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Assessment of Socio-economical Status and its Impact on Land use Management in Central Himalaya

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ABSTRACT

The agro-ecosystems of Central Himalayan villages are sustainable as they function essentially through recycling of resources within systems. Traditional village ecosystem's functioning is governed by agriculture, forest and animal husbandry. This study has presented the assessment of socio-economical situation of farmers and the after effects of farming on land use management in Central Himalaya. In the study area the agrodiversity maintained for low dependency on market, economically poor society and no other income sources were mostly nondescript in nature. The natural resources in these ecosystems are under enormous pressure since past many years. The pressure is attributed to various forces such as industrialization and commercialization of agriculture. The expenditure incurred on fodder and concentrate was highest for all categories of families. The animals were fed with fodder and other supplements little amount like mustard-cake, wheat flour, finger millets and barley seed depending upon availability. This study highlighted the resultant degradation of the natural environment that warrants production and suitable management of resources to save them from further decline. This study will also be helpful to make the policy and management strategy for the future sustainable development of these marginal landscape. Finding of this study will be beneficial and helpful in near future for policy makers, researchers and social scientists to understand the role of socio-economical status of farmers in conservation of village ecosystems in the mountains.

Key words: Agro-ecosystem, central himalayas, farm yard manure, land use, livestock, traditional agriculture, socio-economical

INTRODUCTION

The Central Himalayan region is characterized by undulating terrain, sparse population, fragmented land holdings and rainfed subsistence agriculture. About 90% of agriculture is practiced on rainfed terraces which are unit for cultivation for subsistence livelihood (Sharma, 1989). About 71% of the land holding are less than 1 ha in size (PC, 2001). The forests of Himalaya have a permeative influence on the ecosystems, environment and the lives of people of the region (Yu *et al*., 2007). For their daily needs and survival, these people mostly depend on forest resources livestock and traditional agriculture practices.

Due to anthropogenic pressure, agricultural practices and dependency of people on natural resources, the forest covers in Garhwal Himalayas has altered drastically (Wakeel *et al*., 2005). In

application of local wisdom, the mountain people have maintained the mountain, ecology (Chandra, 2007). These agro ecosystems are mainly women centered as the men have migrated in search of off-farm employment. According to Maikhuri (1996), due to high biomass production, consumption and energy dynamics, Himalayan village can be considered as an ecosystem. Himalayan village ecosystems function mainly by recycling resource within system and are mostly sustainable from the ecological point of view (Chandra, 2007). Agriculture, forest and animal husbandry contribute, individually or in combination, to the functioning of the traditional village ecosystems. In this region mixed farming is the choice of farmers and livestock is an inseparable component of traditional agriculture. Mix farming not only supplements the families' income but also contributes to Farm Yard Manure (FYM) which is an essential requirement of rainfed agriculture of this region (Chander and Mukherjee, 1995). Over the past several years there has been a tremendous pressure upon these natural resources, due to several forces like, including industrialization and commercialization of agriculture.

Degradation of the natural environment warrants production and suitable management of resources to save them from further decline (Gregory and Ingram, 2000). The study was therefore, based on assessment of socio-economical status of farmers and the impact of socio-economic changes on land use management in Central Himalayan villages.

MATERIALS AND METHODS

Study area: The study was investigated at Langasu-Uttaron, (900 m above seas level (m asl)), village of district Chamoli, Uttarakhand in Central Himalaya (Fig. 1). The study area represents unique method of practicing traditional agriculture and surrounded by lush green forest of oak (*Quercus semecarpifolia*) and pine (*Pinus wallichiana*). Oak forest and agricultural land provides green fodder for livestock throughout the year. In summer season oak forest is utilized for livestock grazing but in winter season grazing was preferred in pine forest due to thin crown density in pine forest and availability of sun rays on forest floor.

