

Indigenous Knowledge Systems and Sustainable Management of Natural Resources in a High Altitude Society in Kumaun Himalaya, India

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ABSTRACT Considerable effort has been made to study the resource use patterns of indigenous people with a view to understanding the traditional knowledge base of different ecosystems. This study has tried to explore the linkages between the subsistence economy and utilization and conservation of natural resources in the transhumant Bhotiya society of central Himalaya. These people are also aware that the biological diversity is a crucial factor in generating the natural resources on which they depend for their survival. Hence, they have domesticated a number of wild plants and crops, and have devised their own mechanisms for indigenous cattle production. These practices of conservation of their natural resources, has ensured their survival in extreme inhospitable environmental conditions of high altitudes. But, now their indigenous knowledge and practices are on the verge of extinction, due to the integration of their society with the main stream of other societies and market economy.

INTRODUCTION

One of the most critical issues on the national and global agenda is the need to preserve biodiversity for future generations while trying to understand and document the indigenous knowledge of resource management practices. So far, this challenge, has been partially addressed by the national and global agencies, who have restricted themselves to preserve biodiversity as outlined by the World Commission on Environment and Development (1987), which led to calls for 'sustainable development'. As a result, the model of 'development' which was foisted upon the 'Third World' for the last fifty years, a strong argument has been made that development dictated from outside rather anchored in the knowledge base of the target population is in principle modernization disguised and not fully concerned with the local needs (Foucault, 1988; Nyerere, 1990; and Gegeo, 1998). This is evidenced by the continuing marginalization of already marginalized populations in Latin America and elsewhere (Grugel, 1995; Afshar, 1996) at global level, and similarly, marginalization of the tribals, pastoralists and marginal farmers in India at national level (Agarwal and Narain, 1985; Shiva, 1991; Rahul, 1997; Farooquee and Nautiyal, 1999). Only recently it has been realised by the scholars and researchers that

indigenous knowledge systems should constitute the core of development models in the third world (Long and Long, 1992; Hobart, 1993; Dudley, 1993; Brush and Stabinsky, 1996). Because indigenous knowledge has permitted its holders to exist in 'harmony' with nature, allowing them to use it sustainably, it is seen as especially pivotal in discussions of sustainable resource use (Compton, 1989; Flora and Flora, 1989; Ghai and Vivian, 1992; Moock, 1992; Sen, 1992; Inglis, 1993).

Indigenous knowledge and resource use practice has been defined as a cumulative body of knowledge and beliefs handed down through generations by cultural transmission about the relationship of living beings, (including human) with one another and with their environment (Gadgil et al, 1993). Indigenous knowledge is local knowledge unique to a given culture or society, it contrasts with the international knowledge system generated by universities, research institutions and private firms. It is regarded as the basis for local -level decision making in agriculture, pastoralism, food preparation, health care, natural resource management, and a host of other activities in rural communities staying very close to the nature. It mostly highlights the knowledge possessed by the poor and marginalized population, and emphasises on empowering people like farmers

to have greater control over their own destinies. The primary dimension of difference and uniqueness, according to Warren (1991), seems to lie in an organic relationship between the local community and its knowledge. Indigenous knowledge, therefore, is of crucial significance if one wishes to introduce a cost-effective, participatory and sustainable development process (Warren, 1991).

This paper tries to establish the significance of indigenous knowledge from conservation and sustainable development perspective, and tries to examine how the subsistence economy of transhumant people of central Himalaya have utilised and conserved their natural resources. How they have created management system that has more just socio-economic implications, and have addressed the question of equity in utilizing the available diversified plant and animal resources of the region, and have conserved them from their eradication by domestication to many of them. In the beginning, this paper highlights the diversified resource use practice of the community, and then enlists important domesticated plant and animal resources in their region, and later it analyses the various conservation strategies adopted, and issues relating to the question of sustainability.

STUDY AREA

The Indian Himalaya extends about 2500 km in length and 250 km in width covering an area of about 590 thousand km² where 51 million people live, and there is great ecosystem diversity and landscape variability. Although the region corresponds to only 18% of the geographical area of India, it is home to more than 50% of the country's forest cover and some 40% of the species endemic to the Indian subcontinent. There are dry deciduous and rain forests, sub-tropical forests, temperate conifer forests and alpine meadows, where a whole range of medicinal plants are found. Inaccessibility, due to difficult terrain, has made the high altitudes out of bounds for the majority of human beings. The geographical isolation of the studied region has preserved the cultural traditions of the people; as a result, the inter-linked production subsystems for agriculture, animal husbandry and forest products have remained intact. Environmental, biological, socio-cultural and economic factors prevailing in the Himalaya have resulted in the

evolution of diverse agro-ecosystems. The traditional agro-ecosystems of the Himalaya involve complex and varied inter-linkages. The basic aim of optimising productivity in the long run rather than maximising productivity in the short term is central and confers viability and sustainability on traditional systems (Palni, 1996).

