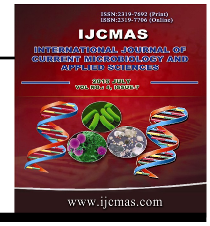

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Original Research Article

Vulnerability Assessment of Farming Community to Environmental Changes in Low-Hills of Himachal Pradesh in India

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A B S T R A C T

Keywords

Exposure, Sensitivity, Adaptive capacity, Natural resources, Vulnerability Index

Vulnerability index as a function of exposure, sensitivity and adaptive capacity at the household scales was developed to assess vulnerability of farming community. A questionnaire based survey was conducted during 2014 by taking 202 households across four blocks in two districts of low-hills zone of Himachal Pradesh. The quantitative and qualitative data was collected by employing participatory method. The indicators of vulnerability are weighted using Principal Component Analysis. In the low-hill zone, frequency of drought events, share of non natural resources based income and human assets registered highest weights of 0.68 , 0.98 and 0.89 among the indicators of exposure, sensitivity and adaptive capacity, respectively. In the region households vulnerability depended on socioeconomic characteristics such as education, infrastructure and income as well as access to capital assets. In the region, households situated away from the district headquarter were found to experience higher vulnerability as compared to those of near district headquarter. The study therefore, indicated that efforts need to be made to address farm issues at local level to enhance adaptive capacity of the households.

Introduction

Himachal Pradesh has a large repository of natural resources. It is the most important source of clean water for the people of Northern India. Snow and glacier melt during the summer season provide large inflows to five major river basins and their tributaries the crucial source of water supply for the people inhabiting in these basins. The availability of abundant water resources, fertile soil and suitable climate has led to the development of a highly agricultural based society in this region. In view of significance of agricultural sector and water resources for the State, its sensitivity to the vagaries environmental change makes it imperative for the planners and scientists to strategize as in case of any changes in the pattern of climate in the form of shift in the time period, frequency or magnitude, there can be substantial impacts on the overall economy of the State. Low hill and valley region of Himachal Pradesh comprise of number of ranges which run roughly parallel to each other for long distances and converge at places, meet and diverge again giving rise to small and longitudinal hills/hillocks. These ranges arise gradually from plains of adjoining states and the average landholding size for this group is 0.85 ha. Owing to these topographical conditions, the region is highly sensitive to environmental changes and the need arises to characterize the nature of environment vulnerability at the community level.

Environmental change is impacting the natural ecosystems and is expected to have substantial adverse effects mainly on agriculture on which 58 per cent of the nation's population still depends for livelihood. Agriculture has traditionally been the main livelihood strategy for most of the farmer communities in Himachal Pradesh. Thus environmental change is especially affecting farming communities which farm in ecologically fragile zones and rely directly on their immediate environments for subsistence and livelihood (UNFCCC, 2004). On this background, it is important to clearly understand and realize what is happening at the community level, because farming communities are the most vulnerable groups to environmental change.

According to IPCC 'Vulnerability' is a function of character, magnitude and rate of variation of system, climate to which a system is exposed, its sensitivity, and it's adaptive capacity. It has also been indicated that the assessment of vulnerability could also be drawn on a wide range of physical, biological and social science disciplines, and consequently employed variety of methods and tools (Bhattacharya *et al.*, 2006). Vulnerability assessment measures the seriousness of potential threats on the basis of known hazards and the level of vulnerability of societies and individuals. It can be used to translate early warning information into preventive action (IDNDR, 1999) and is a necessary element in early warning and emergency preparedness. Thus, Vulnerability Assessment is a key tool for informing adaptation planning and enabling resource managers to make such decisions. A framework has been developed for undertaking exercise to estimate the extent of vulnerability through the index based approach. The household was selected as the main unit of analysis because major decisions about adaptation to environmental change and livelihood processes are taken at the household level (Thomas *et al.*, 2007). This present study explored vulnerability of farming community by integrating quantitative analysis with qualitative information obtained from primary field survey. The study was conceived on the basis of contextual vulnerability which assesses the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of environmental change (Fussel, 2007; IPCC, 2007; Hinkel, 2011). The overall objective of this study was to assess the vulnerability of farmer communities to environmental changes in low-hills of Himachal Pradesh in India.

Material and Methods

Study area

Himachal Pradesh is a hill state with climate ranging from subtropical to dry temperate. In the state low hill subtropical region occupies about 35% of the geographical area and about 40% of the cultivated area. This region consists of foothills and valley area up to 800 meters above mean sea level. The soils of low hills are shallow brown and alluvial having light texture. The major crops of this region are rice, wheat, citrus, mango, litchi, guava, vegetables and barley. The average annual rainfall of this zone is about 130 cm.