On the basis of preliminary studies done in Central Himalayas, a typical mid altitude village has been selected for this study. The basic criteria of selection was the presence of high degree of agrobiodiversity, crop rotation, variability in management practice, low input agriculture, high

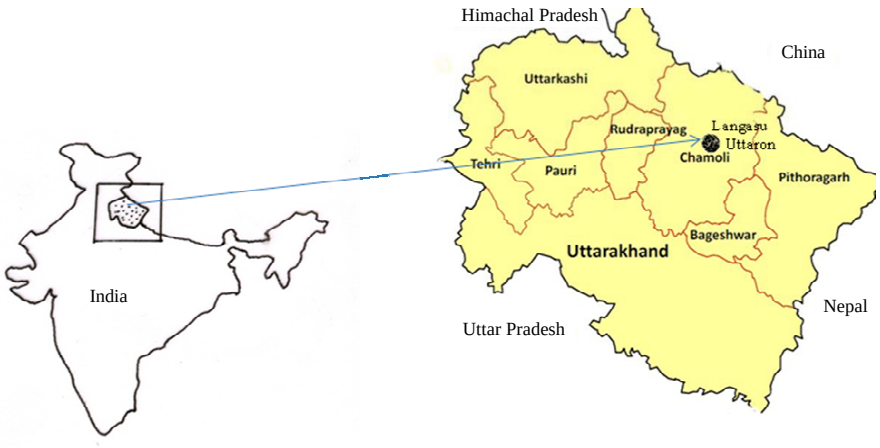

Fig. 1: Map of the study site

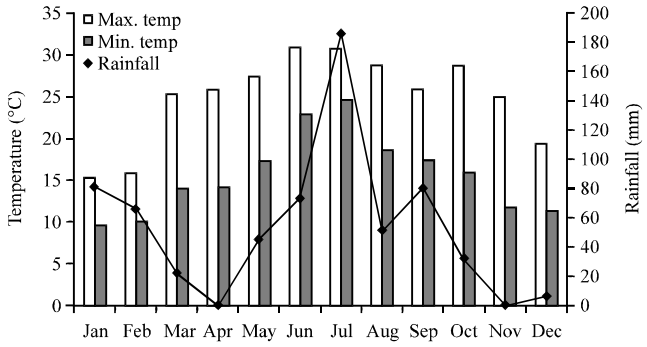

Fig. 2: Climatic data of village Langasu-uttaron

dependency on forest, subsistence level agriculture and low dependency on market. The second important criteria was the presence of different type of land uses viz. Irrigated Agriculture (IR), Rainfed Agriculture (RF), Home Garden cultivation (HG), Abundant Land (AL), Pine Forest (PF), Oak Forest (OF) and Scrub Land (SL) which make a complete repetitive structure of agroecosystem in mountain region.

Climatic condition: Monthly minimum and maximum temperatures ranges between 9.6 to 15.45°C and 24.6 to 30.2°C, respectively. This region has two distinct rainy seasons, namely winter rain from December to March and summer rain from July to September. The total annual rainfall is 642 mm and about 37% of the rainfall occurs over a small period of July-August (Fig. 2).

Survey: The study was multidimensional, hence quantitative and qualitative information was obtained through literature review and available records. The primary data for the study was collected from the selected farmers by using Participatory Rural Appraisal (PRA) method with the help of a structured questionnaire (Chambers, 1993; Borrini-Feyerabend and Borrini, 1996; Chandra, 2007). The data collected include the personal details of the farmers, i.e., age, education, social participation, family members, total owned agricultural land, total cultivated land, income from all sources, expenditure on food, clothes, education, availability and utilization of human and bullock labour as well as hired labour for agriculture.

Four major attributes of soil fertility, crop periodicity, labour requirement and weed infestation were also compared based on the PRA and questionnaires provided to farmers. Farmers evaluated the attributes and graded them as highest, intermediate and lowest according to their understanding and local perception. The rating of soil fertility was a combined expression of proportion of soil depth, degree of compaction and requirement for manure. The farmers compared productivity in terms of total crop biomass rather than monetary value of the production. Their perception on labour requirement was based both on the field labour and labour involved in traveling between dwelling place and field for carrying the manure and yield product. Data were calculated with the help of excel.

