Traditional Culture and Biodiversity Conservation: Examples From Uttarakhand, Central Himalaya

Author: Negi, Chandra Singh

Source: Mountain Research and Development, 30(3) : 259-265

Published By: International Mountain Society

URL: https://doi.org/10.1659/MRD-JOURNAL-D-09-00040.1

Mountain Research and Development (MRD)
An international, peer-reviewed open access journal
published by the International Mountain Society (IMS)
www.mrd-journal.org

MountainResearch
Systems knowledge

Traditional Culture and Biodiversity Conservation: Examples From Uttarakhand, Central Himalaya

Chandra Singh Negi
csnsacred1@rediffmail.com
Department of Zoology, Government Post Graduate College, Pithoragarh, Uttarakhand-262502, India

Cultural diversity in remote mountain regions is closely linked to biodiversity, as there is a symbiotic relationship between habitats and cultures, and between ecosystems and cultural identity; indeed, religious rules and rituals often strengthen this relationship and are characterized by a conservation ethic. The present paper presents an analysis of information collected from knowledgeable members of mountain communities in the State of Uttarakhand, Central Himalaya. The data collected are analyzed within the framework of traditional knowledge-based systems (TKBS) methodology, using the conservation purpose of rules and practices as a means of typifying the information on sacred natural sites (forests/groves, pastures, water bodies), on the phenomenon of dedicating forests to a deity, on the inherent taboos regarding resource exploitation, and on other traditional beliefs and customs, in order to understand the environmental and conservationist implications of these rules and practices. The analysis shows that the cultural precepts of remote Uttarakhand mountain communities can be considered a precondition for sustainable development. In fact, the association of religion with ecosystem management is inherent in traditional Himalayan communities' culture; one cannot think of ecological systems in the Himalaya without religion. However, this knowledge and related conservation rules need to be strengthened in the face of current change.

Keywords: *Nature conservation; culture; sacred forests; taboos; traditional knowledge-based systems (TKBS); Uttarakhand; Himalaya; India.*

Peer-reviewed: *May 2010* ***Accepted:*** *June 2010*

Introduction

Beginning several decades ago, the idea that indigenous people and other small-scale societies were exemplary conservationists gained widespread currency in popular media as well as academic circles (Smith and Wishnie 2000). This indigenous conservationism has often been attributed to a spiritual respect for, and a practical understanding of, the natural world (eg Vecsey 1980; Martinez 1996; Berkes 1999). Evidence offered in support of this characterization includes culturally expressed conservation ethics, animistic religious beliefs conceptualizing other species as social beings, and the relatively higher richness of biodiversity found within sacred forests (Duming 1992; Gadgil et al 1993; Callicott 1994; Alcorn 1996; Bodley 1996; Bernbaum 2006).

In traditional societies, sustainable natural resource management is driven by the beliefs and behaviors of human communities, and local cultures are strengthened by their intimate connections to the natural environment that sustains them (Rist et al 2003). Our modern world is often poorer for the scientific rationalism that treats objective and sacred knowledge as separate spheres, while traditional cultures do not make such distinctions (Malhotra and Mark 1989; Joshi 1992; Kumbhojkar and Kulkarni 1998; Negi 2003, 2005). However, traditional knowledge-based systems (TKBS) qualify as being of conservation value only if they satisfy two basic criteria: they must (a) prevent or mitigate resource depletion, species extirpation, and habitat degradation and (b) be designed to do so (Alvard 1998; Ruttan and Borgerhoff Mulder 1999; Smith and Wishnie 2000). With these two criteria as analytical tools, the present paper describes the inherent conservation role of salient cultural practices in various landscapes, including in sacred forests, and of the traditional knowledge-based systems developed and practiced by mountain communities in the State of Uttarakhand, Central Himalaya.

Methodology

The knowledge-based systems methodology for acquisition of local ecological knowledge suggested by Walker et al (1997) and Sinclair and Walker (1999) was adapted: knowledge about natural resources and related rituals and rules was collected from a small sample of deliberately chosen individuals thought to be knowledgeable by other villagers regarding the area of interest explained by the researcher. As far as possible, care was taken to include representatives across the caste divide. Knowledge was collected through focused interviews, with information being sought regarding the

location of sacred natural sites (SNSs), the features related to these sites, local perception of the sacredness of the SNSs, and management issues (including caste dynamics).

