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Environment, Socio-cultural System and Economic Development in Cold Desert of Western Himalayas
(A Study of Spiti Valley of Himachal Pradesh)

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ABSTRACT This paper is based on a study in the Spiti sub-division of Himachal Pradesh and it aims at suggesting guidelines for development programme in such cold desert area.The environmental limitations of the cold desert restrict raising crops more than once in a year and that too under assured irrigation. The economic activities in the area also remain limited to summer season (April to September). The study suggested that to combat the environmental and ecological stress, the water conservation should find highest priority in our planning process for the overall development of the valley. Secondly, immediate afforestation is needed on large scale to cover the denuded, rugged, treeless uncultivable land for providing greenery, fuelwood and fodder. The domestication of cash animals and improvement of milch animals may open new vistas of economic activity in the desert region. Besides, the psycho-social approach is required to make the tribals aware regarding agricultural development and the enviromental degradation in order to develop the cold desert on economic front.

Little is known about the reality that lies behind the veil of ever-green, coniferous Himalayan Pir Panjal range. There are vast tracts of brown, yellow and blackish mountains with deep and dangerous gorges occasionally spreading into long plains behind the ever-green forests and mountains. These areas are having desert like conditions with no vegetation, loose and shallow sand like soil and have been, therefore, termed as Cold Deserts of Great Himalayas having arid and temperate climatic conditions. These deserts spread in an area of approximately 10,000 sq.km. extending from Baralacha pass (5,000 meters) in Lahaul and Spiti district covering the entire Spiti sub-division and extends upto Pooh sub-division of district Kinnaur. These areas have been administratively declared as tribal areas mainly for the purpose of development in view of their social and economic backwardness.

The development of such isolated and difficult area is a challenging task. Recently, the tribals of Cold desert received special attention of various developmental agencies like Desert Development Programme (1977) and Integrated, Tribal Development Programme (1980), however, it has been realised that the gains of these developmental activities could not percolate among the masses, to the desired extent. This calls for identification of constraints which inhibit the development of tribal economy. Hence the present study is aimed at acquainting with the environmental limitations of the cold desert area, the social and cultural characteristics of the inhabitants, their economic status and the agricultural development in the region.

Keeping this in mind the present study is undertaken in the Spiti sub-division of Lahaul and Spiti district which forms an integral part of the cold desert areas of Himachal Pradesh.

A two-stage stratified random sampling design was followed for the selection of the sample. The villages were selected as the primary sampling

unit and the households as the secondary and ultimate sampling unit. The household from the selected villages were stratified into three categories *viz*, small, medium and large on the basis of their land holdings as: Small <1 ha., Medium 1-2 ha. and large> 2 ha. Finally, a sample of 65 households, comprising of 30 small, 20 medium and 15 large, was selected.

The People

The inhabitants of the area are *Bodh* tribals who are also known as *Bhot*. They are basically Buddhists. They have more or less mongoloid features. Primogeniture is the rule among the Spitians. The area is very sparsely populated, according to 1981 census, the total population of the Spiti sub-division was 10,362 and the denisity of population was just one per sq. km. The sex ratio of the area is quite alarming: just 676 females per thousand males. The literacy rate is just 25 per cent.

ENVIRONMENTAL CONDITIONS

Location

Spiti lies east of Lahaul and Kullu at the extreme north-eastern corner of Himachal Pradesh between N latitude 31°-42' and 33° and E longitude 77°-37' and 78°-35'. The valley is adjoined on its eastern border by Tibet, on its north by Ladakh district of Jammu and Kashmir, on the western and southern by Lahaul subdivision and Kullu district, on its south-eastern boundary by the border district of Kinnaur. Kaza-the headquarters of Spiti is at distance of about 500 km. from the state capital, Shimla.

Topography

The Spiti sub-division is vastly different and more difficult in terms of terrain, climate and habitation than the regions surrounding it. It has its own mountain ranges which belong to the great and Mid-Himalayas. The average mean elevation of Spiti is about 4,570 metres. The villages are inhabited around occasional streams on flat pieces of land. At places, the higher valley slopes are covered with undulating alpine pastures which rise into mountains. With the exception of few pastures, the mountain slopes are generally bereft of any other kind of vegetation.