The study was carried out in the central Himalayan Darma and Byans valleys of Dharchula block in Pithoragarh district (29°31'–30°2' N and 80°40'–81° E) in the hilly areas of Uttar Pradesh bordering India, Nepal and China. The block lies within the higher mountain zone (up to 7800 m altitude) with deep gorges and steep hill-sides. There are nineteen migratory villages in the region, whose inhabitants migrate to summer settlements (up to 4100 m) during the month of May and return to winter settlements (about 1200 m) during the month of October. The entire region is inhabited by the Bhotiyas, an ethnic community of Mongoloid origin, who were traditional trans-border traders, and traded between India and erstwhile Tibet now China and Nepal till trans-border was terminated in 1962 due to Sino-Indian conflict. Later, they adapted themselves to a mixed range of agriculture, pastoralism and trade in minor forest products.

The extreme ecological conditions of high altitude have shaped a life-style characterized by periodic movement between two settlements, one of which is in the valley where people reside in winter due to heavy snowfall on higher reaches, where they stay during summer. The production systems in this society, has been increasingly agropastoral rather than strictly agriculture or livestock based. Livestock and animal husbandry have made these people more dependent on their immediate environment, and accordingly they have diversified their resource use practice (Farooquee and Saxena, 1994). Due to their seasonal movements between their summer settlement in the higher altitudes (around timber line; 3000–4000 m) and winter settlement in the river valleys (1200–1600 m) they are well informed and in touch with different floristic compositions and a wide range of natural resources. The meagre availability of plant resources above timber line zone and the fragility of high altitude resource base has conditioned the life style and resource use practice of these people. The fragility of high altitude is best exemplified by the availability of few rare endemic, and aromatic medicinal herbs (Dhar

and Samant, 1993; Samant, 1994; Dhar et al, 1996). As a result, these people are compelled to utilise every available resource for their diversified needs, and conserve them from their depletion for future whether domesticated or in wild.

Subsistence Economy, Diversified Resource Use and Indigenous Knowledge

Due to the precariousness of agricultural practice and the low agricultural yield characteristic of the high altitude, has entailed the distribution of production risks between subsistence techniques like agriculture, pastoralism, animal husbandry and trade in medicinal plants. The word subsistence economy it self explains, the impoverished nature of their economy, which is based on consistent income from sources such as agriculture, woollen products from livestock and sale of medicinal herbs. Income from agriculture accounted for 32-36 % of their total earning, woollen products 18-24 %, sale of livestock 28-38 %, and sale of medicinal plants 12-13 % of their total earnings from all sources (Farooquee and Saxena, 1996). As a matter of fact, these people have evolved the utility of various resources, based on its availability, suitability, longevity and eco-feasibility. Some of the major species of plants used by these communities for their varied requirements in both the settlements have been classified under different categories (Table 1). The variability in terms of utilization of fuel wood and fodder in their two settlements, based on their availability and altitudinal distribution is given in (Table 2). These people have good knowledge about the

properties of various plants spread over an altitudinal gradient of 1200 m to 4500 m amsl, and are known to derive their food requirements from a number of undomesticated plants (Table 3).

The Bhotiyas have identified a number of plants found and grown in the high altitudes for their various kind needs, some of the popular plants of their utility ranging from the wild and non domesticated to a number of domesticated plants, mostly for the food requirements have been presented in (Table 4). It is interesting to note that their staple diet consists of a mixture of food grains grown at both the elevations. Crops like ogal (*Fagopyrum esculentum*), phaphar (*Fagopyrum tataricum*), chuwa (*Amaranthus paniculatus*), and barley (*Hordium vulgare*) are mostly grown on the higher elevation, and are consumed by them when they are in their summer settlements. They also consume rice (*Oryza sativa*), wheat (*Triticum aetivum*), madua (*Eleusine coracana*) and maize (*Zea mays*). A number of local legumes like gahat (*Dolichos ceniflorus*), bhatt (*Glycine maz*), bean (*Phaseolus vulgaris*), rajma (*Vigna sinensis*) and vegetables are common to their diet.

