

## **Traditional Ecological Knowledge, Biodiversity and Resource used Practices in High altitudes Region of Western Himalayas**

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### **Abstract**

The people located in Sangla valley in the state of Himachal Pradesh are economically poor due to its inaccessibility and inhospitable geo-climatic setup but they are remarkably rich in social and cultural milieu and endowed natural wealth. Subsistence farming practices, livestock husbandry and trading off the minor forest resources such as medicinal plants, wild edibles and timber are the only means of economy of the rural people. People are socially categorized as tribal. They have their own empirical and innovative knowledge experienced/ inherited through trial and error with the locally available biological resources and diverse geo-climatic conditions thus, establishing a perfect harmony with the nature. The practices of conservation of cultural and biological diversity have been practicing since time immemorial. The preservation of forests on the ground of social-cultural-religious cult and mythological beliefs has become a matter of adopting the strategies of revival of degraded landscape. There is need to adopt integrated model of options to achieve a meaningful development by incorporating indigenous knowledge with complex ecological/environmental milieus with present social and economic conditions derived on scientific parameters so that sustainability of the area could be maintained for long term.

### **Introduction**

Although, western Himalaya covers approximately 11 per cent of the Himalayan landmass, about 90 per cent people lived in villages. People were well aware of the values of conserving social, cultural and biological resources and have devised effective methods to conserve and protect them. The people are highly traditional and have characteristic manifestation of man's cultural interactions with nature. These in turn, evolved multitude of strategies to make effective and harmonious use of resources. During this process, these ethnical societies have restored to cultural adjustments for a harmonious articulation between community techniques and technologies. Nonetheless, culture played a vital role in the management of biological resources of the area. In case if natural resources are not able to fulfill the basic needs of the individuals then society starts changing resulting into a new era of tribal culture. The society decides its own goals and methods of its own, ensuring sustained improvement in the quality of life without affecting the traditional values. Therefore, culture plays vital role in development and conservation of traditional society and biological resources (Pernetta and Hill, 1984; Cohn, 1984; Ramakrishnan, 1992; Scott and Walter, 1993; Davis and Wali, 1994; Singh, 2001). The linkages between local knowledge, culture and conservation in Himalaya have not received any significant recognition (Singh *et al.*, 1996). This study will therefore, analyses the cultural facets where innovation of science and technology is not going to flavour significant change in their life style but rather rejuvenating their indigenous knowledge based conservation practices could be helpful for improvement in their overall socio-economic conditions and sustainability of the area.

### Study Area

The study village are located in the Sangla valley which is nested in the Kinnaur district of Himachal Pradesh in India. It belongs the part of Great Himalayas converging from 31° 6' to 31° 30' N and 78° 10' to 79° E. The length of the valley is about 65 km which covers an area of nearly 300 sq. km. accommodating approximately 9500 inhabitants. The valley comprises of a number of small watersheds that finds their way into the Baspa river. The hamlets are scattered all along the valley. The strips of cultivable lands in valley vary from a few hectares to a few kilometers. The valley is relatively wider near Sangla village. Vegetation cover on the left bank of the river is in general, very sparse. Tree species like *Quercus semicarpifolia* and *Betula utilis* were predominantly found at higher elevation. North facing slope is relatively gentle and has adequate vegetation cover, farm fields, soil cover and sporadic settlements. Perpetual snow cover usually covered upper most part of the mountain peaks. A major part of the valley remains cut-off from other parts of the State due too heavy snow fall during winter period. The rocks varied in the region with age from pre-cambrian to permocarboniferous. Schists, gneisses, granites, quartzites, phyllites, conglongrates, quartzites slate, dolomite and limestone are the major rock types. Rocks have been highly exposed along the Karchham-Sangla road. Soil is sandy to loam and is highly fragile. Thus, the problem of land slide and erosion is rather very common in places where the land is not properly terraced.

There are four seasons: spring starts from middle of March to middle of May; summer from mid May to mid September; autumn from mid September to November and winter season form December to March. The summer is mild and with the on set of monsoon there is a gradual decline in the temperature. After the receding of monsoon the mercury drops further thus winter sets in. The period from November to March is of coldest duration. On the basis of rainfall, the district can be divided into two zones- wet zone and dry zone. Usually rainfall occurs in monsoon and winter periods.

