuntze	Hisar	Rosaceae	Medicinal (cuts and wounds)
Picrorhiza kurroa Royle ex Benth	Kutki	Scrophulariaceae	Medicinal (fever, hepatitis, chronic dysentery)
Nardostachys jatamansi (D.Don.) DC.	Jattamaansi	Valerianaceae	Medicinal (tranquilizer, sedative, high blood pressure, used in dysmenorrhoea for pain relief and smooth menstrual flow)
		Shrubs	
Berberis aristata DC.	Kingor	Berberidaceae	Medicinal (used in ophthalmia, conjunctivitis, ulcers)
Juniperus indica Bertol.	Guugal	Cupressaceae	Medicinal (cough, cold, and fever)
Rhododendron anthopogon D.Don	Taalisri, burans	Ericaceae	Medicinal (against respiratory diseases)
Rhododendron campanulatum D.Don.	Chimal/burans	Ericaceae	Medicinal (chronic rheumatism and sciatica)
Rhododendron lepidotum Wall. ex. G.Don	Burans	Ericaceae	Medicinal (respiratory and digestive ailments)
Clematis buchananiana DC.	Belkangu	Ranunculaceae	Medicinal (skin ailments, sinus inflammation, wounds)
Cotoneaster acuminatus Lindl.	Ruins	Rosaceae	Medicinal (diarrhea and dysentery)
Cotoneaster microphyllus Wall. ex Lindl.	Ruins	Rosaceae	Anti-inflammatory, cuts, and wounds
Leptodermis lanceolata Wall.	Koo-basya	Rubiaceae	Medicinal (migraines)

Table 9: List of animal species (with IUCN conservation status) found in Tungnath SG.

Scientific name	Common name	Family	IUCN status*
Canis aureus	Jackal	Canidae	Least concern
Capricornis sumatraensis	Serow	Bovidae	Vulnerable
Hemitragus jemlahicus	Himalayan tahr	Bovidae	Near threatened
Macaca mulatta	Rhesus macaque	Cercopithecidae	Least concern
Moschus chrysogaster	Alpine musk deer	Moschidae	Endangered
Ochotona roylei	Himalayan mouse-hare	Ochotonidae	Least concern
Panthera pardus	Common leopard	Felidae	Vulnerable
Presbytis entellus	Common langur	Cercopithecidae	Least concern
Pseudois nayaur	Bharal	Bovidae	Least concern
Pteropus giganteus	Indian flying fox	Pteropodidae	Least concern
Ursus thibetanus	Himalayan black bear	Ursidae	Vulnerable

*http://www.iucnredlist.org/search.

Table 10: List of birds and reptiles (with IUCN conservation status) found in Tungnath SG.

Scientific name	Common name	Family	IUCN status*
	Birds		
Aquila nipalensis	Steppe eagle	Accipitridae	Endangered
Gypaetus barbatus	Bearded vulture	Accipitridae	Near threatened
Lophophorus impejanus	Himalayan monal	Phasianidae	Least concern
Megalaima viridis	White-cheeked barbet	Megalaimidae	Least concern
Neophron percnopterus	Egyptian Vulture	Megalaimidae	Least concern
Pucrasia macrolopha	Koklass	Phasianidae	Least concern
Tragopan melanocephalus	Western tragopan	Phasianidae	Vulnerable
Zoothera monticola	Greater long-billed thrush	Turdidae	Least concern
	Reptiles		
Calotes versicolor	Indian garden lizard	Agamidae	Not evaluated
Hemidactylus brookii	Spotted Indian gecko	Gekkonidae	Least concern
Naja naja	Spectacled cobra	Elapidae	Near threatened
Orthriophis hodgsoni	Himalayan trinket snake	Colubridae	Not evaluated
Scincella himalayanum	Himalayan ground skink	Scincidae	Least concern

*http://www.iucnredlist.org/search.

(g) Killing/hunting of animals and plucking/uprooting of plants are strictly forbidden in the SGs.