Survey and data collection

To ensure representativeness of the sample selected in the low hills subtropical zone of Himachal Pradesh, two sites namely Kangra and Hamirpur falling in this zone were selected. The samples were selected by following stratified random sampling technique. The two study sites were stratified on the basis of distance from district headquarter.

In each district two administrative blocks were purposely chosen. In the selected districts the two selected sites were: one near to district headquarter and other away from the district headquarter. The study sites near the district headquarters were Rait and Hamirpur blocks in Kangra and Hamirpur district, respectively whereas, Fatehpur and Bhoranj blocks were the sites away from the headquarters of Kangra and Hamirpur district, respectively (Fig. 1).

Primary data from all the study sites were collected through structured questionnaire interviews with household heads and field observations. The information collected from the household heads on socio-economic variables comprised mainly of three broad areas of vulnerability namely exposure, sensitivity and adaptive capability. Data was coded and analyzed by using SPSS 16.

Sampling plan

Stratified three stage random sampling technique was adopted to select the sample for the study considering four administrative blocks as strata. Selection of panchayats was done in first stage and in second stage selection of villages was done from the panchayats selected in first stage and in the third and final stage ultimate households were selected. In the first stage of sampling, a complete list of panchayats in each administrative block was taken from the respective departments and out of these 30 percent of total panchayats were selected randomly for the study. Then in the second stage 20 percent villages were selected randomly from each panchayat. In the third and final stage of the sampling, a complete list of all the farm households in each of the selected villages was compiled. Ultimately 10 percent of farm households from each administrative block were proportionally allocated in the selected villages. Thus in all, a sample of 202 farm households of different blocks was selected.

Vulnerability indicators

The process of construction of vulnerability index progressed from selection of indicators, assignments of weights to them and finally their aggregation to form an index. Review of literature supplemented with participant observation and focus group discussions was used to select the indicators for exposure, sensitivity and adaptive capacity.

Vulnerability in this context is a physical risk and a social response within a defined geographic territory and is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity'' (McCarthy *et al.*, 2001; Dolan and Walker, 2003).

Exposure

Exposure refers to the extent and the characteristics as a system exposed to significant environmental change. Data was collected on farmers' perception on frequency of floods, landslides, droughts, frosts and hail events. It was hypothesized that higher the rate of change of climate variables and frequency of weather extreme events, higher will be the exposure of the households to environmental change.

Sensitivity

Sensitivity refers to the degree to which a system is modified or affected by an internal or external disturbance or set of disturbances (Gallopin, 2003). Trend on the number of portable water sources, percentage of land destruction by extreme events, number of livestock affected by extreme events, destruction of property by extreme events, share of income based on natural resources and share of off-farm income was considered to influence the sensitivity for the purpose of this study. It was hypothesized that higher impacts of extreme events will increase the household sensitivity. Higher share of natural resource based income i.e. farm income will increase the sensitivity of the household while higher share of off farm income will reduces the sensitivity.

Adaptive capacity

The adaptive capacity of a system or society reflects its ability to modify its characteristics or behavior in order to better cope up with existing or anticipated external stresses and changes in external conditions (Brooks, 2003). The presence of adaptive capacity is a necessary condition for the design and implementation of effective adaptation strategies so as to reduce the likelihood and the magnitude of harmful outcomes resulting from environmental changes (Brooks and Adger, 2005). Therefore, data on livelihoods assets like physical, human, natural, financial and social human capitals was collected.

Indicators for the physical assets considered were walking distance to the nearest road, distance to market and percentage of irrigated land. Walking distance to the nearest motor road, which in this case is also equivalent to the nearest marketplace, was assumed to be inversely related to adaptive capacity as household located far away from the markets is in a disadvantageous position for lacking the opportunity of income generation from alternative sources like non-farm labour, which help in securing livelihoods during the periods of food shortage or crop failure. Farther distance from the roads also symbolizes poor access to inputs as the service centers are located at the road-heads. In addition, greater distance from the motor roads was assumed as limited access to information as the marketplace acts as informal gathering centers where information exchange takes place, and also the formal institutions providing extension services are located there. Higher percentage of irrigated land was considered as lesser dependence on natural rain for agricultural purposes, which is becoming more unpredictable nowadays.

Human asset was assumed by its education level, salaried income and trainings or vocational courses attended by the family members because such indicators diversify household livelihood sources and help to buffer the risks posed by environmental changes on farm income. The quality of land possessed by the households was considered as an indicator of natural assets. With the assumption that such assets, by their own nature, are more vulnerable to environmental changes than other types of assets. Natural asset indicators considered were share of productive and unproductive land as well as bullocks because higher share of productive land means higher food self-sufficiency, thus higher adaptive capacity and reverse in case of unproductive land.