### Methodology

After reconnaissance of the valley, out of 11 villages located in entire valley, three villages namely Batseri/Bosering, Rakchham and Chhitkul representing distinct elevation were finally selected for thorough study. While selecting the villages it has been ensured that these villages would represent all characteristics of the valley. Equal representation was given to each village and a total of 75 per cent families were selected and interviewed randomly for documentation of indigenous knowledge based activities. The questionnaires were designed based on interactive discussions with individual and group of the people in entire valley. None of the farmers interviewed had a history of involvement with this study projects. The fields of farmers were visited and an inventory was made for crops and biological resource use and conservation practices. All the respondent farmers were categorized into three farm size classes i.e., small (farm land having < 1 ha), medium (1-2.5 ha) and larger farm (>2.5 ha). Most of the interviewees belong to small and medium size of land holdings. Women were given equal preference at the time of filling the questionnaires. All information relating to endowed resource use patterns, conservation values and plants used as medicines for traditional health care system were thoroughly documented. Further, farming practices such as factors favouring cultivation of indigenous landraces, crop diversity and cropping patterns and use of different tools and craftsmanship were extracted through a thorough, detailed discussion and filling up questionnaires over a period of years 1996-97. The role of in-depth rooted culture in eco-development and management programmes were also noted from individual viewpoints and were put them altogether into ecological, social and economic development framework.

## Results and Discussion

The salient features of the three study villages are mentioned in Table 1. The village Chhitkul is located at higher elevation (3400m), Batseri is situated at lower elevation (2800m) whereas Rakchham village is settled at middle elevation (3000). Road ends at Chhitkul, that is the last village of the Sangla valley. Batseri to Chhitkul area has been declared as Rakchham Sanctuary under Wild Life (Protection) Act 1972 of Government of India. There is no vegetation cover around the Chhitkul except stunted growth of *Berberis* species. This village remains under snow for a period of about 4-5 months. Per household cultivable land holdings of the study villages is less than one ha which is close to other study areas too (Singh *et al.*, 1997a,b). Area not available for the cultivation and area under cultivable waste (including common grazing lands and sacred area) are higher in Rakchham village followed by Batseri. Rearing of the livestock is an integral component of farming system. Distress selling of sheep and goat to earn money is not uncommon. Better climate, geography and soil cover supports high varieties of crop cultivation in Batseri village as compared to other two villages. Livestock holding is higher in Chhitkul village, which reveals that their economy depends primarily on animal rearing. There are eleven villages scattered along the Sangla valley. The houses are two storied which are built up of stones and woods. These are either slated or flat roofed and are white washed and shining. The ground floor is used for cattle shed while the upper storeyed for living purpose. It is considered that people are from the Aryan stock, but a significant trace of Mongoloid feature has also been noticed in them. The inhabitants are generally of dark complexion but good looking with a well built muscular stature. They are frank, active, generous, hospitable and highly honorable in their dealings. Two principal castes/kanets *ie.*, rajaput and scheduled castes are common. Apart from Hinduism, people mostly follow the trend of Buddhism. Sheep and goat rearing is very common. The villagers believe in swears of the local deity. There is also a sprinkling of polyandry practiced amongst the people. The people are mostly dressed in woolen clothes. Their clothing is well suited to the climate and culture. Women wrap up a woolen shawl like garments locally known as *dohru* in a slightly different way than the *saree*.

Social and cultural variability, environmental/ecological complexity and diverse geoclimatic conditions have characterized the interactive functions of various subsystems such as agriculture, domestic, forest and animal husbandry in varieties of ways and means of indigenous knowledge based techniques and technologies of self dependency (Table 2a,b,c,d). In this process, people have been utilizing locally available resources in various ways. Preparation of organic manure based on local knowledge and resources derived from dung and urines of animals, beddings and collected forest based leaf litter, and other locally available resources like waste fodder, weeding materials, vegetable waste and other domestic/agricultural wastes were used commonly. Indigenous knowledge regarding use of wild edibles and medicinal plants, trading off minor produce, cultivation of traditional crops and artisan activities related to formulation of implements are amongst some of the common indigenous practices. Since long time, people have developed a symbiotic relationship with endowed natural resources and cultural values. Traditional ways of operating farming systems have evolved centuries ago through a magnitude of empirical oriented trial and error over spatio-temporal scale. Indigenous technique of harvesting and managing natural water resource for various purposes is very common. They use water for drinking purpose, irrigation of crops, running watermills to make flour, use of sawmills to make plumber, plank etc. Incorporating the scientific inputs to modify