The availability of medicinal plants, as part of the surrounding natural vegetation, and the knowledge of these plants acquired traditionally helped these people to collect, process and trade in them. They obtained a substantial part of their income from sale of medicinal plants and traditional medical treatment. The local knowledge of medicinal herbs in this society has developed over a long period of time, and they were exposed to a wide variety of plants and herbs because of there frequent movement between their summer

Table 1: Some major uses of plants other than food, fuel and fodder

Uses	Plants
Timber (house construction)	Raga (<i>Abies pindrow</i>)Bhooj (<i>Betula utilis</i>)Deodar (<i>Cedrus deodara</i>)Surai (<i>Cupressus torulosa</i>)
Timber (wood carving)	Walnut (<i>Juglans regia</i>)
Agricultural implements	Gray (<i>Carpinus viminea</i>)Okhar (<i>Juglans regia</i>)Banj (<i>Quercus spp.</i>)
Baskets and mats	Ringal (<i>Arundinaria falcata</i>)
Wooden Pot (Jokhal)	Lawaint (<i>Taxus baccata subsp. wallichiana</i>)
Ropes	Jyorjari (<i>Daphne papyracea</i>)Jyor-jhar (<i>Wikstroemia canescens</i>)Bhimal (<i>Grewia oppositifolia</i>)
Sweaping (broom)	Babyo (<i>Eulaliopsis binata</i>)Baikal (<i>Sarcococca hookeriana</i>)
Colouring agent (dye)	Kaphal (<i>Myrica esculenta</i>)Banj (<i>Quercus leucotrichophora</i>)Kilmora (<i>Berberis aristata</i>)Shiyama (<i>Rumex nepalensis</i>)
Thatching of huts	Bans (<i>Bambusa spp.</i>)
Tent poles	Kanta-bans (<i>Dendrocalamus spp.</i>)
Insecticide	Toon (<i>Toona ciliata</i>)
Incense	Chhichi (<i>Juniperus communis</i>)Masee (<i>Nardostachys grandiflora</i>)Gogal (<i>Pleurospermum angelicoides</i>)Shamioh (<i>Valeriana wallichii</i>)

Table 2: Plants used for fodder and fuelwood

Botanical name	Local name	Altitude (m.)
	Fodder trees	
<i>Arundinaria falcate</i>	Ringal	1800-2500
<i>Betula utilis</i>	Bhojpatra	3000-3800
<i>Quercus floribunda</i>	Telunj	2200-2700
<i>Quercus leucotrichophora</i>	Banj	1700-2000
<i>Quercus semecarpifolia</i>	Kharsu	2500-3500
<i>Grewia oppositifolia</i>	Bhimal	upto 1800
<i>Albizia lebbek</i>	Siris	500- 1600
<i>Bauhinia variegata</i>	Kweral	upto 1400
<i>Salix elegans</i>	Bhoksya	2500-3200
<i>Cotoneaster affinis</i>	Ruins	2200-3000
<i>Prinsepia utilis</i>	Bhenkula	upto 2400
<i>Alnus nepalensis</i>	Utis	upto 2500
Fuelwood		
<i>Quercus floribunda</i>	Telunj	2200-2700
<i>Quercus leucotrichophora</i>	Banj	1700-2000
<i>Quercus semecarpifolia</i>	Kharsu	2500-3500
<i>Rhododendron spp.</i>	Burans	1600-3200
<i>Alnus nepalensis</i>	Utis	upto 2500
<i>Cotoneaster spp.</i>	Ruins	1800-2200
<i>Berberis spp.</i>	Kilmora	upto 2600
<i>Pinus sp.</i>	Chir	1000-2000
<i>Betula utilis</i>	Bhojpatra	3000-3800
<i>Juniperus spp.</i>	Chhichi	3500-4500
<i>Tsuga dumosa</i>	Tansen	2000-3200
<i>Rosa macrophylla</i>	Sedum	3000-4500