Gross household annual income and household savings were taken as the indicators of financial assets. The sum total of the farm and off-farm income was considered as gross annual income of the household because greater availability of income at disposal helps to maximize positive livelihood outcomes. Membership in CBOs improves the households' social networks and access to credit will provide social safety nets against all types of shocks and thus increases the adaptive capacity, therefore, the number of membership in formal community based organizations (CBOs) and access to credit represents social assets.

Calculation of the Vulnerability Index

The vulnerability of a given system largely depends on its exposure and sensitivity which may be formulated mathematically as follows:

$$V = f\,(\underset{(-)}{I} - \underset{(+)}{AC})$$

Where, V is vulnerability, I is potential impact, and AC is adaptive capacity. A higher adaptive capacity is associated with a lower vulnerability, while a higher impact is associated with high degree of vulnerability. Given the above equation, vulnerability is defined as a function of a range of biophysical and socio-economic factors, commonly aggregated into three components that estimate the adaptive capacity, sensitivity and exposure to climate variability and overall change in environmental conditions. By considering the theoretical determinants of provincial farming sector vulnerability and selected appropriate indicators for its capture, some form of standardization were carried out to ensure that all the indicators are comparable (Vincent, 2004). After standardizing the data, the weights were attached to the vulnerability indicators. In order to generate weights for the indicators, principal component analysis (PCA) was used.

PCA is a technique for extracting from a set of variables those few orthogonal linear combinations of variables that most successfully capture the common information. Following Filmer and Pritchett (2001), the first principal component of a set of variables were defined as the linear index of all the factors that captures the largest amount of information common to all of them. PCA was run for the selected indicators of exposure, sensitivity, and adaptive capacity separately. Stepwise PCA was run for the indicators of adaptive capacity. The first-step PCA was run for the indicators of each asset group separately to observe the relative importance of indicators within each asset category. From the weights obtained from first-step PCA, individual index values for each asset type was calculated. Second-step PCA was run using the index values for each of the five asset types to analyze which asset group contributes the most to the total adaptive capacity. Overall adaptive capacity index was calculated using the weights (loadings) obtained from the second step PCA run for the five asset categories. The normalized variables are then multiplied PCA starts by specifying each variable normalized by its mean and standard deviation and then multiplied with the assigned weights to construct the indices for exposure, sensitivity and adaptive capacity, each separately using the following formula:

$$I_j = \sum_{i=1}^{k} b_i \left[\frac{a_{ji} - x_i}{s_i}\right]$$

where, 'I' is the respective index value, 'b' is the loadings from first component from PCA (PCA1) taken as weights for respective indicators, 'a' is the indicator value, 'x' is the mean indicator value, and 's' is the standard deviation of the indicators. Finally, vulnerability index for each household was calculated as: V = E + S – AC, where, V is the vulnerability index, E the exposure index, S is the sensitivity index and AC is the adaptive capacity index for respective household. The overall vulnerability index facilitates inter-household comparison within the administrative blocks considered under study and inter-administrative block comparison within each district as well. Higher value of the vulnerability index indicates higher vulnerability. However negative value of the index does not imply that the household is not vulnerable at all. This index gives a comparative ranking of the sampled households and/or selected sites.

Results and Discussion

Exposure indicators

The weights obtained from PCA analysis for the exposure indicators (Table 1) ranged from 0.68 (drought) to 0.26 (landslides). The frequency of droughts registered the highest weight of 0.68 followed by floods (0.59), frost events (0.58), hail events (0.41) and minimum was with landslides (0.26). The study envisaged a positive relationship with the overall environmental hazard composite score and consequently the exposure index and further indicated that farming community of low-hills of Himachal Pradesh has become vulnerable to frequent occurrence of droughts. The highest vulnerability of farming community due to frequent occurrence of drought may be ascribed to rainfed farming (80%) in the region. Therefore, management of drought needs to be considered on priority for the upliftment of farmers. In addition to drought it is evident that increased frequency of flood and frost also contributing towards vulnerability of the region.

The exposure indicators in the region ranged from 0.98–1.58. The indicators registered significantly higher values at the blocks away from the district headquarters (Fatehpur and Bhoranj) than the blocks near to district headquarters (Rait and Hamirpur). Higher exposure index values for Fatehpur and Bhoranj blocks may probably be due to the less developmental activities because of their situation away from major commercial and administrative centres. Further survey study revealed that shallow soils embedded with gravels, pebbles and stones are having poor water retentivity, thereby making these blocks more prone to drought and floods. On the other hand, Rait and Hamirpur blocks located relatively nearer to commercial and administrative centres availed better development facilities and perceived less apparent risks and threats from the physical environment.