these old systems for better hydropower use will be an asset to the tribal people. Diverting water through small canals and pipes will indeed be helpful for proper use of water rather making big dams/hydro-electric project thus that threatening the fragile ecosystem of newly born mountains of Himalaya. Altogether it has been noted that people are rich in terms of indigenous ecological knowledge and managing available resources as well. Similar practices have also been reported from other region of the Himachal Pradesh (Singh *et al.*, 1996; Singh *et al.*, 1997a,b). Protecting forest (sacred groves) areas on the ground of religious beliefs have also been noted in the area, which is rich in biological and cultural diversity (Singh, 1997; Singh, 2000). Such practices were regulated through informal committee consisting of head priest (*Talrasa*) and other five peoples. Similar practices were also noted from other part of the Himachal Himalaya (Singh *et al.*, 1996).

As such the subsistence farmers cultivate a total of 16 crops as staple food (Table 3). All crops are of local breed. Crops like wheat (*Triticum aestivum*), jao (*Hordeum vulgare*), opla (*Fagopyrum tataricum*) and phapra (*F. esculentum*) were cultivated as major food crops. Farmers are well knowledgeable regarding quality of different crops and various farm fields in terms of production and nutrient management. They also take care of slope, direction and face in relation to performance of crops. Rotation of farm fields for the replenishment of nutrients is common practices. Leguminous crops were sown either monoculture or mixed cropping. Majority of the crops were harvested during rainy season; heavy snowfall does not permit the cultivation of winter crops. Crop diversity in the study area is significantly high when compared with north east Himalaya (Mishra and Ramakrishnan, 1982), central Himalaya (Pandey and Singh, 1984) and other mountainous regions (Garcia-Ruiz and Lasanta Martinez, 1993; Sarmiento *et al.*, 1993). As compared to mixed cropping in other parts of the Himachal Pradesh (Singh *et al.*, 1997b), single crop cultivation is quite common in the study area. Landscape diversity and environmental complexity have favoured the evolution of multiple ways of cultivation of varieties of local crops. Crop cultivation in valley and terraced lands varies and depends on local knowledge of field quality. However, introduction of fruit bearing tree like apple in Batsari and at the lower parts of Rakchham is hardly 15 years old. Large-scale plantation of apple in the area is required through landscape study and planning (Singh and Ram, 1997).

In their traditional health care system, twelve plant species were used as medicinal purposes (Table 4). The use pattern varies upon the species and ailments. Knowledge regarding preparation of ingredients and doses used for respective diseases were highly praised worthy. Some of the medicinal plants were also used to cure animal diseases. High market demand/extraction of medicinal plants like *Aconitum heterophyllum*, *Jurinea macrocephala*, *Picrorrhiza kurrooa* and *Podophyllum hexandrum* has resulted large scale collection imperil habitat and biodiversity threat. Older people have faith and love in use of medicinal plants and also show their enthusiasm to teach the younger generation. Imparting scientific knowledge for cultivation of agricultural fields and waste lands which are close to similar climatic regions of high altitudes could promote economic benefits to subsistence farmers and also could accelerate regeneration of species in their natural habitat. Thus, establishing a harmonic symbiotic relationship between demand and natural existence seems for preservation of altogether social, cultural, economic and natural heritage.

Indigenous knowledge pertaining to the use of plants for different purpose has been noted among the people of the study villages (Table 5). Leaves of species of *Pinus*, *Abies*, *Picea* and *Cedrus* are collected once a year (on 25<sup>th</sup> October) for the purpose of bedding and making organic manure deriving from mixing leaf litter and farming waste with dung and urine of animals

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which is ultimately used for crop production. Similarly, leaves of *Betula*, *Eugenia*, *Juglans* and *Salix* are used for fodder purposes during the lean period. The area is endowed with a rich variety of wild edible species of food value. Wild edibles have been known for their high nutritive values, which improved milk production of milch cattle, goats and sheeps and also kept the body warm during the chilled winter season. Hard labour and low monetary value involved in the collection of wild edibles have not yet attracted market demand. Therefore, availability and growth of these plants are not limited. There is an urgent need to improve the utility values of these wild edible plants by innovating value added products so that better economy could be rendered to the farmers.