RESULTS

The cultivated land/household was (0.35 ha) while uncultivated land was 0.075 ha. Most of the land (11.8 ha) was rainfed, compare to irrigated (4.06 ha). Livestock population was also very less and it was only 1.8/household (Table 1). The entire population was categorized into two groups of

Table 1: Profile of the study site

Parameter	Units	Values
Altitude	m asl	900-1200
Total agricultural land	ha	19.6
Actual cultivated land	ha	16.14
Cultivated land per household	ha	0.35
Uncultivated (fallow) land per household	ha	0.075
Rainfed agricultural land	ha	11.18
Irrigated agricultural land	ha	4.06
Agricultural land per household	ha	0.35
Total land under kitchen garden	ha	0.9
Average family size		7.0
Human density per ha cultivated land	%	19.95
Livestock holding per households	%	1.8
Livestock density per ha cultivated land	ha	5.2
Live stock grazing density per ha forest land	ha	2.4

Table 2: Population of Langasu-Uttaron village

Parameter	Total	Native families (No.)	Native families (%)	Migrated families (No.)	Migrated families (%)
Households	140.00	46.00	33.00	94.00	67.00
Population	530.00	322.00	60.75	208.00	39.25
Male	287.00	153.00	53.31	134.00	46.69
Female	243.00	169.00	69.55	74.00	30.45
Male female ratio	1: 0.84	1: 1.10	-	1: 0.55	-
Average family size	3.8	7.00	-	2.2	-

Table 3: Categories of farmer on the basis of cultivation of land

Categories of farmers	Cultivated land area (ha)	No. of farmers	Percentage
Small	>0.2	5	10.87
Medium	0.2-0.4	32	69.56
Large	<0.4	9	19.57
Overall		46	100.00

household's viz., native and migrant. About 67% of the village population was migrant households while native families were only 33% (Table 2). Migrant families were involved only in government jobs, business and other labour works. Migrated families were present in study site, due to the employment opportunities, education of their children and other primary requirements. Agriculture was done only by native households. Income source of the native families were mainly from agriculture and secondary sources i.e., business, labour and also from rent obtained by letting out their houses to migrant families.

On the basis of land cultivation, farmers were divided in three categories i.e., large, medium and small. Majority of the farmers were placed in medium (69.56%) group followed by large (19.57) and small (10.87%) respectively (Table 3). The large farmer group consisted of those having cultivated land (0.4), medium (0.2-0.4) and small having (>0.2). Almost all categories of the farmers practiced mixed farming which is inherent to the hill-farming system to enhance the productivity of crop and lower risk on crop failure due to unpredictable weather. Farmers of this region evolved various mixed cropping and crop rotation strategies with agronomic, fodder requirements and

Table 4: Livestock population in Langasu-Uttaron

	Number of livestock			
Population	Medium	Large	Total	Percentage
Jersey cow	4	3	7	8
Local cow	3	7	10	12
Bullock	18	14	32	38
Buffalo	5	3	8	10
Jersey calves	4	5	9	11
Local calves	4	8	12	14
Buffalo calves	3	3	6	7
Total	41	43	84	100

Table 5: Livelihood analysis of selected households

Parameters	Small	Medium	Large
Particulars			
Average family size	6	7.8	5.4
Land ownership (%)	15	55.0	30.0
Land cultivated by families (%)	2	66.0	32.0
Average livestock unit	0	1.2	4.8
Earning (Rs.)			
Agriculture	2,119	10,926.0	18,835.0
A.H. (Draught and milk products)	0	1,950.0	48,000.0
Others (Salaries, business and labour)	2,28,000	92,880.0	55,992.0
Total (Rs.)	2,30,119	1,05,756.0	1,22,827.0
Expenditure (Rs.)			
Food	30,000	20,926.0	18,835.0
Vegetable, non-vegetable, oil, medicine etc.	30,000	15,000.0	15,000.0
Clothing	5,440	4,211.0	3,877.0
Education	31,400	4,053.0	4,111.0
Electricity	4,800	3,600.0	3,600.0
Others	20,000	25,000.0	25,000.0
Total (Rs.)	1,21,640	72,790.0	70,423.0
Saving (Rs.)	1,08,479	32,966.0	52,404.0

availability of rain water. Livestock population is not so much varied from medium to large family, however, people having Bullock (38%) followed by local calves (14%) and (12%) local cows (Table 4).