Sensitivity indicators

The weights for indicators of sensitivity are presented in table 2 which were found to range from 0.98 (share of natural based income) to 0.13 (number of livestock killed by extreme events). All the indicators had a positive relationship with sensitivity index except trend in availability of water resources and share of non natural resource based income which had a negative relationship. The absolute values for the weights indicated that share of natural resources based income and that of non natural resources based income contributed more to the sensitivity index than the other indicators in the region. However, the share of non natural resources based income decreased the overall household sensitivity as shown by negative sign of the weight, while higher share of natural resource based income has made the household more sensitive to environmental changes. Higher share of natural resource based income (composed of agriculture, livestock, forest, honey and handicrafts) increase the sensitivity of the household as these sources are more dependent on climate; while higher share of non-natural resource based remunerative income sources (composed of salaried jobs, non-farm skilled jobs, and remittances from abroad) reduces the sensitivity. These three income sources are categorized as remunerative sources because the return from these sources is comparatively higher than other sources of income.

In the region the share of non natural resource based income and availability of portable water resources found to register negative values of -0.98 and -0.13, respectively which has reduced the sensitivity of the community. Significantly higher mean values for indicators viz. physical property and percentage of land destroyed by extreme events for blocks away from the district headquarters when compared to those located nearer to the district headquarters indicated that household near district headquarters are less affected by loss of property due to their better equipped conditions for environmental changes. Trend in availability of portable water resources showed significantly higher mean values for Rait and Hamirpur compared to Fatehpur and Bhoranj block which might have reduced the sensitivity. Higher share of natural resource based income compared to non-natural resource based income in Fatehpur and Hamirpur blocks might have made the household more sensitive to impacts of environmental changes compared to Rait and Bhoranj blocks.

Adaptive capacity indicators

Examination of the weights for the five groups of indicators for adaptive capacity, figure 2 presented in revealed that among the physical assets distance to the market had the highest influence (-0.74) followed by distance to the nearest motorable road (-0.69), percentage of irrigated land (0.46). Distances to the nearest natural produce market and the nearest motorable road influenced the adaptive capacity negatively as indicated by the negative sign of their weights. Among the human assets, number of people with salaried employment got the highest weight (0.83) followed by number of people with vocational skills (0.80) and education level of the household head (0.02). The indicators for human assets had a positive influence on the adaptive capacity. Under natural assets category both percentages of productive (0.9) and unproductive land (-0.89) had the highest impact on adaptive capacity while the number of bullocks owned had the least (0.05). Percentage of unproductive land influenced the adaptive capacity negatively as indicated by the negative sign of the weight. The results are in line with the findings of Ravindranath and Sathaye (2002) who advocated that the adaptive capacity of dry land farmers having unproductive land is generally found to be very low. For financial assets, both monthly income and savings had equal influence (0.94) and the same picture is replicated under social assets category whereby the number of CBOs that the household had membership had equal weight with the household access to credit (0.73).

In low hill region of HP second-step PCA indicated that human assets contribute maximum towards adaptive capacity of the community followed by financial and social assets. Human assets are very important because they form the basis that creates employment opportunities for income generation whereas financial assets can be converted to other forms of asset when needed. Furthermore, local institutions and social networks are equally crucial as demonstrated by the importance of social assets. Physical and natural assets receives the least weightage, which is quite relevant given the fact that physical and natural resources are more impacted upon by environmental change and related disasters compared to other asset types.

The data presented in table 3 revealed that mean values were significantly higher in Hamirpur block for indicators of adaptive capacity viz. education level (12.41), number of persons in the household having salaried employment (2.5), gross monthly household income (46666) and savings (10554) while Fatehpur block had lowest mean values for these indicators. Mean values for irrigated (81.33) and productive land (93.88) were significantly higher in Rait block and lower in Bhoranj and Fatehpur block, respectively. The results indicated that Hamirpur block had comparatively higher asset possession while Fatehpur block had the least asset possession.

The index values for adaptive capacity and its components indicated that Hamirpur fared the best in two of the asset categories (human and financial) and second best in social and physical assets, thereby scoring the highest (0.55) in overall adaptive capacity (Fig. 3) followed by Rait and Bhoranj blocks. Fatehpur stands the last in terms of human and financial asset categories and thus had the least adaptive capacity.