Similarly, people have been using a number of plant species for fuel wood, timber, tools and implements making on a routine basis (Table 6). For proper equitable sharing and management, collection of leaf litter and fuel wood is allowed once a day in a year (in the month of November). Usually two people from a family are allowed for wood collection. Such practices are strictly observed in remotely located villages and are controlled through informal committee of the village. Such practices helped in equitable use of natural resources so that long-term indigenous conservation practices could be maintained. Further, people are well aware regarding the artisan work to fulfill their day-to-day domestic needs and activities. Some of them are skilled in preparation of wooden and bamboo based items while a few of them for making iron articles symbolizing their interdependence and self-sufficiency. However, poor people largely depend on indigenous tools/implements to save their economy. It has been felt that there is a strong need to improve the capacity of the locally designed implements such as watermills, *raksh* and *khadi* so that small scale industry coupled with employment could be generated at the household level.

All animals domesticated in the area are of local breed (Table 7). Cows, bullocks, goats, sheep, mules, ponies and yaks constitute the major livestock. Wild yak used for the breeding purposes and the offspring's of yak is used for a wide variety of purposes such as milk, wool, and drought work. Bullocks are used for ploughing of agricultural fields. Traditional knowledge related to preparation of milk products is very unique. Sheep and goats are domesticated merely for wool production and distress selling and also for meat fetching. As such mules and ponies are usually reared small land holders and poor people to fulfill their livelihood and drastically used for transportation work in harsh geo-climatically conditions prevailing in the area.

#### Conclusion

The tribal people of the Sangla valley in Kinnaur district of Himachal Pradesh have indigenously been conserving natural resources since generations and were well aware about their environmental protection and sustainable use. Socio-cultural diversity, geo-climatic variability and environmental complexity favour people to develop symbiotic relationship with the locally available resources and precarious nature that has resulted/experienced through various empirical knowledge they have accumulated through trial and error. Such conducive practices have not only helped the people for better upliftment of livelihood but also altogether management of entire watershed/landscape in general. Economy of the people could be improved by empowering the efficiency of the locally available resources, enhancement of local knowledge, developing participatory approach of local people and institutions/programmes, encouraging small scale industries, increasing market values of medicinal plants and food items, proper use of water resources in terms of micro-hydels, sensitization of people for participation in development planning and awareness building in indigenous know-how and do-how based packages/practices. Altogether, planning for the improvement of their overall economy should be based on the

cultural, social sentiments of the local people and incorporation of scientific knowledge so that overall sustainability of the area could be maintained for long-term basis.

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**Table 1. Salient feature of the study area/Sangla valley.**

<b>Feature</b>	<b>Attributes</b>
Geographical/administrative setup	Kinnaur district, Sangla valley
Elevation gradient (m amsl)	2800-3400
Climate	Sub-tropical to humid temperate
Soil types	Sandy loam
Agriculture system	Terraced rain-fed and irrigated valley land
Cultivation of traditional staple food crops	16
Introduced cash crops	Fruit trees (Apple, pear)
Forest types	Broad leaves and conifers
Alpine and permanent pasture	Exist
Human and livestock population	Moderate
Sheep and goat rearing	Common
Existence of area under cultivable waste	Common
Literacy rate (%)	33

**Table 2a. Predominance of domestic based indigenous knowledge in the Sangla valley.**

<b>Attributes</b>	<b>% Response</b>
Existence of traditional houses	100
Availability of skilled person (mason, blacksmith)	20
Settlement near natural water source and avalanche prone area	100
Construction of houses using locally available resources	90
Designing of houses tuned to local geo-climatic conditions	100
Dependency on hydro-power operated water and saw mills	100
Preparation of handicraft items	90
Designing of locally available resource based implements/tools	100
Preparation and uses of traditional dresses	100
Existence of village level committee	100
Resolution of social conflicts at village level	100
Beliefs in local deity	100
Participation in fair and festivals	95
Practice of polyandry system	60
Practice of kitchen garden system	100
Practice of barter system	85
Use of local chulah for energy conservation	100
Preparation of energy rich food in winter	100