3.4. Myths Associated with the Hariyali Devi and Tungnath SGs. According to Hindu Mythology, when Devi Mahamaya was conceived in the form of Devaki's seventh child, the cruel brother of Devaki, Kansa threw Devi Mahamaya aggressively on the ground. Immediately multiple body parts of Devi got scattered all over the earth. The hand fell at Hariyali Devi. Since then, it has become a revered place as *Siddha Peeth*. The temple is open for all seasons but it is more celebratory at the time of *Janmashtami, Navratri, and Deepawali*. The myth which prevails according to the *Bhagwat Puran* is the following: Yogmaya was the sister of Lord Krishna, and she replaced him in the cell of his parents during his birth. When Kansa threw her against the wall, she turned into lightning and came to Hariyali Parvat to make her abode. Since then, the adjoining forest is known as "Hariyali" and is worshipped by people.

The Tungnath temple is the highest Hindu shrine and is believed to be 1000 years old. It has a rich legend linked to the Pandavas, Heroes of Mahabharata epic. According to Hindu Mythology, Vyas Rishi advised the Pandavas that since they were culpable of slaying their own relatives (Kauravas, their cousins) during the Mahabharata war, their act could be pardoned only by Lord Shiva. Consequently, the Pandavas went in search of Shiva who was convinced of the guilt of Pandavas. In order to keep away from them, Shiva took the form of a bull and went into hiding in an underground safe haven of Guptakashi, where Pandavas chased him. But later Shiva's body in the form of bull's body parts rematerialized at five different locations that represent the "Panch Kedar," where Pandavas built temples of Lord Shiva at each location to worship and venerate, seeking his pardon and blessings. Each location is identified with a part of his body; Tungnath is identified as a place where his "Bahu (hands)" were seen. Legend also states that Lord Ram, the chief icon on the Ramayana epic, meditated at the Chandrashila peak, which is close to Tungnath.

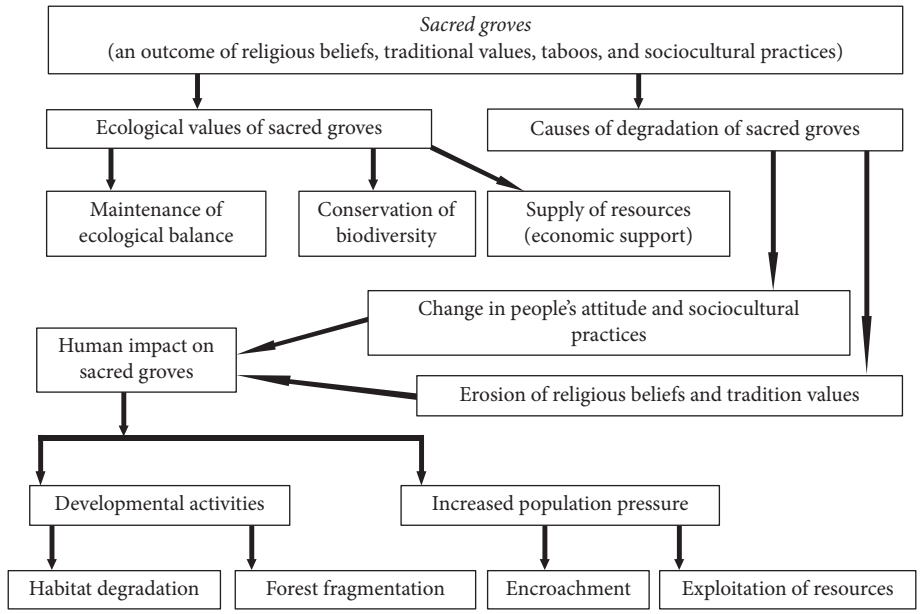

Figure 2: Relationships between ecological values, religious beliefs, and traditional values and causes of degradation of sacred groves (courtesy: [7]).

3.5. Festivals (Melas) Associated with the Sacred Groves. SGs are associated with religious rites, festivals, and recreation. The organization and celebration of fairs and festivals have preserved the traditional and sociocultural heritage of Garhwal to a great extent. In Hariyali Devi and Tungnath SGs, festivals (locally called as *melas*) are organized during April and October every year on the occasion of *Navratri*, *Shivratri, Holi*, and so forth. At these *melas* (festivals), the local communities reaffirm their commitment to the forest and the deity. The heads of the communities supervise the utilization and maintenance of the SGs to ensure that there is no deviation from the village-appointed rules. Anthwal et al. [14] also reported several festivals related to SGs in Uttarakhand. Many plant species have also been associated with religious festivals, namely, *Azadirachta indica* (Sheela Asthami, Nimb Saptami), *Ficus bengalensis* (Vat Savitri), *Aegle marmelos* (Bilvamengal sawan ke somvaar), *Musa paradisiaca* (Kadii Vrat), and *Ficus religiosa* (Somvati Amavasya), due to popular and common beliefs [14].