The share of cultivating agriculture land was 66% for medium farmers followed by 32% for larger farmers and only 2% for smaller of farmers (Table 5). Major share of the expenditure for all the categories of farmers is on food and it varied from lower to higher farmer's category. The expenditure on education increased with the increase in income. Saving was highest for smaller group i.e., low depending on agriculture. Home garden cultivation was predominated by vegetable crops mainly green leafy vegetables and spices (Table 6). An important characteristic of home garden is their multifaceted usefulness. The fruit trees produced in home garden are, *Mangifera indica* (mango), *Psidium guajava* (guava), *Citrus medica* (lemon), *Punica granatum* (pomegranate), *Musa balbisiana* (banana), *Citrus sinensis* (orange), *Juglans regia* (apricot) and *Artocarpus lakoocha* (jackfruit) that served as either subsistence food (Table 6) or as cash crop and also provided a varied diet balanced in form of carbohydrates, proteins, vitamins and minerals (Gopalan *et al*., 2004). Labour was utilized for looking after the animals, feeding, grazing, cleaning

Table 6: Vegetable crops in home garden of Langasu-Uttaron

Scientific name	Family	English name	Common name
Common fruits trees			
Psidium guajava	Myrtaceae	Guava	Amrudh
Citrus medica Linn.	Rutaceae	Lemon	Nibu
Punica granatum Linn.	Lythraceae	Pomegranate	Anar
Musa balbisiana	Musaceae	Banana	Kela
Citrus sinensis	Rutaceae	Orange	Malta
Mangifera indica	Anacardiaceae	Mango	Aam
Artocarpus lakoocha	Moraceae	Jackfruit	Kathal
Juglans regia	Juglandaceae	Apricot	Aakhrot
Vegetables crops			
Zea mays	Poaceae	Maize	Makai
Colocasia esculenta	Araceae	Colocasia	Arbi
Cucurbita pepo	Cucurbitaceae	Pumpkin	Kaddu
Momordica charantia	Cucurbitaceae	Bitter gourd	Karela
Lagenaria siceraria	Cucurbitaceae	Bottle gourd	Loki
Capsicum annum	Solanaceae	Green chilli	Hari mirch
Abelomoschus esculentus	Malvaceae	Ladies finger	Bhindi
Zingiber officinale	Zingiberaceae	Ginger	Adrakh
Curcuma domestica	Zingiberaceae	Turmeric	Haldi
Cucumis sativus	Cucurbitaceae	Cucumber	Khira
Solanum tuberosum	Solanaceae	Potato	Aalu
Brassica rugosa	Brassicaceae	Mustard	Rey
Solanum lycopersicum	Solanaceae	Tomato	Tamater

Table 7: Farmer's assessment (%) in different agricultural land use types

	Land use type		
Land use attributes	Home garden	Rainfed agroecosystem	Irrigated agroecosystem
Soil fertility			
Highest	26	35	65
Intermediate	35	46	23
Lowest	39	19	12
Crop productivity			
Highest	84	25	85
Intermediate	15	45	15
Lowest	1	30	0
Labour requirement			
Highest	94	25	62
Intermediate	6	48	15
Lowest	0	27	23
Weed infestation			
Highest	74	85	16
Intermediate	14	15	24
Lowest	12	0	60

of gothes (animal shed) and milking of animals. Soil fertility and crop productivity was highest 65 and 85% under irrigated agroecosystem; however, the labour requirement was highest (94%) under home garden. On the basis of inputs given by farmers highest (85%) weed infection was reported in rainfed agroecosystem (Table 7).

DISCUSSION

In this study, it was observed that there is a change of preference from joint to nuclear families. The females contributed to about 80-90% in families. Women have been food growers, processor and storers from the beginning of recorded history (Eneh and Nkamnebe, 2011). The lifestyle and major activities of the people to sustain their livelihood in the region revolve around their animal husbandry and the traditional livestock-based farming system. This is closely linked to the surrounding resource/forests. Livestock also play a crucial role in food security and as risk aversion mechanisms for sustaining families when there is crop failure. Livestock generate income in rural areas and also form a part of nature's chain for recycling nutrients, converting low quality and other agro byproducts into good quality and organic fertilizer, the latter being important for retaining soil fertility.