Table 3: Various food requirements from wild plants

Botanical name	Local name	Utility
<i>Pleurospermum angelicoides</i>	Choru	Condiment
<i>Carum carvi</i>	Thoya	Condiment
<i>Allium humile</i>	Pharan	Condiment
<i>Angelica glauca</i>	Chhipi	Condiment
<i>Gaultheria nummularioides</i>	Bantimla	Fruit
<i>Grewia oppositifolia</i>	Bhimal	Fruit
<i>Rosa macrophylla</i>	Sedum	Fruit
<i>Viburnum cotinifolium</i>	Ghenu	Fruit
<i>Fagopyrum cymosum</i>	Jhangar	Vegetable
<i>Megacarpaea polyandra</i>	Rukee	Vegetable
<i>Allium stracheyi</i>	Jambu	Vegetable
<i>Chenopodium botrys</i>	Bathuwa	Vegetable
<i>Smilacina purpurea</i>	Puran	Vegetable
<i>Paeonia emodi</i>	Chamla	Vegetable
<i>Diplazium esculentum</i>	Ligura	Vegetable
<i>Phytolacca acinosa</i>	Jagra	Vegetable
<i>Prinsepia utilis</i>	Jhatalu	Oilseed
<i>Prunus armeniaca</i>	Chulu	Oilseed
<i>Prunus persica</i>	Aru	Oilseed

and winter settlements stretched sometimes over 100 kms. People residing in the remote and inaccessible high altitudes of Himalaya were not exposed to any other form of medical treatment until 1960, and hence, depended totally upon traditional forms of treatment. The sedentary Himalayan societies in general had less exposure

Table 4: Lesser known and other domesticated plants of high altitude

Botanical name	Local name	Utility
<i>Amaranthus paniculatus</i>	Chuwa	Cereal
<i>Fagopyrum esculentum</i>	Ogal	Cereal
<i>Fagopyrum tataricum</i>	Phaphar	Cereal
<i>Hordeum himalayens</i>	Uwa	Cereal
<i>Panicum miliaceum</i>	Chenna	Cereal
<i>Triticum aestivum</i>	Nappal	Cereal
<i>Eleusine coracana</i>	Mandua	Cereal
<i>Zea mays</i>	Makka	Cereal
<i>Phaseolus vulgaris</i>	Rajma	Pulses
<i>Macrotyloma uniflorum</i>	Gahat	Pulses
<i>Glycine max</i>	Bhatt	Pulses
<i>Pisum sativum</i>	Matar	Pulses
<i>Brassica campestris</i>	Sarso	oilseed
<i>Solanum tuberosum</i>	Aloo	Vegetable
<i>Chenopodium album</i>	Bathuwa	Vegetable
<i>Rhaphanus sativus</i>	Mula	Vegetable
<i>Vicia faba</i>	Bakla	Vegetable

to medicinal plants, and depended more on the Bhotiya system of traditional treatment. The indigenous Bhotiya treatment mainly focused on ailments like gastric problems, digestive system, dysentery and diarrhoea, liver malfunctioning, kidney stone, fever, blood purifier, common cold and cough, skin diseases and for vigour and vitality of the body (Table 5).

Due to their periodic movement between their summer and winter settlement, they required a livestock which could adapt itself in both the conditions (high altitudes and lower valleys), could be used as pack animals, and which could be immune to lowland cattle diseases. As a result, have developed their own indigenous breed of cattle through breeding of Yak and local cow. The new offspring locally called as Jhupu, Jumo, Garu, Garmo, Talbu, and Talbuni has the required characteristics to adjust in extreme cold conditions of high altitude, and could also tolerate the warm conditions of lower altitudes (Farooquee and Saxena, 1994). The level to which these people have perfected their sense of livestock husbandry is remarkable (Table 6). Due to the fragility of the resource base, and the subsistence nature of their economy have resulted in the diversified use of domesticated livestock and animal husbandry (Table 7). These indigenous breed of Jhupu, Jumo, Garu, Garmo, Talbu and Talbuni (*Bos indicus*) can be classified into four sub types based on their utility, i.e., dairy breeds, dual purpose breeds (used for draught with medium milk yield), draught cattle, and pack animals.