Vulnerability Index

The combined effect of the exposure and sensitivity indicators together produce potential impact of environmental change on the farming communities in various blocks in low hills of HP. It is evident from figure 4 that Fatehpur block had highest potential impacts due to its high exposure to extreme events and higher sensitivity due to its more dependency on natural resources. This was followed by Hamirpur block. A mid-range potential impact was noticed for Bhoranj block. Rait block showed the lowest potential impacts, as they had experienced least exposure to extreme events and had the least dependency on the natural resources based income. The adaptive capacity index indicated large differences across the four blocks. Coping capacity is greatest in the Hamirpur block, with an index value of 0.55. Rait ranks a distant second with an index value of -1.43 followed by Bhoranj and Fatehpur block. Hamirpur block has the highest adaptive capacity because of the combined effects of high levels of literacy and income, and low levels of unemployment. Comparing blocks based on their potential impacts and adaptive capacities, keeping in mind that these parameters increase and decrease vulnerability, respectively, we can predict the most vulnerable areas. Fatehpur block has the highest level of vulnerability because of its high potential impact and low adaptive capacity whereas Hamirpur block has the lowest level of vulnerability because of its high adaptive capacity.

Table.1 Weights and mean values of exposure indicators in low-hills of Himachal Pradesh

Indicators	Weight	Aggregate (n=202)	Fatehpur (n=50)	Rait (n=50)	Hamirpur (n=46)	Bhoranj (n=56)	P- Value
Frequency of floods	0.59	1.19 (0.52)	1.36 (0.57)	1.10 (0.5)	1.15 (0.51)	1.16 (0.46)	0.06***
Frequency of drought	0.68	1.16 (0.51)	1.58 (0.50)	0.98 (0.47)	1.07 (0.39)	1.04 (0.42)	0.00*
Frequency of landslides	0.26	1.09 (0.52)	1.06 (0.65)	1.00 (0.49)	1.20 (0.45)	1.11 (0.45)	0.31
Frequency of hail events	0.41	1.21 (0.61)	1.40 (0.67)	1.02 (0.55)	1.20 (0.54)	1.23 (0.63)	0.02**
Frequency of frost events	0.58	1.13 (0.38)	1.26 (0.44)	1.12 (0.33)	1.02 (0.26)	1.12 (0.43)	0.02**

Note: Figures in parenthesis indicate standard deviation
*, **,*** indicates significant at 1%, 5% and 10% level of significance, respectively

Table.2 Weights and mean values of sensitivity indicators in low hills of Himachal Pradesh

Indicators	Weight	Aggregate (n=202)	Fatehpur (n=50)	Rait (n=50)	Hamirpur (n=46)	Bhoranj (n=56)	P- Value
Physical Property destroyed by extreme events	0.17	0.07 (0.26)	0.08 (0.27)	0.04 (0.2)	0.02 (0.15)	0.14 (0.35)	0.08***
Number of livestock killed by extreme events in the last 10 years	0.13	0.14 (0.47)	0.10 (0.30)	0.14 (0.40)	0.15 (0.42)	0.18 (0.66)	0.86
Trend in availability of portable water resources	- 0.13	0.59 (0.50)	0.52 (0.50)	0.58 (0.50)	0.76 (0.43)	0.52 (0.50)	0.05**
Percentage of land destroyed by extreme events in the last ten years	0.23	0.06 (0.33)	0.03 (0.11)	0.02 (0.12)	0.01 (0.03)	0.2 (0.6)	0.01*
Share of natural resources based income	0.98	11.44 (6.55)	13.14 (7.54)	9.91 (6.40)	13.4 (5.77)	9.68 (5.58)	0.002*
Share of non natural resource based income	-0.98	88.56 (6.55)	86.85 (7.54)	90.09 (6.40)	86.6 (5.77)	90.32 (5.58)	0.002*

Note: Figures in parenthesis indicate standard deviation
*, **,** indicates significant at 1%, 5% and 10% level of significance, respectively