Spiti is famous for its various geological series for ammonite fossils. It is said to be part of the Tethys sea during pre-Cambrian times. In terms of area, the cold desert of Spiti may be too tiny as compared to four major south-western deserts: North America, Patagonia, Turkistan and the Gobi. But in terms of high mountains, extreme climate and poor economic conditions of the people, it is one of the worst scourged areas on earth.

Climate

Spiti has only two seasons—shortlived summer and a long freezing winter. The climate of Spiti is bracing though the days in the short summer are exceptionally hot, yet the nights are almost invariably cold. Snow may fall from September to April. The temperature goes down considerably during winter sometimes to the extent of —30°C and the summer temperature in these cold deserts rarely exceeds 30°C. The area is characterised by high velocity howling winds that lash the valley regularly with an average speed of 45-50 km/hr. The strong winds are very trying and the visitor who is exposed to their full fury has good cause to remember this, the face and hands if left unexposed being cut open and abraded, as if with a penknife.

In Spiti the rainfall is scanty (average 177 mm) and showers are very infrequent—the valley being almost quite beyond the influence of the monsoons. The only season in which moisture is obtained is the winter when snowfall is both heavy and frequent.

Soils

The soils of cold desert are generally poorly developed and alkaline in nature. The soils are generally dry and barren. They have been eroded and support scanty vegetation. The average organic matter content is quite low (about 2 per cent). In the cold desert, the precipitation is only in the form of snow and there is no splash erosion. The cultivated soils of Spiti desert are

located on gentle to moderately steep slopes having pH value around 8 and are coarse to medium in texture with abundance of stones. The inadequate soil moisture and soil erosion are the main problems of these lands.

Vegetation

In the cold desert Spiti, there are no forests except for some plantations raised recently by Forest Department. The vegetation of entire Spiti is sparse, scattered and discontinuous clearly showing the landscape with brown sand barren rocks. The only green patches soothing to the eyes are available around the villages with cultivated fields and clustered patches of *populus* and *Salix* plantations near *Gompas*. Before the winter sets in, caravans of men, women and beasts set out to collect fuel-wood. They remove all types of shrubs and thorny bushes and uproot every twig and shrub for fuel purposes. In addition, the Government supplies large quantities of fuel-wood, coal and kerosene at subsidised rates to cater the needs of local inhabitants.

Land Utilisation

Nearly two-thirds of the reported area of Spiti was under plough (Table 1). It has a single cropping season (monoculture) with cropping intensity to the tune of exactly 100 per cent which means not even a single metre of land was sown more than once. The area under forests accounted for 0.36 per cent of the total geographical area. However, there were no permanent pastures or grazing lands in the valley.

Table 1: Land utilisation pattern of Spiti *vis-a-vis* Himachal Pradesh, 1982-83

S. No.	*Particulars*	*Area (in'000 hectares)*	
		Spiti	*Himachal Pradesh*
1.	Geographical area by village papers	1684 (100.00)	3113.4 (100.00)
2.	Forests	6 (0.36)	808.6 (25.98)
3.	Not available for cultivation:		
	a) Barren and unculturable land	231 (13.71)	143.6 (4.61)
	b) Land put to non-agricultural uses	36 (2.14)	163.5 (5.25)
4.	Culturable waste	41 (2.43)	239.0 (7.68)
5.	Permanent pastures and other grazing lands	Nil (0.00)	1,088.9 (34.97)
6.	Land under miscellaneous trees, crops etc.	6 (0.36)	41.4 (1.33)
7.	Fallow land		
	a) Current fallows	244 (14.49)	43.1 (1.38)
	b) Other fallows	Nil (0.00)	13.9 (0.45)
8.	Net area sown	1120 (61.51)	571.4 (18.35)
9.	Area sown more than once	Nil (0.00)	386.5 (12.41)
10.	Total corpped area	1120 (66.51)	957.9 (30.77)
11.	Cropping intensity (%)	100	168

Note: The total area of Spiti according to Surveyor General of India (1981) was 7460 sq.km.