Precepts of conservation inherent in cultural landscapes

In analyzing the data collected on traditional knowledge-based systems in the study area, Smith and Wishnie's (2000) organization of information according to the conservation purpose of rules applied in traditional practices was used: (1) harvesting restraints, (2) protection or propagation of resource species, (3) regulating the onset or duration of harvests, (4) avoidance of harmful habitat modification, and (5) patch-switching to maximize overall return rates. In addition, the phenomenon of dedicating forests to a deity (6) is discussed.

Harvesting restraint

The type of resource utilization that most clearly meets the criterion of conservation design is harvesting restraints that raise short-term production costs. Examples from the landscape studied include a number of sacred pastures and landscapes, principally in the Vyas Valley, where grazing pressure is regulated by means of taboos, that is, in Hya-Roshe *bugyal* (*bugyal:* alpine meadows/pastures) near the village of Napalchhu, and Putuk-tu *bugyal* near the village of Kuti, where only the sacred yak (*Bos grunniens*) and its local hybrids, *jhuppu* and *jomos*, are allowed to graze. Such is the fear factor that no shepherd dares to make use of these pastures, which are among the best preserved in the area. Similarly, the inhabitants of the Vyas Valley religiously guard against killing of *fiya* (Himalayan marmot: *Marmot bobak* Muller), which is regarded as a totem.

Protection or propagation of a resource species

Another form of conservation involves practices designed to protect or propagate resource species. Examples include the institutions of *kathburiya devi* and *nabu samo:*

a. *Kathburiya devi:* Atop mountain ridges at the end of a tough climb, sacred heaps or piles referred to as *kathburiya*, or wayside goddess, can be found. The locals usually pay homage to *kathburiya devi* by depositing a small branch, preferably of deodar or the cones of the same, and very often a blossoming branch of the native vegetation, referred to as *chiyunli*, as an offering of thanks for the successful climb to that point. The institution of *kathburiya* represents an effective means of regeneration of flora on the hilltop, even if the locals are not conscious of the outcome of the ritual.
b. *Nabu samo: nabu* stands for insects and *samo* means to destroy, that is, the festival symbolizes the victory over harmful (crop-destroying) insects. Every member of the village collectively gathers the pests/insects (in a cloth) from their fields; the collections are then tied to the horns of a goat, which is sacrificed. With only a handful of residents now remaining within the Choudas Valley, the customary fanfare associated with *nabu samo* has dwindled over the last decade. However, it does point to a very effective traditional means of getting rid of the pests through systematic collection by the entire community.

Regulating onset or duration of harvests

Controls governing the timing of resource harvests, as well as who has the right to participate in harvesting, are widespread in small-scale societies. One prime example of the practice in the study area includes the *nanda astami* (celebrated in praise of the local goddess Nanda Devi, the highest peak in western Himalaya) and associated with the harvesting of the sacred flower, the *brahmakamal* (*Saussurea obvallata*), invariably carried out toward the end of August.

The celebration of the festival brings forth the salient aspect of the ethics of conservation inherent in the local cultural ethos. On the appointed day, only two persons (out of the hundreds of Johaaris who gather together in the village of Martoli, Johaar Valley) are delegated to collect the *brahmakamal* from Salang Gwar, the sacred alpine pasture where the species abounds. These two individuals—after taking a ritualistic bath, walking barefoot and dressed in white, carrying with them the seasonally available cucumber to propitiate the goddess—offer due prayers to the resident deity upon reaching the meadow, after which the collection begins. Only fully opened and mature *brahmakamal* are selected for the offering (Figure 1). *Nanda astami* brings out the intrinsic message of conservation in a traditional society: (1) It is celebrated only after the flowering and the shedding of seeds by the species has taken place, and hence collection of the same does the least damage in relation to regeneration; and (2) the restriction imposed on the number of harvesters is an effective means to restrict the size of the pool harvested.

Avoidance of harmful habitat modification

Some types of habitats are more sensitive to the effects of modification than others, and hence avoidance or mitigation of such habitat change can be a form of conservation. For example, the taboo on the collection of *aalam sammo* (described below) in sacred forests; restricted grazing, allowing only milk cows and sacred yaks to graze in some of the sacred pastures, as in Hya-roshe and Putuk-tu *bugyals*, both representing some of the best conserved pastures within the Vyas Valley; and regulated cyclical grazing practices as prevalent in Chipla Kedar and the Ralam Valley are conservation practices inherent in the

FIGURE 1 The sacred *brahmakamal* (*Saussurea obvallata*) is harvested only during the festival of Nanda Astami. (Photo by C. S. Negi)

customary lifestyle of the inhabitants of the Askote Conservation Landscape (ACL). The taboo system surrounding sacred natural sites (sacred forests/groves, pastures, and water bodies) is described in greater detail below.