Table 5: Traditional Bhotiya knowledge and utilization of medicinal herbs

<i>Ailment/Purpose</i>	<i>Name of the Herb</i>	<i>Useful Part</i>	<i>Processing</i>
Antiseptic application	Dolu (<i>Rheum australe</i>)	Root	— Boiled in water- Grinded before
Antibiotic wounds	Pangar (<i>Aesculus indica</i>)	Seed	- Used as antibiotic on external
Appetiser soup	Jambu (<i>Allium sp.</i>)	Full plant except root	- Sun dried- Used as condiments in
Arthritis its consumption	Jatamanshi (<i>Nardostachys grandiflora</i>)	Flower	- Sun dried- Boiled in water before
Asthma	Dhatra kala (<i>Datura-alba metal</i>)	Seed	- Sun dried-Its smoke used for
Asthma patients	Majethi or Majistha (<i>Rubia cordifolia</i>)	Root	- Air dried
Blood purifier	Kins or Kinjadi (<i>Dioscorea deltoidea</i>)	Root	- Air dried- Boiled in milk before
Constipation its consumption	Vantulsi (<i>Origanum vulgare</i>)	Leaves Seed	- Air dried
Cough and cold	Hansraj (<i>Adiantum venustum</i>)	Full plant except root	- Sun dried
Diarrhoea	Goochi (<i>Morchella esculenta</i>)	Fruiting body	- Air dried
Digestive system	Gurjar Gudchi (<i>Tinospora cordifolia</i>)	Stem	- Sun dried- Boiled in water before
Fever grinding	Satuwa (<i>Paris polyphylla</i>)	Root	- Sun dried
Gastric	Samewa Sugandh (<i>Valeriana wallichii</i>)	Full plant	- Air dried
Insect repellent	Mamira (<i>Thalictrum sp.</i>)	Root	- Air dried
Jaundice	Paashan Bhed (<i>Bergenia ligulata</i>)	Root	- Sun dried
Kidney stone	Chirayata (<i>Swertia chirata</i>)	Full plant	- Air dried
Leukoderma	Mamira (<i>Thalictrum sp.</i>)	Root	- Air dried
Liver disorder	Kutki (<i>Picrorhiza kurrooa</i>)	Root	- Sun dried
Malaria	Dhavephul (<i>Woodfordia fruticosa</i>)	Flower	- Sun dried
Piles	Dolu (<i>Rheum australe</i>)	Root	- Boiled in water- Grinded before
Skin diseases application	Gurbach or Gurbaj (<i>Acorus calamus</i>)	Root	- Sun dried
Sprain	Solam Mishri (<i>Eulophia compestris</i>)	Root	- Sun dried
Urinary tract infection	Salampanja (<i>Dactylorhiza hatagirea</i>)	Root	- Boiled with salt — Grinded before
Vigour & Vitality use	Kalihari (<i>Gloriosa superba</i>)	Root	- Sun dried
Wound			

Table 6: Achievements in breeding Cow (*Bos indicus*) with Yak (*Bos grunniens*)

<i>Male</i>	<i>Female</i>	<i>Offspring Female</i>	<i>Offspring Male</i>
Yak	Cow	Jumo	Jhupu (Sterile)
Yak	Jumo	Garmo	Garu (Sterile)
Yak	Garmo	Yak	Yak
Local bull	Yak cow	Dumjo	Dumju
Local bull	Jumo	Talbuni	Talbu
Local bull	Garmo	Talbuni	Talbu
Yak	Talbuni	Garjo	Garju

Traditional Institutions, Knowledge and Sustainability

One of the important features of this community is the functioning of a number of social groups to make certain decisions regarding sharing and utilization of their natural resources. The Bhotiya society did understand the manifestations of their natural resource system in terms of the myriad opportunities and constraints for the community's survival. Their community organizations such as the village council (*gram*

panchayat), forest council (*van panchayat*) water council (*pani panchayat*), youth forum (*yuva dal*) and women organization (*mahila mangal dal*) have evolved norms and practices to regulate individual and collective behaviour (vis-à-vis nature). These traditional institutions take decisions regarding the regulation of resource sharing and utilization and maintenance of their resources, like the forest, grazing land and water springs. Similarly, they also take decisions regarding the collective labour required for the protection and conservation of these