3.6. Conservation of Medicinal Plants. The traditional medical systems of northern India (such as Ayurveda and Tibetan) are a component of culture developed over long time [15]. Medicinally important plants have high importance for religious activities of north Indian native communities that worshiped the plants in the form of god, goddesses, and minor deities [16]. Thus, SGs are the valuable repositories of medicinal and aromatic plants.

Most of the denizens residing in the vicinity of groves are very simple, illiterate, and poor and are almost without any access to modern medicine systems. But they do have conscientiously nourished their traditional knowledge, customs, rituals, and ceremonies with great potency. Local traditional knowledge and the practice of plant-based medicine are still widespread in the rural areas of Garhwal and these play an important role in primary health care [17]. Even the local people prefer to stick to the traditional herbal remedies, and it is due to a situation of having no alternative choices, as well as poverty and belief in the effectiveness of folklore herbal remedies [17]. The denizens living around these SGs have conserved the medicinal plants of these regions for use in a sustainable way by themselves and by their future generations. Religious beliefs and traditional customs have played an important role in this conservation. They have deep faith that if someone from outside the village uproots the medicinal plants from their village, it is treated as an evil act that may bring misery of great order to the village folks.

3.7. Present Status of the HD and TN SGs. Sacred groves, in general, are good instruments of biodiversity conservation. As already mentioned, our ancestors were aware that the natural resources that sustained them should be conserved for the future generations. But, in the course of time, science and technology developed and industries were established and expanded to meet the increasing demands of the people. People's changing attitudes, the erosion of traditional beliefs, and human impact have caused degradation of sacred groves over the years (Figure 2). The same is true for the studied sacred groves. Various anthropogenic activities have altered the structure and function of different ecosystems all over the world [18]. One of the most noticeable effects of ecosystem perturbation has been the depletion of biodiversity [19]. Vanishing of species due to different anthropogenic disturbances like alteration of natural habitats, excessive utilization, pollution, universal climate change, and invasion of nonnative species is so fast that many precious taxa may disappear even before they are documented and identified and their scientific value is discovered [7]. Many scholars have worked on

conservation of sacred groves through sociocultural practices in different parts of India [1, 12, 20–26].

Lack of awareness in terms of long-term future benefits has resulted in the destruction of SGs. No legislative protection has been implemented so far in India. This has caused considerable ecological damage. Sacred groves have become the victims of deteriorating faith. Such religiously protected areas provide a comprehensive and rich ecological niche as repositories of genetic diversity [12]. The increased threats to SGs can be related to the lack of an in-built conservation effort, higher demands for NTFPs, fuel wood collection, and decrease in the religious faiths along with the reduced commitment of the present generation toward such natural sacred places.

Encroachments of SGs areas by various government departments for different developmental projects, as well as migration and immigration of people, also have contributed to the extinction of SGs. These SGs need to be protected and managed wisely as was done a few decades ago. For providing necessary protection to the SGs and maintaining their natural identity and sanctity, it is imperative that the surrounding population is taken into confidence. The surrounding village communities need to be educated and guided for sustaining the sanctity of existing groves and strengthening them. Conservation of SGs is impossible without the active participation of the local people. Conservation without compensation is only conversation [17, 27]. By improving their living standards and by giving benefits of conservation to them, long-term conservation goals in these SGs can be achieved.

4. Conclusion

India has a very high number of scared groves that play an important role in biodiversity conservation because of various myths and religious beliefs associated with them. These SGs have been conserving the biodiversity for many decades. But, nowadays, the attitude of people has changed and this along with the mistrust of traditional beliefs has caused degradation of sacred groves all over India. For improving their degraded condition, it is suggested that the local people living inside and around the SGs need to be taken into confidence, so that long-term conservation goals can be achieved.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this work.

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