Sacred natural sites and the taboo system

SNSs are distributed throughout the State of Uttarakhand; the prime examples of sacred forests offered within the State are Bombasing (above the village of Tedang), Bhujani (above the village of Martoli; Figure 2), where sacred forests are referred to as *Se-Rong* (*Se:* god, *rong:* forest), the sacred dedicated forest of Maanthaat, the sacred forest of Madhkeshwar, the sacred forest surrounding the lake of Thamri Kund, and the sacred forest of Hokara Devi (Figure 3). The villagers would not dare to enter these forests for fear of angering the resident deity; nor do they defy the norms for procuring deadwood, fodder grasses, or any produce from the forest, except on the singular occasion of annual festivals. One can easily envision the important role played by these sacred forests in the protection of the village, situated below, from impending avalanches during the winter months, or sliding mountain debris throughout the year, or as the only source of water. It is only during the festival of Aalam Sammo that the villagers venture into these restricted forests, to procure *aalam*, an upright/straight stem of the *bhoj patra* (*Betula utilis*), used as a sacred pole staff.

Characteristic features of the sacred forests: With minor variants, some of the characteristic features of the sacred forests in the landscape are the following:

- Most are Panchayat or civil *soyam* forests.
- They are usually dominated either by *banj* (*Quercus leucotrichophora*, or *Quercus semecarpifolia*), *raga* (*Cupressus*

http://dx.doi.org/10.1659/MRD-JOURNAL-D-09-00040.1

FIGURE 2 Bhujani, the sacred forest located above the village Martoli in Johaar Valley, remains the only refuge for the endangered species of musk deer (*Moschus chrysogaster chrysogaster*). (Photo by C. S. Negi)

torulosa), *deodar* (*Cedrus deodara*), *bhoj patra* (*Betula utilis*), or *ratpa* (*Rhododendron campanulatum*), or at higher altitudes by *bil* (*Juniperus communis*, *Juniperus indica*), which in turn are treated as sacred species.