SOCIO-ECONOMIC CONDITION

Socio-economic Status of Sampled Households

The average size of holding in the study area was 1.44 hectares (Table 2). The per capita land in the study area, on an average, was worked out to be 0.23 hectare. It is interesting to note from the table that about 87 per cent of the total cultivated area was under irrigation. In the study area, the average family consisted of 6 persons. On the whole, 69 per cent of the family members were observed to be engaged in agriculture. The number of milch animals, per farm, increased from 0.9 on small farms to 2.10 on large farms. However, on an average, the number of milch animals per farm was 1.31. The number of sheep and goat, on an average farm, came out to be 7.40. The literacy rate was found to be 34 per cent which was less than the state literacy rate of 42 per cent. On an average the outstanding loan, per farm, was worked out to be Rs. 543. The average per capita income was Rs. 1435 which was quite low when compared to state as a whole (Rs. 2700).

Cropping Pattern

The existing cropping pattern in Spiti Valley is presented in table 3. A perusal of the table reveals that about 62 per cent of the total cropped area was devoted to cereals. It is evident from the table that barley was the most important cereal crop which accounted for nearly 47 per cent of the total cropped area on all farms. The area under potato was to the extent of 12 per cent. About 16 per cent of area was allocated to pulses *viz.*, kidney beans and peas. On an average, about 93 per cent of the total cropped area was sown and rest was kept as fallow. The average cropping intensity in the study area was worked out to be 92.55 per cent. The peculiar climatic and geographical features of the Spiti Valley inhibit growing of more than one crop in a year.

Average Yield

Table 4 presents the average yields of important crops in the study area. It is evident from the table that yields of crops were comparatively higher than the state average yields, which could be attributed to the fact that, in these areas crops were sown under assured irrigation during summer season.

Table 2: Socio-economic indicator of household in Spiti Valley, 1986-87

Particulars	*Size of farm*			*All*
	Small	*Medium*	*Large*	*Farms*
Size of holding (ha)	0.73	1.39	2.92	1.44
Cultivated area (ha)	0.62	1.21	2.26	1.18
Per capita land (ha)	0.14	0.23	0.39	0.23
Cultivated area under irrigation (%)	88.35	83.46	90.06	87.24
Family-size (No.)	5.32	5.92	7.52	6.01
Family members engaged in agriculture(%)	66.37	70.21	73.78	69.26
Milch animals (No.)	0.91	1.32	2.10	1.33
Sheep and Goats (No.)	5.21	7.06	12.23	7.40
Literacy rate (%)	33.31	32.68	38.39	34.29
Outstanding debt (Rs.)	425	603	717	543
Per capita income (Rs.)	1362	1401	1626	1425

Table 3: Existing cropping pattern in Spiti Valley, 1986-87 (In per cent)

Crops	*Size of Farm*			*All*
	Small	*Medium*	*Large*	*Farms*
Wheat (local)	3.20	4.81	3.26	3.71
Wheat (high yielding)	8.97	12.88	13.27	11.17
Barley	51.78	42.76	41.75	46.95
Potato	13.62	12.46	8.72	12.13
Peas	9.27	8.33	10.93	9.36
Kidney beans	6.31	5.76	6.46	6.18
Mustard	2.92	4.09	5.01	3.76
Net area sown (ha)	0.59	1.10	2.02	1.10
Per cent	(96.07)	(91.09)	(89.40)	(93.25)
Current fallow	3.93	9.01	10.60	6.74
Total cropped area	0.62	1.21	2.26	1.18
Per cent	(100.00)	(100.00)	(100.00)	(100.00)
Cropping intensity (%)	95.16	91.00	89.38	92.55

Note: Figures in the parentheses indicate percentages

Table 4: Average yields of important crops, 1986-87 (quintal/hectare)

Crops	*Size of farms*			*All*
	Small	*Medium*	*Large*	*Farms*
Wheat (local)	12.78	13.08	11.62	12.60
Wheat (high Yielding)	24.61	22.72	19.96	22.96
Barley	21.18	20.23	19.29	20.45
Potato	102.33	115.92	120.81	110.78
Kidney beans	12.55	11.99	11.13	11.91
Peas	12.89	11.78	10.83	12.07
Mustard	6.78	7.33	8.56	7.51

The average yield of wheat-local and wheat-HYV were recorded as 12.60 and 22.96 quintals per hectare. The per hectare yield of barley was noted to be 20.45 quintals. In case of kidney beans and peas the average yields were noted to be 11.91 and 12.07 quintals. The average yield of potato ranged from 102.33 quintals on small farms to 120.81 quintals per hectare, on large farms. The per hectare yield of potato on all farms, was worked out to be 110.78 quintals. The average yield of mustard was found to be 7.51 quintals per hectare.