Table 7: Domestication of diversified livestock and animal husbandry

<i>Name</i>	<i>Breed/Variety</i>	<i>Purpose</i>
Yak (<i>Bos grunniens</i>)	Tibetan	Breeding
Cow (<i>Bos indicus</i>)	Local	Milk, Procreation
Ox (<i>Bos indicus</i>)	Local	Draught animal
Jhupu (Sterile)	Cross breed of Yak and local cow	Draught and Pack animal
Jumo (Fertile)	Cross breed of Yak and local cow	Milk
Garu (Sterile)	Cross breed of Yak and Jumo	Draught and Pack animal
Garmo (Fertile)	Cross breed of Yak and Jumo	Milk
Talbu	Cross breed of Yak cow and local bull	Draught and Pack animal
Talbuni	Cross breed of Yak cow and local bull	Milk
Sheep (<i>Ovis aries</i>)	Local	Wool, Meat and Pack animal
Goat (<i>Capra hirtus</i>)	Local	Wool, Meat and Pack animal
Tibetan Sheep	Tibetan	Procreation, Wool and Meat
Tibetan Goat	Tibetan	Procreation, Wool and Meat
Horse	Local	Transportation and Pack animal
Mule	Local	Transportation and Pack animal
Dog	Tibetan	Watch and Guard
Cat	Local	To check Rhodents
Hen	Local	Eggs and Meat

resources. These traditional institutions, created traditionally by the community are still functional to a great extent, and are respected by the community, their decisions are regarded and obeyed, and has social binding. The evolution of such institutions in this society is an indication of their traditional vision, to respond appropriately to their biophysical circumstances. These traditional understandings of their biophysical environment has helped in adapting community needs to resources rather than over extracting to meet unrestrained demands. Thus, in the past, the community could strike a balance between their ecosystem and social systems.

The traditional institutions of the Bhotiya community have build up their practices based on close proximity and functional knowledge of resource use, and hence, have a strong sense of conservation ingrained in their traditions. The general attitude of these people towards their ecosystems is quite respectful; their sense of belongingness to their natural ecosystem is also reflected by their behaviour. The Bhotiya society remained largely isolated from the mainstream market forces due to their remoteness and inaccessibility, and hence, depended totally on their local resource base for its food and health. As a result of this, the social survival, welfare strategies were totally focused on their local, diverse and fragile resource base. Hence, there emerged a system, which individually or jointly strengthened the ecosystem-social system links

and contributed to the natural resource-friendly management systems. This contributed to the high collective stake in protection and regeneration of local natural resources. The closer proximity of this society to their resource base, contributed to the better understanding of the limitations and potential of their resources. However, the local control over the local resources and the greater autonomy, due to absence of external impositions led to the adoption of social responses tuned to minimise the pressure on resources through social and institutional sanctions.

The most important and popular conservation strategy being the praying and tying up of white and red pieces of cloth on few medium size plants and bushes, usually on the roadsides and other such common places more susceptible to destruction by humans and which are non palatable. Those plants and trees which are worshiped, and have pieces of cloth tied on them are not cut by the community for any other purpose. As a result, they have preserved a number of species of different plants and trees at different locations in and around their villages. Similarly, few trees due to their landmark locations, and which also provides shelter to a large number of birds, insects, bats and primates are also assigned religious sanctity for their conservation irrespective of species, like the trees of all species of genus *Ficus* are protected in many parts of the world (Gadgil and Guha, 1992). These conservation techniques are

utilised to save trees, which becomes quite rare especially in the villages around the timber-line. Such plants and bushes are neither harvested nor cut for any purpose, on their path and way to their grazing lands, way to another village a number of such bushes and trees can be seen on the path side.

Construction of small temples and worship places, near the big and old trees of Surain (*Abies pindrow*) which is considered to be sacred is a very common practice, plants/bushes around such sacred places are neither cut nor grazed by anyone, like the sacred groves in north east India especially in Mizoram (Malhotra, 1990), and the natural resources within the boundary of a temple were assigned to a deity in Kumaun region (Sharma et al., 1999). Similarly, each Bhotiya village has a common village deity called as “Narsingh” also referred as “*gram devta*”, for whom, a large patch of forest consisting of around 30-60 trees are assigned. Besides village deity, each family has its own deity for whom few trees are also assigned, these trees are neither cut, nor their products are brought to any commercial use. In fact, most of these villages have such identified patches of forests, trees and rocks, which is respected and considered out of bound for general purposes. Periodically, certain religious functions and worships are conducted at such places, with full participation of the entire village. There are special deity for alpine regions, called as “*Shidua and Biduwa*”, who are worshiped by the pastoral grazers during their visit to alpine regions. Although, the conservation of plant species are known through the linkages of plant resources with the local deity is quite common (Gadgil, 1991; Gadgil and Berkes, 1991), the Bhotiyas are also known to have a festival, when the birds and crows are fed with the cooked preparation of their harvested crops. Traditionally, hunting of birds were not done in this community, as they were regarded as indicators of different seasons, and their movements were associated with the arrival of wind, rain, sunshine and snow. But, now under the influences of outside community, and for the requirement of money, poaching of birds and animals has become a threat to its rich biodiversity. Thus, by looking closely at the traditional practices and systems regarding natural ecosystem, one can identify the circumstances and processes, which had contributed to the positive ecosystem-social system links.