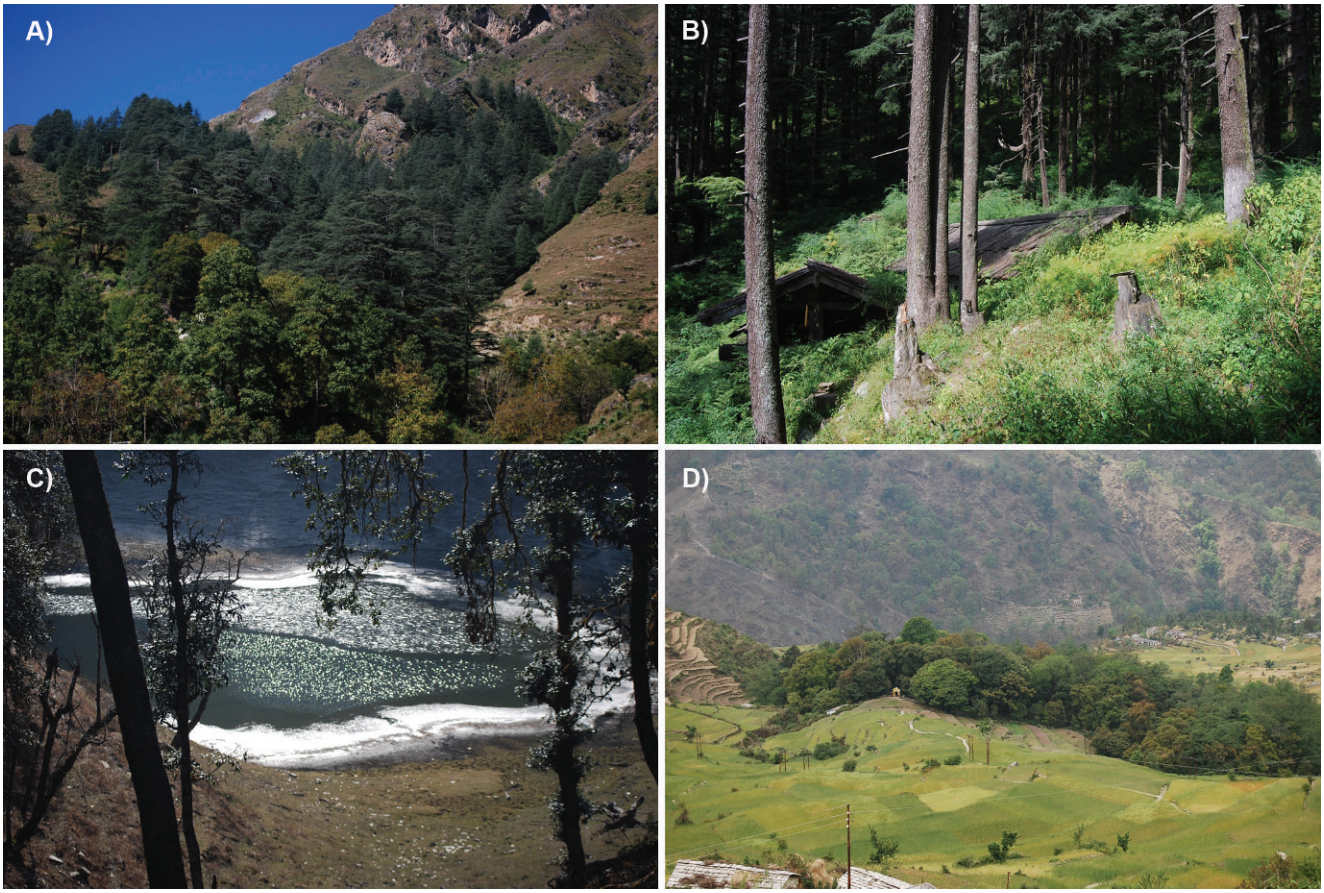
- Lopping and felling of trees is strictly prohibited; however, regulated resource use, that is, collection of deadwood, twigs, and fodder grass, may be allowed at certain times. In rare cases, no resource use is permitted except for the purposes of the resident deity of the forest during specific festivals devoted to the deity.
- The most conspicuous taboo is the segment taboo, which restricts pregnant and menstruating women as well as the lower castes from entering these sacred forests. Since most (if not all) of the tasks related to the harvesting of forest resources is carried out by women alone, the restriction thus imposed plays a significant role in limiting the amount harvested, even if it is valid only for a few days. As for the restriction imposed on the lower castes, it seems more problematical, because these members of the communities are mostly bereft of access to natural resources at large and are tempted to do the most damage, as the resources do not belong to them. However, this taboo has lately shown signs of being weakened.
- Where the sacred forest remains the only source of water, the taboo system in practice is more stringent.

Patch-switching to maximize overall return rates

Pastoralists often move their herds to better grazing areas before the current area is completely depleted, because the likelihood of obtaining higher foraging returns elsewhere seems more economical (Charnov 1976; Winterhalder 1981; Ruttan and Borgerhoff Mulder 1999). This foraging strategy (practiced throughout the ACL) involves the regulation of livestock grazing pressure, wherein the precise movement of the *anwals* (shepherds), accompanied by their livestock population, is strictly monitored, and taxes are duly excised by one of the villagers, who is detailed not just to ascertain the precise size of the livestock but also to ensure that the duration of

http://dx.doi.org/10.1659/MRD-JOURNAL-D-09-00040.1

FIGURE 3 (A) The sacred dedicated forest of Maanthaat; villagers enter the forest only once in a year, during the celebration of the resident deity. (B) The sacred forest of Madhkeshwar; the doors to this site are opened only once in 60–70 years. This is probably the most feared sacred forest in the State of Uttarakhand, as well as the most extensive one. According to those interviewed, even the local deities dare not infringe upon the sacrosanct boundary. (C) The sacred Thamri Kund remains the only water hole in the area for wild animals, and thus if one wished to see animals such as *sambhar* (*Cervus unicolor* Kerr) or *serow* (*Capricornis sumatraensis*), one could easily view them drinking water, as hunting is taboo in this forest. Recently efforts have been made to develop the lake as a tourist spot; what the impact of such a development will be on fauna, flora, and water resources will depend on the measures taken to protect them. (D) The sacred forest of Hokara Devi. (Photos by C. S. Negi)



grazing in one locality (the alpine pasture) is not extended beyond the permissible time.