Extent of Use of Modern Farm Technology

Agricultural development of any region

depends upon the adoption of new agricultural technology in that region. Therefore, the indicators representing the extent of adoption of modern farm technology on farms of cold desert were studied and have been presented in table 5. It can be noted from the table that on the sampled farms only 11 per cent of the total cropped area was under high yielding varieties. In the study area, only 18 per cent of the farmers were using fertilizers. However, the fertilizer consumption, per hectare, was around 18 kg. This is inspite of 50 per cent subsidy on fertilizers being given to the farmers by H.P. Government. It was observed that none of the sampled farmers was using chemicals for the control of weeds and insect-pests. Further, it is interesting to note from the table none of the farmers was using the recommended cropping pattern as well as the recommended package of practices. The proportion of cross-bred milch animals to total milch animals was as low as about 13 per cent. This is again in spite of adequate number of veterinary health care institutes located in the study area.

A perusal of the table with respect to farm-size reveals not any notable difference among small, medium and large farms for the use of modern technology on their farms.

Table 5: Extent of use of modern farm technology

Perticulars	*Size of Farm*			*All*
	Small	*Medium*	*Large*	*Farms*
Per cent of cropped under HYVsf (%)	8.97	12.88	13.27	11.17
Per cent of farmers using fertilizers (%)	13.33	20.00	26.66	19.40
Fertilizer consumption (Kg/ha)	18.95	16.60	17.73	17.94
Per cent of farmers using chemicals (%)	NIL	NIL	NIL	NIL
Per cent of cross-bred milch animals to total milch animals	10.23	12.07	18.61	12.73
Per cent of farmers using recommended cropping pattern(%)	NIL	NIL	NIL	NIL
Per cent of farmers using recommended package of practices (%)	NIL	NIL	NIL	NIL
Per cent of farmers	NIL	5	6.66	3.07

Constraints in Agricultural Development

Agricultural development is a pre-requisite to economic development of an area and the economic status of the people. Therefore, there is a need to identify the constraints which inhibit the agricultural development in the region and which would also enable the planners and policy makers to chalk out appropriate strategies for the development of such areas.

Geographical Constraints

The Spiti sub-division of Lahaul and Spiti district is more difficult in terms of terrain, climate and habitation. The arid climate, highly rugged conditions and high altitude make this region difficult for human habitation. The region is a typical mountain desert. Soil of Spiti is too dry and too barren to support plant life on its own. Due to severity of climate there is only one cropping season in the valley. The climate of an area is such that no forest is seen. However, vast stretches of land are lying unutilised due to non-exploitation of existing irrigation potential which ultimately bars the possibility of agricultural development.

Economic Constraints

In spite of strenuous efforts made by the State Government for the agricultural development of cold desert areas, it has been realised that improved technology did not make a significant dent in the study area and much remains to be done.

Table 6 summarises the constraints in the adoption of improved technology on different sizes of farms. It can be seen from the table that inadequate and untimely supply of farm inputs (HYV seeds and fertilizers) was one of the most severe problems of the study area, reported by 71 per cent of the farmers. This is attributed to

Table 6: Economic constraints in the adoption of improved technology (in per cent)

Particulars	Size of farm			All Farms
	Small	Medium	Large	
Inadequate and untimely supply of critical inputs	70	73	71	71
Small size of holdings	86	70	20	66
Scarcity of capital	73	70	47	66
Lack of proper credit facilities	60	65	60	62
Lack of irrigation	60	55	53	57
Inadequate extension services	53	50	27	46
Lack of technical know-how	63	45	13	46
Scarcity of labour during peak periods	27	35	73	40
Improved technology not profitable	60	60	27	52

heavy snowfall in the region as a results of which the transportation and communication is badly affected and inputs are not made available to the farmers in time. The problem of small holdings was reported by 66 per cent of the farmers, in general.