End of Community Control and Traditional Resource Use

The total dependence of the Bhotiyas for sustenance on local resources was the main incentive behind the regulated use of their natural resources, clubbed with the inaccessibility of the region. The uniqueness of this traditional society was the community control over production and conservation measures to the rationing of demand, as well as adherence to the social sanctions. All decisions regarding utilization of natural resources was done by the traditional village council, they decided the dates for grazing in a particular meadow along with the number of livestock to be grazed. On the basis of the decided numbers, the villagers prioritised their livestock for grazing into different grazing lands. Similarly, the village council also fixed the norms and responsibilities for the maintenance and repair of its boundary walls and channels for the proper flow of water from the community forests, grazing lands, water springs and barren lands. Yet an equally important role in this context was played by site and season specific functional knowledge of the resources, like the utilization of alpine meadows, forests and mountains of high altitudes, which remains under snow for six to eight months. The village level traditional institutions did provide enough freedom to the villagers on the use of such resource base, but they monitored the action and impact of resource utilization from a distance, and advised the individuals on various accounts. The people accordingly adjusted their requirements in terms of animal grazing intensity, seasonal collection and use of food, fuel and fodder to the availability and potential of the resource base.

Construction of roads in the Himalayan region began after 1962, and slowly integrated the Himalayan societies with the mainstream society, and this led to the beginning of transformation of traditional agrarian societies. Later, the border communities located in the remote inaccessible areas were also brought under the control of government machineries, and the authority of the state, executed through different agencies, was extended to such remote areas also. Slowly the government agencies exercised its authority and brought such societies under the complete control including the resources and mandates that traditionally

belonged to the people. In the name of development, welfare and political integration, the Bhotiyas were given the status of scheduled tribe in 1967, and reservation in government jobs for the people. This led to the beginning of transformation of traditional Bhotiya trans-humant society from agro-pastoral economy to service sector. As a result, there began migration of these people to other urban areas for employment, and the lure and glamour of urban life particularly attracted the younger generation. With this process, both formal and informal control of the communities over local resources weakened, and similarly the traditional resource management arrangements and role of traditional village level institutions also got disrupted.

Although the Bhotiyas continue the indigenous mode of production-subsistence agriculture supplemented by pastoralism and internal trade in minor forest products. There is a growing concern among these people that their lives are increasingly dependent on market forces and global mode of production, i.e., growing dependence on the purchase of food grains imported from other regions, and on the supply of a number of items including spices, condiments, cooking oil, clothing and medicines, rather than on their own skills to provide for themselves. In their view, the most critical change brought by education, employment and out migration was that their lives have become more depended on the market forces, on which they have no control. However, they do understand the implications of change from traditional community based resource utilization to individual money oriented economy. The recent developments have brought their traditional mode of production in serious danger of being displaced and replaced by money - oriented economy. Earlier, money was not required in their traditional mode of production and resource utilization, barter exchange of goods and services was more common and prevalent in their society. Now, the community has literary no control over the individual's life, as they are more depended on market forces rather than community resources.

Beginning of Economic and Social Homogenization

One of the important impacts of the

developmental initiatives in this region has been the collapse of traditional self - sufficient economy and making them dependent on the supply of market resources. The original subsistence livelihood of the highland peoples was composed of a wide range of diverse activities, if any one of these was to fail in any given year this was not of particular concern, since others also contributed to sustenance. Although natural resources were scarce and hard to obtain, the Bhotiyas had a remarkably good life with beautiful art, architecture and jewellery. Life moved at a gentle pace and people enjoyed a degree of leisure, the element of satisfaction was so much, that no one accumulated more than the required resources. But, the developmental initiatives have led to the homogenisation of their economic sphere, cultural matrix and environmental concern, resulting into loss of their indigenous knowledge systems, collapse of collective concern for their natural resources and transformation of subsistence economy to cash oriented economy. The transformation of the previously heterogeneous economic, cultural and environmental contexts of this highland society into a more homogeneous entities have increased the competition within the society over the access to only few types of resources, thereby increasing pressure on the resource base on the one hand and collapse of the traditional arrangements of resource sharing and sustainable utilization.