Dedication of forests to a deity

The practice of dedicating forests to a deity is a very recent phenomenon, invariably born of the need to impede the rapid weakening of the traditional taboo system governing resource utilization, and thus to reinforce or strengthen the same. The deity in virtually all the villages remains the much feared goddess Kotgyari, and the period for which the forests are dedicated varies from a minimum of 5 to 20 years, depending upon the precise state of the forest at the time of dedication.

The sole force driving this phenomenon throughout the region remains the scarce or fast depleting fodder base. It is an effective example of an indigenous conservation practice, utilized by local communities to stop excessive exploitation of community forests and thus to regenerate them to the extent that sustainable means of exploitation of fodder can be put into effect. Strict following of the norms surrounding the dedicated forests is adhered to, principally out of the inborn fear of the wrath of the presiding deity. Invariably, the communities do not tend to dedicate the complete forest, but rather retain a small patch. There are specified norms governing the use and extent of the use to be permitted in the sanctified area, which are primarily "defined to the deity" at the time of the dedication, and enumerated in the affidavit, a legal document. At times of dire need, the community decides to open up the forest, allowing restricted collection of litter mass and even of fodder.

http://dx.doi.org/10.1659/MRD-JOURNAL-D-09-00040.1

Discussion and conclusions

Anthropologists have ascribed various social functions to taboos: They serve to distinguish between sacred and profane entities in a culture (Durkheim 1915), relate to animist and magical belief systems (Frazer 1922), serve psychological ends (Malinowski 1922), and even facilitate ecological adaptations (Rappaport 1968; Harris 1971). In fact, it may be difficult to distinguish among the ecological, social, and religious origins and functions of taboos (Colding and Folke 1997, 2001). Taboos often apply to certain sets of natural resources that are particularly vulnerable to overexploitation, and thus the imposition of temporal taboos regulates access to resources on either a sporadic, weekly, monthly, or even seasonal basis (Colding and Folke 2001).

Social taboos are good examples of informal institutions (North 1994) that are based on cultural norms independent of government for either promulgation or enforcement (Posner and Rasmusen 1999; Singh 2006). These have very often been neglected in conservation designs in biodiversity-rich developing countries (Alcorn 1995; Robbins 1998), where park protection remains the only major approach for protecting biodiversity (Gadgil et al. 1998; McNeely 2003). However, because most of the world's biodiversity exists outside of protected areas (Murphree 1994), informal institutions—such as sacred forests—may play an active role in nature conservation.

The institution of *nabu samo*, the strong sense of faith and reverence for local deities, illustrates not just the significance of ethnosociological concepts vis-à-vis environmental management but, importantly, the scope of their practical application. The institution of sacred natural sites, along with the strict norms and taboos that relate to resource utilization, invariably relates to sustainable resource management practices (Dorm-Adorbu et al 1991; Fargey 1991; Ntiamoa-Baidu 1995; Hagan 1998; Chandran and Hughes 2000). Lately, however, the taboo system has been weakened by Western education and by immigrants who very often have no respect for local traditions, as well as by a lack of modern legislation to reinforce traditional rules (Fargey 1991; Ntiamoa-Baidu 1995; Abayie Boateng 1998). Needless to say, there is an urgent need to set forth specific guidelines to safeguard sacred areas and promote traditional knowledge about conservation. This must involve the revitalization and enforcement of traditional education, delineation of protective boundaries, improvement of relevant ecological knowledge, and official legal recognition of these factors (Dorm-Adzobu and Ampadu-Agyei 1995; Lebbie and Guries 1995; Decher 1997; McWilliam 2001; Swamy et al 2003).

ACKNOWLEDGMENTS

The author gratefully acknowledges financial help received from the Director, Uttarakhand State Council for Science & Technology, Government of Uttarakhand, Dehradun, and the Director, GB Pant Institute of Himalayan Environment & Development, Kosi-Katarmal, Almora. This study, however, would not have been possible without the help of the village residents—the ultimate custodians of biodiversity.

REFERENCES

Abayie Boateng A. 1998. Traditional conservation practices: Ghana's example. *Institute of African Studies Research Review* 14(1):42–51.

Alcorn JB. 1995. Economic botany, conservation, and development: What's the connection? *Annals of the Missouri Botanical Garden* 82:34–46.

Alcorn JB. 1996. Is biodiversity conserved by indigenous peoples? *In:* Jain SK, editor. *Ethnobiology in Human Welfare*. New Delhi, India: Deep, pp 234–238.