Table.3 Status of adaptive capacity indicators in low-hills of Himachal Pradesh

Indicators	Aggregate (n=202)	Fatehpur (n=50)	Rait (n=50)	Hamirpur (n=46)	Bhoranj (n=56)	P- Value
Walking distance to the nearest motorable road	4.96	5.2	3.98	3.89	6.48	0.000*
	(3.32)	(3.18)	(2.44)	(2.36)	(4.13)	
Walking distance to the nearest agricultural produce market	21.41	18.68	16.38	20.39	29.18	0.000*
	(11.57)	(8.64)	(8.04)	(10.58)	(13.48)	
Irrigated land	76.5	76.25	81.33	76.63	72.28	0.025**
	(15.34)	(10.32)	(15.54)	(14.96)	(18.09)	
Education qualification of the household head	10.06	8.36	10.00	12.41	9.71	0.000*
	(3.6)	(3.35)	(4.01)	(2.53)	(3.2)	
Number of persons in the household having salaried employment	2.29	1.92	2.24	2.5	2.5	0.001*
	(0.86)	(0.80)	(0.80)	(0.72)	(0.95)	
Number of persons in the household with vocational training	0.16	0.16	0.18	0.24	0.09	0.235
	(0.37)	(0.37)	(0.39)	(0.43)	(0.29)	
Have bullock	0.14	0.14	0.12	0.09	0.21	0.298
	(0.35)	(0.35)	(0.33)	(0.28)	(0.41)	
Share of productive land	90.5	87.96	93.68	92.16	88.56	0.009*
	(10.08)	(8.44)	(6.30)	(10.32)	(12.81)	
Share of unproductive land	4.2	2.63	1.75	6.62	5.78	0.001*
	(7)	(3.66)	(4.55)	(9.95)	(7.23)	
Gross monthly household income	35945	24992	31247	46666	41112	0.000*
	(14463)	(10386)	(11957)	(11757)	(13244)	
Monthly household savings	6389.4	2827	3323	10554	8886.6	0.000*
	(4900)	(1967)	(1436)	(4957)	(4628)	
Membership to CBOs	0.18	0.12	0.20	0.22	0.18	0.62
	(0.38)	(0.33)	(0.40)	(0.42)	(0.39)	
Access to credit from credit & savings societies	0.91	0.92	0.96	0.93	0.84	0.15
	(0.29)	(0.27)	(0.20)	(0.25)	(0.37)	

Note: Figures in parenthesis indicate standard deviation
*, ** indicates significant at 1% and 5% level of significance, respectively

Figure.1 Map of study area showing selected administrative blocks in low-hills area of Himachal Pradesh

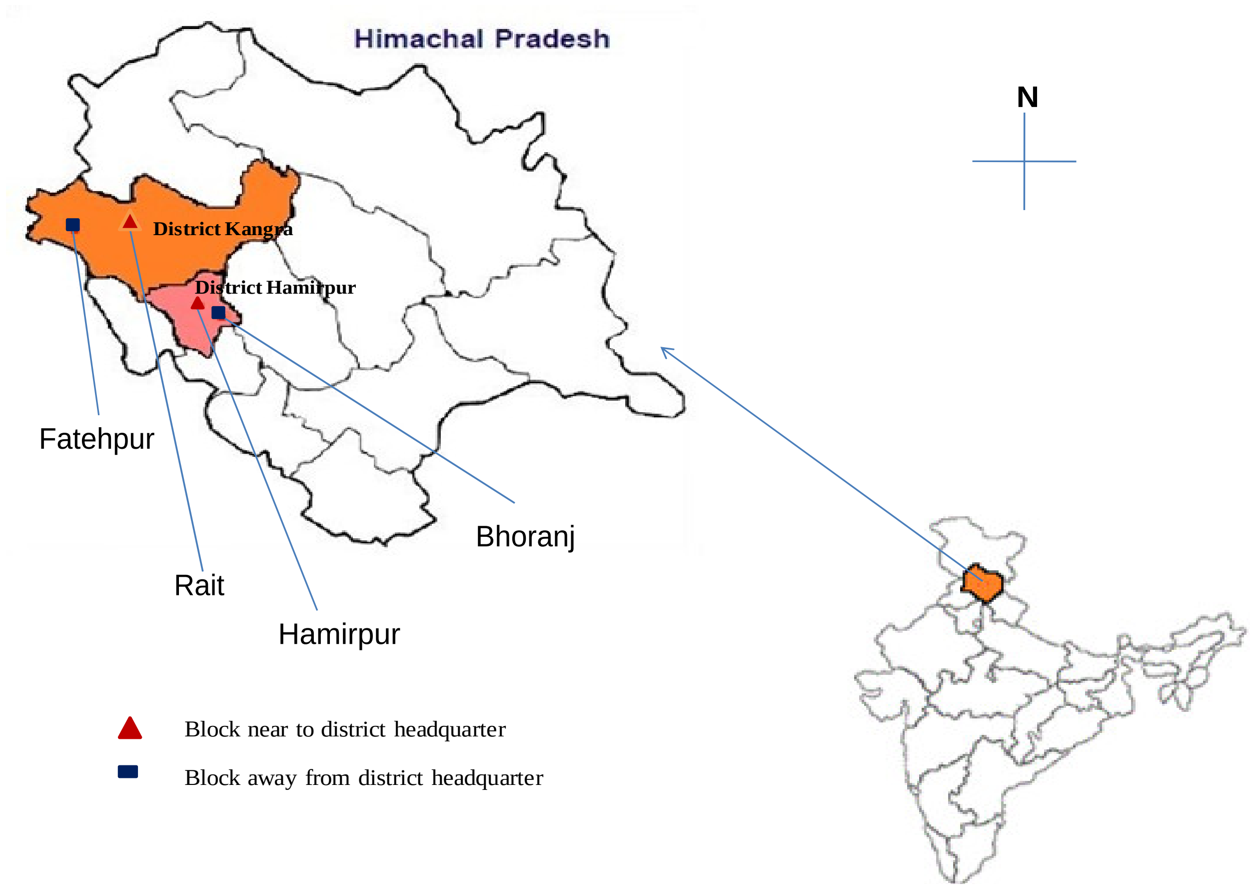


Figure.2 Structure of aggregate adaptive capacity index, composite sub-indices, and component indicators. (Figures in parenthesis are the loadings obtained from first principal component taken as weights for the respective indicators)