With increasing emphasis on market economy and 'maximization of profit' motive, agrobiodiversity and agroecosystem management have changed and there has been a significant decline in both domesticated and wild biodiversity. Because farmers in the Central Himalayas have limited access to purchased inputs, they have developed mixed combinations that are adapted to low external input managements (Saxena *et al*., 2005). The expenditure incurred on fodder and concentrate was highest in all the categories of families. Fodder mainly consisted of green grass and tree leaves (imputed value of labor for bringing the leaves and grasses from the forest as well as agricultural land was considered for this purpose). Increase in livestock population and reduction in fodder production from farmland with changing cropping patterns implies more intensive grazing in forests. Due to deforestation fuelwood is also become scare at the study site.

A significant proportion of fodder energy ends as manure in the crop field, helping to maintain soil fertility and water retention capacity (Tripathi and Sah, 2001). The animals were fed small amount of concentrates like mustard-cake, wheat flour, finger millet and barley seed, depending upon availability. New livestock husbandry practices have been promoted by the government by giving subsidy for buffaloes and cross-breeds of cows. Increase in livestock population and changes in composition of livestock population are a common trend (Sharma and Shaw, 1993). Naturally these hybrid cows and buffaloes provide more amount of milk and cow dung as compared to the indigenous breeds (Singh, 1993).

As agriculture is an important occupation in the hill area it is necessary to find out the expenditure pattern among the farmers in this sector. The agrodiversity maintained for low dependency on market, economically poor society and no other income sources were mostly nondescript in nature. Agrodiversity also play multiple roles in rural systems economy and has a strong human dimension, as manifested through sociocultural link and involvement of women (Maki-Hokkonen, 1996). Agricultural lands were divided into a number of small plots due to the slope of hill. In the irrigated land mainly two crops are grown in one year, in rainfed systems, three crops are grown every two years and in the home garden multiple crops are grown per one year. Highest percentage of land ownership and cultivated areas were under medium size farmers compare to small size.

Home garden in the present case could be described as a land use located near the dwelling place having a high species diversity, high tree density, presence of fruit trees and cultivation of vegetable in at least one growing season. It more carefully tended, protected from animals and utilized for diverse products, therefore multiple crops in a year. Whenever, two or more crops are grown together in the same cropping system, the resulting interactions can have mutually beneficial effects as they effectively reduce the need for external inputs (Chandra, 2007). The

Central Himalayas is known for most successful mixed cropping systems where a high percentage of agricultural land is still under mixed cropping (Maikhuri, 1996; Maikhuri *et al*., 1999, 2001; Nautiyal *et al*., 2002). Such changes have benefited local people in economic terms but at the same time increased their vulnerability to environmental and economic risks. Some cultivars use tree as a base for some cucurbits as agrisilvicultaral practices. Due to the mixture of trees and vegetable species and their variability in flowering time and fruit maturity, sources of food or income was insured throughout the year (Maikhuri *et al*., 1999; Gopalan *et al*., 2004).

CONCLUSIONS

From the present study, it was observed that when questioned about the advantages of complex cropping pattern and crop system diversity, the respondents could not come out with distinct reasons by them. This indicates that articulation on expressions of ideas could deviate from the actual perception held when the aspects being discussed involved strategies that have become almost an instinctive and natural response to a given situation. The apparent difference in response given could arise due to either the enhanced understanding of the families or abilities to relate to ideas or due to their attempt to go down favorably with the researcher as a knowledgeable individual. Families are search of job and other livelihood options migrating towards town. However, in the villages the migrant families were involved only in government jobs, business and other labour works. Agriculture was done only by native households and old people as youth having less interest in agriculture. Therefore, a sound policy and government support is required for enhancing the agricultural biodiversity including value of the traditional crops, promotion of elite landraces selected on the basis of urban consumption needs.

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