In the central Himalayan region, over 40 crop species and numerous land races selected by the farmers comprising of cereals, millets, pseudo-cereals, pulses, oilseed, tubers, bulbs, and medicinal herbs are cultivated across an altitude gradient. This huge diversity has been maintained through a variety of crop compositions, cropping patterns and crop rotations (Maikhuri et al., 1996; Palni et al., 1998). Unfortunately the area under cultivation of these traditional crops has declined precariously in many parts of the Himalaya. For example, in Garhwal Himalaya, the area supporting a variety of traditional crops has declined by 72-95% (Maikhuri et al., 1996). These crops have mostly been replaced by high yielding varieties and cash crops like potato, soyabean, kidney bean, pigeon pea and amaranth. Due to lack of appropriate policies and specific programmes to encourage conservation of agrobiodiversity, especially in rainfed mountain areas, there is threat to genetic erosion of crop diversity in the Himalayan region

(Palni et al., 1998).

A similar trend of loss of crop diversity is also prevalent in this region of high altitudes, this is well reflected from the meagre availability of local food crops, vegetables, fruits and their traditional products in the village shops and local markets of this region. For instance, at Dharchula, which is the biggest market of these people, where, till few years back, all kinds of local crops, grains, condiments, spices, vegetables, fruits, dried vegetables, herbs and beverages were available during different seasons. All of that diversity originated at no great distance, and most of it came from the immediate surroundings of Darma and Byans valleys. Today it can be difficult to find onion in Dharchula that has not travelled from Tanakpur and Haldwani (markets for the mountainous region of Kumaun). The diversity of Bhotiya foods is in decline, and those that are available are becoming more and more costly. In the village shops of Darma and Byans valleys in 1980s, almost all the food in the shops came from the villages themselves or the immediate region. In sum, there has been a transformation from a highly diverse agroecosystem focused on subsistence to a much more uniform one, focused largely on cash cropping. Such a narrow system is inherently less stable than the one it replaced.

These changes have resulted partly from the decisions, which the economic actors have chosen freely in the near past, and partly due to the absence of government mechanism to either regulate, or monitor such forces of market, trade and supply. Unfortunately, they are often discovered when it becomes too late, and when their negative impacts start to appear distinctly, as it happened in the case of this region. Although, cultural and religious traditions do resist the abandonment of traditional institutions and knowledge, but, they too become ineffective beyond a certain limit, and cannot preserve the traditional knowledge systems regarding their various conservation strategies, resource sharing strategies and utilization of diversified resources. As a result, there has been a loss of huge quantity of traditional knowledge of wild and domesticated plant and animal resources, traditional arrangements of resource sharing, traditional cohesiveness of the society, social concern over their natural ecosystems and social, cultural and religious affinity. Such changes have taken place in a number of Himalayan societies,

including in the central Himalayan region, but, due to the high population density and resource scarcity the quantum of impact on the present resource base is very high, and hence require immediate attention in this regard.

CONCLUSIONS

This analysis of a traditional transhumant society and their indigenous knowledge systems covering various diversified resource use pattern and conservation practices suggests, the recognition of environmental context as a necessary prerequisite for the sustainability of any society. A strong and vibrant regional ecology can only provide the support necessary to maintain strong and vibrant culture. Hence, the dependence of one over the other is so subtle and intense that they cannot be separated from each other in a short span of time. Traditional societies in general and the high altitude pastoral Bhotiya communities in particular still follow the basic morals, which is required for mutual co-existence in nature. These morals are deeply routed in their culture based on the concepts of collective survival, social equity, collective responsibility and strong linkages between their society and the natural systems. Thus, the traditional Bhotiya systems had maintained a symbiotic relationship between their ecology and the traditional resource use practice, and in this process they had evolved a rich indigenous knowledge systems, which conserved a number of plants and animal resources of the region. It is very important to note, that cultural diversity - the hallmark of transhumant Bhotiya society, faces the threat to its survival, due to their assimilation into the dominant world culture of cash oriented society based on the market forces, and supported by the governmental agencies in the name of development. This article has focused on a case study, but the underlying questions are the same in many areas of the world regarding loss of traditional knowledge systems and degradation of few left good natural ecosystems. A more refined response is called for, involving empowerment of local people to ensure a culturally and regionally sensitive response that over the long term will serve to protect the traditional linkages of society with their natural ecosystems in such areas of global importance like the Himalayan high altitudes.

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