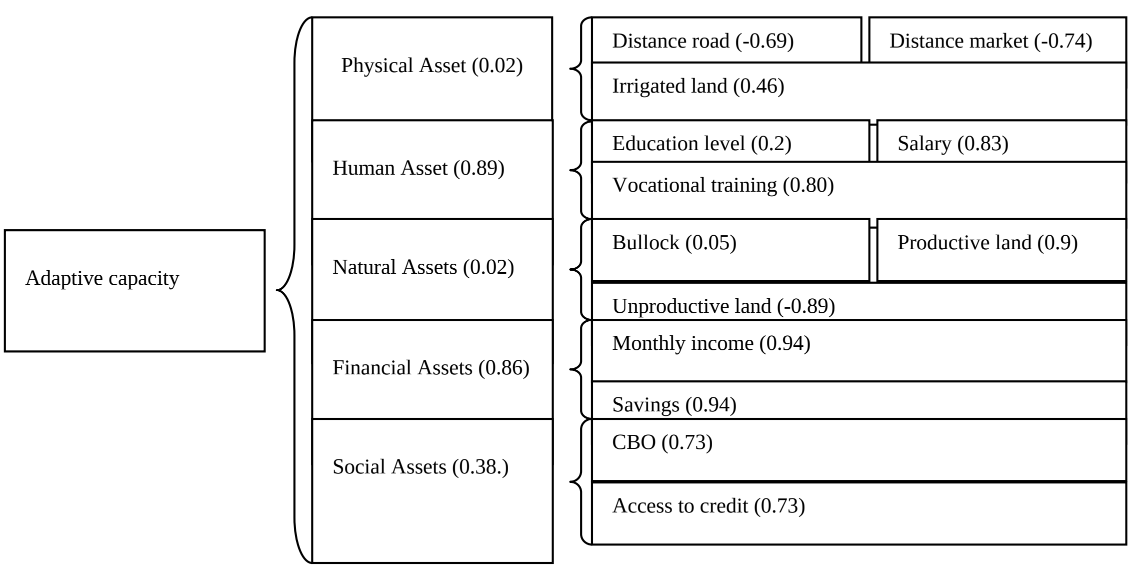


Figure.3 Index scores for adaptive capacity and it's components in low-hills of Himachal Pradesh