Alvard MS. 1998. Evolutionary ecology and resource conservation. *Evolutionary Anthropology* 7:62–74.

Berkes F. 1999. *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. Philadelphia, PA: Francis & Taylor.

Bernbaum E. 2006. Sacred mountains: Themes and teachings. *Mountain Research and Development* 26(4):304–309. doi: 10.1659/0276-4741(2006)26[304:SMTAT]2.0.CO;2

Bodley JH. 1996. *Anthropology and Contemporary Human Problems*. Mountain View, CA: Mayfield.

Callicott JB. 1994. *Earth's Insights: A Multicultural Survey of Ecological Ethics from the Mediterranean Basin to the Australian Outback*. Berkeley, CA: University of California Press.

Chandran MDS, Hughes JD. 2000. Sacred groves and conservation: The comparative history of traditional reserves in the Mediterranean and in South India. *Environment and History* 6:169–186.

Charnov EL. 1976. Optimal foraging, the marginal value theorem. *Theoretical Population Biolology* 9:129–136.

Colding J, Folke C. 1997. The relations among threatened species, their protection, and taboos. *Conservation Ecology* 1(1):6. http://www.ecologyandsociety.org/vol1/iss1/art6/; accessed on 15 July 2010.

Colding J, Folke C. 2001. Social taboos: 'Invisible' systems of local resource management and biological conservation. *Ecological Applications* 11(2):584–600.

Decher J. 1997. Conservation, small mammals, and the future of sacred groves in West Africa. *Biodiversity and Conservation* 6:1007–1026.

Dorm-Adzobu C, Ampadu-Agyei O. 1995. The Malshegu sacred grove, Ghana. *In:* Sigot A, Thrupp LA, Green J, editors. *Towards Common Ground: Gender and Natural Resource Management in Africa*. Nairobi, Kenya: ACTS Press, pp 49–64.

Dorm-Adzorbu C, Ampadu-Agyei O, Veit PG. 1991. *Religious Beliefs and Environmental Protection: The Malshegu Sacred Grove in Northern Ghana*. Washington, DC: World Resources Institute (WRI), and Kenya: Africa Centre for Technology Studies (ACTS) Press.

Duming AT. 1992. *Guardians of the Earth: Indigenous Peoples and the Health of the Earth*. Worldwatch Paper No. 112. Washington, DC: Worldwatch Institute.

Durkheim E. 1915. *The Elementary Forms of the Religious Life*. London, United Kingdom: Allen and Unwin.

Fargey PJ. 1991. *Assessment of the Conservation Status of the Buabeng Fiema Monkey Sanctuary*. Report submitted to the Flora and Fauna Preservation Society. Kumasi, Ghana: University of Science and Technology.

Frazer JG. 1922. *The Golden Bough*. Bungay, United Kingdom: Chaucer Press.

Gadgil M and other colleagues from Srishti Jigyaasa Pariwar. 1998. Conservation: Where are the people? *Hindu Survey of the Environment* 1998: 107–137.

Gadgil M, Berkes F, Folke C. 1993. Indigenous knowledge for biodiversity conservation. *Ambio* 22:151–156.

Hagan GP. 1998. Traditional laws and methods of conservation and sustainable use of biodiversity. *In:* Amlalo DS, Atsiatorme LD, Fiati C, editors. *Proceedings of the Third UNESCO MAB Regional Seminar on Biodiversity Conservation and Sustainable Development in Anglophone Africa (BRAAF), Cape*