**Table 2b. Existence of agriculture based indigenous knowledge in Sangla valley.**

Attributes	% Response
Cultivation of local crops	100
Preparation and usage of organic manure	100
Operation of traditional breeding patterns	100
Traditional pattern of storage of food grains	100
Usage of local implements/tools in farming activities	100
Adequate knowledge on fragmented land use system	100
Belief in traditional knowledge based farming practices	100
Alternate lopping of agro-forestry tree species	90
Maintenance of agro-forestry species to prevent soil erosion	100
Adequate knowledge on thinning/weeding of crops	100
Know-how on inward/outward terracing pattern to protect soil/water	100
Preparation of terrace/bund cementing with stone, trees/shrubs/grasses	100
Management of water resources	100
Rich knowledge on different crops in different fields	100
Knowledge on field quality and land use/cover practices	100
Cultivation of leguminous crops for replenishment of nutrients	100
Knowledge on crops rotation, patterns, sequences, slopes and directions	100

**Table 2c. Indigenous knowledge related to forest based practices on use and conservation resources in Sangla valley.**

Attributes	% Response
Use of wild edibles	95
Use of medicinal plants as traditional health care	100
Knowledge on habitat of species distribution	90
Conservation of biodiversity through religious beliefs	100
Conservation/collection of forest resources through traditional norms	100
Usage of forest resources to make tools/implements	100
Designing of tools/implements eco-friendly to farm and forest resource	100
Collection of dead wood as fuel and leaf litter for bedding	100
Conservation and maintenance of community land	100
Maintenance of natural water supply from forested area	100
Knowledge on their right values	95

**Table 2d. Local knowledge on animal systems in Sangla valley.**

Attributes	% Response
Domestication of wild animals and its breed	100
Operation of traditional breeding pattern	100
Preference of animals suitable to local geo-climatic conditions	100
Preference of animals required less feed/fodder	100
Local techniques of preparation of organic manure	100
Local techniques of keeping animals in harsh environment	100
Know-how to keep room hot through bedding process	100
Know-how for formation of value added products of animals produce	100

**Table 3. Diversity of crops in Sangla Valley.**

Category and common name	Scientific name
<b>Coarse grain</b>	
Amaranths	<i>Amaranths spp.</i>
Barley, jao	<i>Hordeum vulgare</i>
Buckwheat, ogla	<i>Fagopyrum tataricum</i>
Buckwheat, phapra	<i>F. esculentum</i>
Bathu	<i>Chenopodium spp.</i>
China	<i>Echinochloa frumentacea</i>
Makki, maize	<i>Zea mays</i>
<b>Fine grain</b>	
Wheat	<i>Triticum aestivum</i>
<b>Oil seed</b>	
Mustard	<i>Brassica spp.</i>
<b>Pulse</b>	
Moong	<i>Vigna mungo</i>
Pea	<i>Pisum sativum</i>
Rajmah	<i>Vogma sinensis</i>
<b>Vegetable</b>	
Cabbage, gobhi	<i>Brassica spp.</i>
Moli	<i>Raphanus sativus</i>
Potato	<i>Solanum tuberosum</i>
Salgam	<i>Brassica spp.</i>