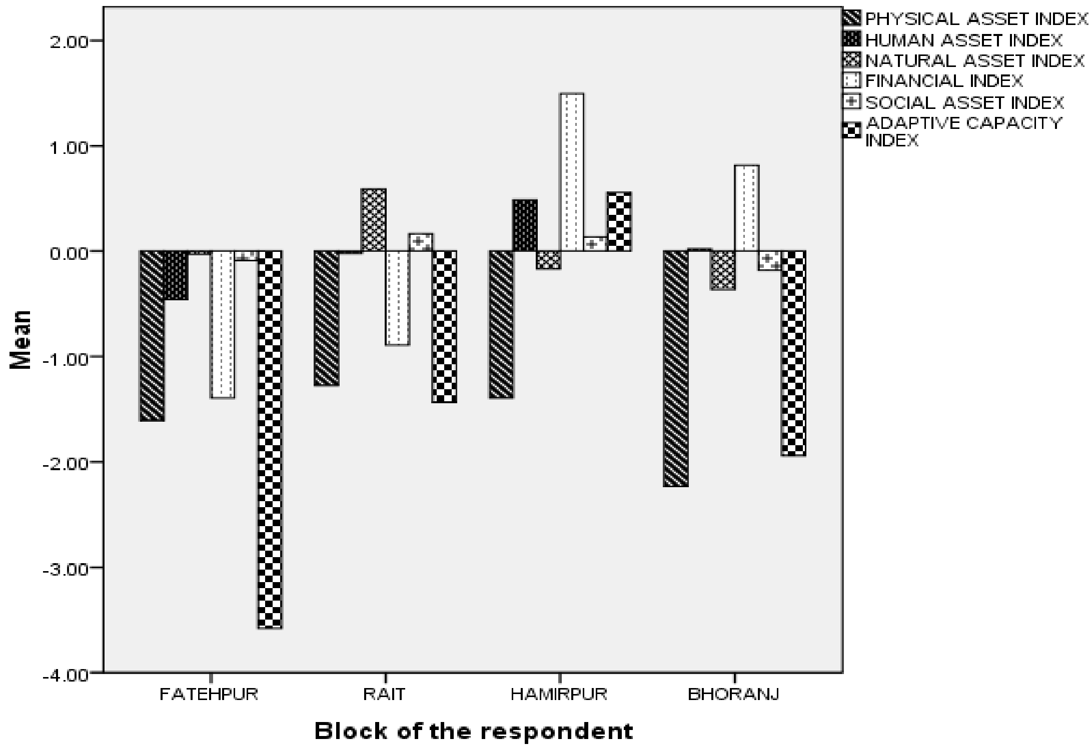
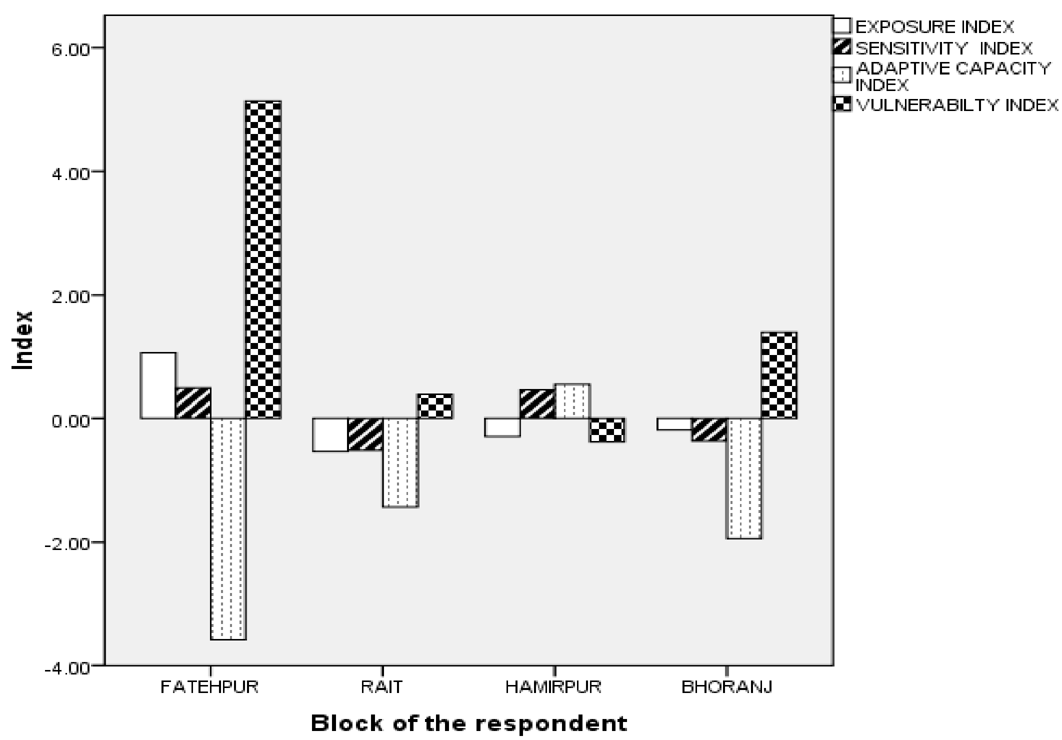


Figure.4 Index scores for vulnerability and it's components for the study sites in low-hills



Rait and Bhoranj block have the mid range vulnerabilities. It is evident from the figure 4 that the order of vulnerability index was: Fatehpur > Bhoranj > Rait > Hamirpur.

Further examination of the results revealed that study sites near the district headquarter (Hamirpur and Rait) were less vulnerable compared to those located away from the district headquarter (Bhoranj and Fatehpur). This may be ascribed to relatively more engagement of households towards off farm income generating activities and their education level. Further the extensive social networks and access to both bonding and bridging social capital, households near to district headquarter were less prone to vulnerability. In comparison, households away from district headquarters have low educational standards which are acting as a limiting factor to build the capacity of a household to increase their potential for non-farm livelihood activities (Paavola, 2008) and consequently low income levels. Moreover, households in these far away areas depend more on natural resources as source of their livelihoods which are becoming more susceptible to environmental changes and consequently increasing their vulnerability.

It is inferred from the present study that in low-hills of Himachal Pradesh households near to district headquarter because of alternative livelihood options are less vulnerable than those situated away from district headquarters due to low levels of human, natural, financial, physical and social capital assets and more dependency on natural resources. Therefore adaptive capacity of people residing away from district headquarter need to be enhanced on sustainable basis by creating facilities of water harvesting and other infrastructure to reduce the pressure on natural resources.

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