Coast, 9–12 March 1997. Accra, Ghana: Environmental Protection Agency (EPA).
Harris M. 1971. *Culture, Man and Nature: An Introduction to General Anthropology*. New York, NY: Thomas Crowell.
Joshi PC. 1992. Afforestation, development and religion: A case from the Himalayas. *In:* Singh SC, editor. *Himalaya: Environment, Economy and People*. New Delhi, India: RK Publications, pp 453–465.
Kumbhojkar MS, Kulkarni DK. 1998. Environmental impacts of sacred groves in Western Ghats of Maharastra. *Science and Culture* 64:205–207.
Lebbie AR, Guries RP. 1995. Ethno botanical value and conservation of sacred groves of the Kpaa Mende in Sierra Leone. *Economic Botany* 49:297–308.
Malhotra KC, ***Mark P***, ***editors***. 1989. *Forest Regeneration Through Community Protection: The West Bengal Experience*. Proceedings of the Working Group Meeting on Forest Protection Committees, Calcutta, 21–22 June 1989. Calcutta, India: West Bengal Forest Department.
Malinowski B. 1922. *Agronauts of the Western Pacific: An Account of Native Enterprise and Adventure in the Archipelagoes of Melanesian New Guinea*. London, United Kingdom: Routledge and Kegan Paul.
Martinez D. 1996. First people, firsthand knowledge. *Sierra* 81(6):50–51.
McNeely JA. 2003. Biological and cultural diversity: The double helix of sustainable development. *In:* Arnason JT, Catling PM, Small E, Dang PT, editors. *Biodiversity & Health: Focusing Research to Policy*. Proceedings of the International Symposium, 25–28 October 2003. Ottawa, Canada: National Research Council, pp 3–9.
McWilliam A. 2001. Prospects for the sacred grove: Valuing lulic forests on Timor. *Asia Pacific Journal of Anthropology* 2:89–113.
Murphree MW. 1994. The role of institutions in community-based conservation. *In:* Western D, Wright RM, Strum SC, editors. *Natural Connections: Perspectives in Community-Based Conservation*. Washington DC: Island Press, pp 403–427.
Negi CS. 2003. Role of traditional knowledge and beliefs in conservation: Case studies from Central Himalaya, India. *Man in India* 83(3 & 4):371–391.
Negi CS. 2005. Religion and biodiversity conservation: Not a mere analogy. *International Journal of Biodiversity Science and Management* 1(2):85–96.
North DC. 1994. Economic performance through time. *American Economic Review* 84 (3):359–368.
Ntiamoa-Baidu Y. 1995. *Indigenous vs. Introduced Biodiversity Conservation Strategies: The Case of Protected Area Systems in Ghana,* African Biodiversity Series Number 1, May 1995. Washington, DC: Biodiversity Support Program.
Posner RA, Rasmusen EB. 1999. Creating and enforcing norms, with special reference to sanctions. *International Review of Law and Economics* 19:369–382.
Rappaport RA. 1968. *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People*. New Haven, CT: Yale University Press.
Rist S, Delgado F, Wiesmann U. 2003. The role of social learning processes in the emergence and development of Aymara land use systems. *Mountain Research and Development* 23(3):263–270. doi: 10.1659/0276-4741(2003)023[0263:TROSLP]2.0.CO;2
Robbins P. 1998. Nomadization in Rajasthan, India: Migration, institutions, and economy. *Human Ecology* 26:87–112.
Ruttan LM, Borgerhoff Mulder M. 1999. Are East African pastoralists truly conservationists? *Current Anthropology* 40:621–652.
Sinclair FL, Walker DH. 1999. A utilitarian approach to the incorporation of local knowledge in agroforestry research and extension. *In:* Buck LE, Lassoie JP, Fernandes ECM, editors. *Agroforestry in Sustainable Agricultural Systems*. Boca Raton, FL: CRC Press, pp 245–275.
Singh C. 2006. Long-term dynamics of geography, religion, and politics: A case study of Kumharsain in the Himachal Himalaya. *Mountain Research and Development* 26(4):328–335. doi: 10.1659/0276-4741(2006)26[328:LDOGRA]2.0.CO;2
Smith EA, Wishnie M. 2000. Conservation and subsistence in small-scale societies. *Annual Review of Anthropology* 29:493–524.
Swamy PS, Kumar M, Sundarapandian SM. 2003. Spirituality and ecology of sacred groves in Tamil Nadu, India. *Unasylva* 54:53–58.
Vecsey C. 1980. American Indian environmental religions. *In:* Vecsey CT, Venables RW, editors. *American Indian Environments: Ecological Issues in Native American History*. Syracuse, NY: Syracuse University Press, pp 1–37.
Walker DH, Sinclair FL, Joshi L, Ambrose B. 1997. Prospects for the use of corporate knowledge bases in the generation, management and communication of knowledge at a front-line agricultural research centre. *Agricultural Systems* 54(3):291–312.
Winterhalder BP. 1981. Foraging strategies in the boreal environment: An analysis of Cree hunting and gathering. *In:* Winterhalder BP, Smith E, editors. *Hunter-Gatherer Foraging Strategies*. Chicago, IL: University of Chicago Press, pp 66–98.

http://dx.doi.org/10.1659/MRD-JOURNAL-D-09-00040.1