**Table 4. Local knowledge related to use of common medicinal plants in Sangla valley.**

Botanical/local name	Usages
<i>Aconitum heterophyllum</i> / patish	Root powder one tea spoon twice daily cure colic and indigestion.
<i>Baniam paraclum</i> / kala jeera	Seed powder two spoon daily cure jaundice, cough, cold
<i>Berberis</i> spp./Kashambal, chava	Root powder three spoon daily used to cure joint pain
<i>Dactylorhiza hatagirea</i> /Hathpanja	Paste of tuber is applied on cuts, wounds three times daily
<i>Dioscorea deltoidea</i> /singli-mingli	Tuber used as soap and stomach problems two tea spoon
<i>Hippophae</i> spp./surachu	Seed oil cures body pain, shoot juice used against colic
<i>Jurinia macrocephala</i> /dhoop, gugal, shur	Root extract 10 ml 2-3 times used as stimulant during child birth, check excessive bleeding and fever
<i>Nardostachys grandiflora</i> /Balchhar, khome	Root extract 5ml 3-times daily cure hysteria, epilepsy and root powder one tea spoon 3-times cures gastric problems
<i>Picrorrhiza kurroa</i> / karoo, kori	Root powder two tea spoon twice daily cures colic, body ache, diarrhea
<i>Podophyllum hexandrum</i> /Bankakroo	Root powder one tea spoon 3- times daily cures colic and vomiting.
<i>Saussurea lappa</i> /kuth	Root extract one tea spoon 2-times daily cures cough, cold
<i>Taxus baccata</i> /Sigacha	Powder of bark 1gm per cup used in tea for cancer treatment

**Table 5. Knowledge related to use of various plant resources in Sangla valley.**

Botanical/local name	Litter	Fodder	Fuel/ timber/ tools	Edibles	RitualPurpose
<i>Abies pindrow</i> /rai,rahi	Mi	—	Ma	—	Yes
<i>Betula utilis</i> /bhojpatra, shrabra botang	—	Ma	Ma	—	Yes
<i>Cedrus deodara</i> /deyar, kelbangbotang	Mi	—	Ma	—	Yes
<i>Eugenia</i> spp./jamun, krun	—	Mi	—	Fr	—
<i>Hippophae</i> spp./surachu	—	—	—	Fr	—
<i>Juglans regia</i> /akhrot,kachh	—	Ma	Ma	Fr	—
<i>Picea morinda</i> /tosh, pan	Mi	—	Ma	—	Yes
<i>Pinus excelsa</i> /lim	Ma	—	Mi	—	Yes
<i>Pinus gerardiana</i> /chilgoza	Ma	—	Mi	Se	Yes
<i>P. longifolia</i> /chilambotang, golda	Ma	—	Mi	—	Yes
<i>Prunus armeniaca</i> /behmi	—	—	—	Fr,Pi,Oi	—
<i>P. avium</i> /khotali, cherry	—	—	—	Fr	—
<i>P. persica</i> /khurmani, chuli	—	—	—	Fr,Pi,Oi	—
<i>Salix</i> spp./ willow, shon	—	Ma	Mi	—	—
<i>Viburnum coriaceum</i>	—	—	—	Fr	—

Ma-major; Mi-minor; - no use; Fr-fruits; Se-seeds; Pi-pickle; Oi-oil

**Table 6. Local implements and tools used in Sangla valley.**

Common/local name	Purposes	% Used
Hal and jua/nag, gral, koal	Ploughing the farm fields	100
Gaiti and kuti/khot	Digging, weeding	100
Kulhari/lasta	Cutting of wood, hedges	100
Basula/washing	Wood finishing and plank making	90
Darat,hasia/thame, chatam	Cutting of hedges, crops, grasses etc	100
Kilta/koting	Carrying of organic manure, food grains etc.	100
Rassi/lat	Made up of sheep hairs and used as rope	100
Kot/kot	Akhrot tree and act as quantification of grain	90
Gharat/gandhotar	Act as watermills to grind grains	20
Takli/tawali	Spinning of wool	95
Raksh, khadi/phoshang, khadi	Preparation of shawl, pattu and patti	100

**Table 7. Usage of different local livestock in Sangla valley.**

Common/local name	Purposes	% Used
Bail, bullocks/ Joo, gara, gira, buma	Ploughing and drought work	100
Gai, cow/ Jomo, gare, gire, bume, brume	Milk, milk products, wool and products	100
Bher, sheep/ Hulas	Breeding, drought, wool, skin as baggage preparation	100
Bher, sheep/ Khas	Milk, wool and baggage preparation	100
Bakri, goat/ Balu	Breeding purpose, wool, drought, baggage	100
Bakri, goat/ Bhakhor	Milk, wool and products and baggage	100
Ghora, mule/ Rang	Carrying luggage, grains etc.	100
Gadha, ash, ponies/ Phoch	Used as carrier	100
Yak/ Yak	Domesticated wild animal act as breeder	100