Scarcity of capital was found to be another big hurdle in the adoption of improved technology. The improved technology is capital intensive and, therefore, accounted for additional capital on the farms. Sixty six per cent farmers, in general, revealed scarcity of adequate amount of capital in the adoption of improved technology. This is attributed to the lack of proper credit facilities in the study area which was complained by as much as 62 per cent of the farmers.

The problem of inadequate irrigation was put forward by 57 per cent of the farmers. This can be attributed to non/slow adoption of improved technology on their farms. It was found that the extension services, were not able to cope up with requirements of the farmers and, therefore, 46 per cent farmers, in general, revealed inadequate extension services and thereby lack of technical know-how regarding improved technology. So much so that 52 per cent farmers revealed the adoption of improved technology to be non-profitable. However, the proportion of complainants decreased with the increase in the size of farm. In the study area, during peak period, human labour was found to be scarce for various farm operations thereby creating production problems.

PRIORITIES FOR DEVELOPMENT

The study suggests the following priorties for the overall development of the study area:

Since water is a pre-requisite to all the development activities like afforestation, agriculture and horticulture, the massive efforts should be made for creating additional irrigation facilities through conventional flow irrigation and lift schemes as also through energy sources like wind mills and solar pumps. Besides, to prevent the loss of useful soil, checkdams, checkwall spurs should be constructed for the proper terraining of *Nallaha*.

The land fit for cultivation needs to be properly terraced and given adequate organic manures to improve upon the soil structure and conserve soil moisture. Efforts should be made to erect stone walls to protect the crops from injuries from high velocity winds.

The denuded, rugged treeless uncultivable land at lower elevation calls for immediate afforestation on large scale for providing greencry, fuelwood and fodder etc. The plantation may be done after breaking the hard pan at 20-30 cm and filling the pits with proper soil-FYM mixture.

The domestication of some cash animals *viz.*, pashmina goats, angora rabbits for wool, rabbits for meat alongwith cross-bred animals and improved breeds of sheep and Yak may open new vistas of economic activity in the desert region. All these efforts require immediate attention to the provision of green and good quality fooder throughout the year. For this, the villagers should come forward to undertake the cultivation of forages near water sources. Secondly, the alpine pastures open to indiscriminate grazing should be put under rotational grazing system. Besides some more promising legumes should be introduced on these land.

A great scope has been envisaged for the diversification of agricultural activities. The area with

its typical agroclimatic conditions is virtually the glass house of the State deprived of various diseases. The valley has vast potential for the introduction of vegetable seed production. Thus, there is an urgent need to develop the cold desert areas, where irrigation facilities are available, for seed crops like potato, beans, peas and cabbage where seed borne diseases are a cause of considerable decline in the yield and quality of produce. This will not only improve the economy of the farmers of the cold desert region but will also be boon to the farmers of major vegetable and potato growing areas of the state and the country.

For this adequate and timely availability of critical inputs like seeds, fertilizers, chemicals and credit should be an aspect of exceptional importance in our planning process to improve the status of agriculture in cold desert areas.

The extension agencies are required to play a vital role in imparting technical guidance to the farmers regarding horticulture, olericulture and agriculture. Effective demonstrations on farmers fields should be conducted. Training programme with women participation be organised atleast once before the crop season on village level basis. In addition to this they should make earnest efforts in making a right sense of enviroment and ecology among the local inhabitants. In such areas it takes lot of time and hard efforts for a blade of grass to grow but it requires no time in uprooting the same for one or other use.

Above all, the psycho-social approach for the overall development of the study area, is required to be followed particularly to amend the local people's attitude towards their socio-economic development and their interaction with the world outside the valley. The teams of socal scientists should conduct appropriate social surveys in order to ascertain the social impact of various developmental programmes launched under Desert Deve lopment Project. Such surveys will also help to assess the social changes that have been brought about by the programme, which would be intimately linked to their economic well-being.

The non-conventional sources of energy *viz.*, solar and wind need to be harnessed for meeting the various requirements of the *hoi polloi*. There is an urgent need for substituting the traditional fuels in these areas. Therefore, in addition to solar cookers, solar water-heaters, solar dryers, fuelefficient utensils; the solar panel lights and community solar lighting system be provided in the valley.

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