**Analysis of Livelihood Strategy Variation in Rudra Prayag district of Garhwal Himalaya: Implications for Poverty Reduction**

**Abstract:**

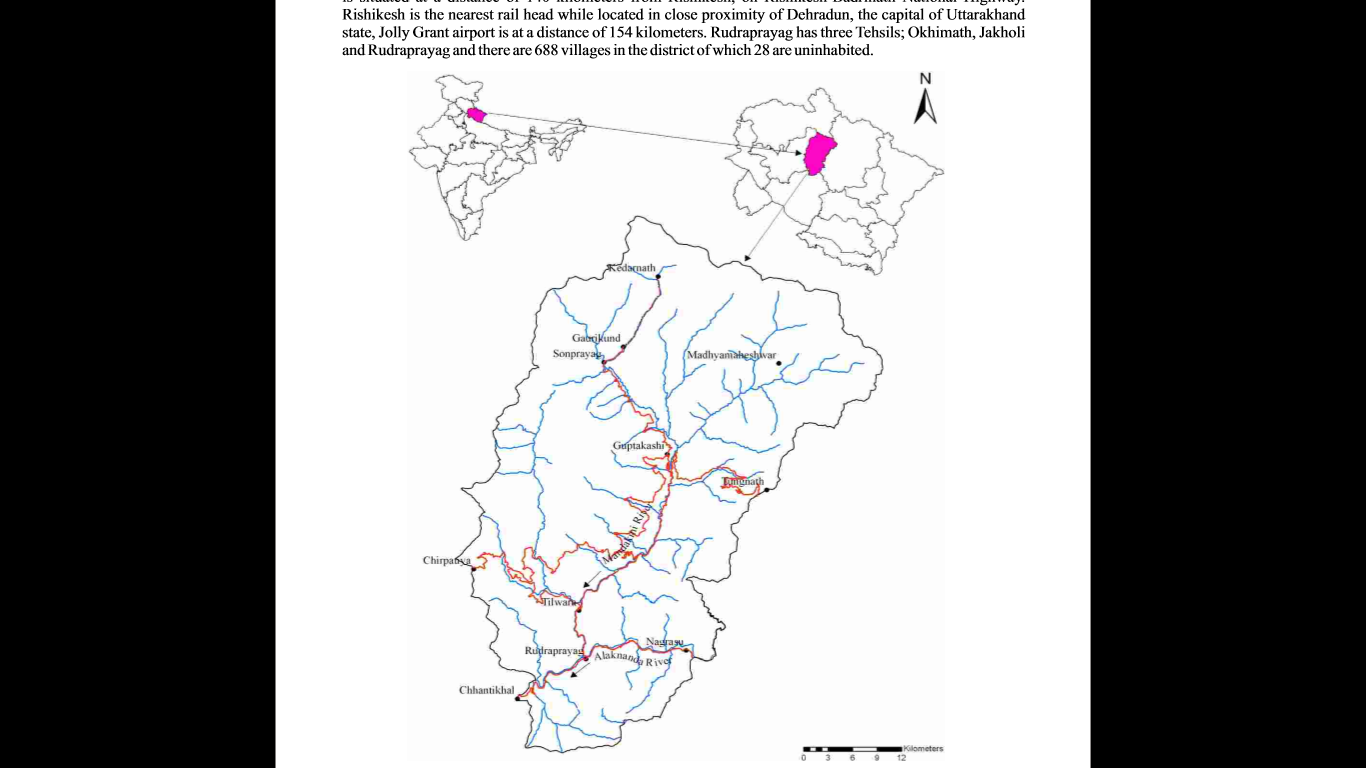
This paper has emphasis on, to understand the variation of livelihood strategies within and between the blocks to understand the quality of life in the villages of district Rudra Prayag. The study also identifies the factors that are interlinked with the socio-economic attributes of the people which involved in various income generating activities. This analysis is essential to understand the mechanism of livelihood strategy changes within and between the blocks of district Rudra Prayag. The result of the study shows that people are mainly dependent on tourism, agriculture, animal husbandry and vegetable cultivation for their livelihood. A random sampling method was used to select the villages. Semi-structured questionnaire and interview method were used to understand the importance of resources for livelihood generation. The data gathered from each selected village was compiled and analyzed by using SPSS 16.A higher proportion of household (57.6%) of Agustmuni block depends on agricultural activities while the majority of people of Jakholi and Ukhimath block depend on remittances (65.1) and agriculture (55.8) respectively. Analysis of the socio-economic characteristics of rural households reveals that age, labour endowment and education in terms of access to basic infrastructure are some of the barriers that poor households face to enter into high-return livelihood strategies.

**Keywords:** Sustainable, Livelihood, Remittances, Subsistence farming

**1. Introduction:**

Uttarakhand, in spite of being a small state, has certain key features that make it distinct from other states of the country and highlights its potential for development. All the hill districts have subsistence farming as their main economic activity. Due to subsistence livelihood, migration and a remittance-based economy operate in the hill districts. They are land-locked with huge distance between the markets and resources. Because of these constraints, traditional agriculture cannot be the lead sector for development. Thus, the state faces the challenge of promoting livelihoods to minimize migration through local employment and income generation, and to enhance the quality of life of people living in villages. The positive features of these hill districts are that they have enormous potential for tourism, a suitable climate for high-value agriculture, and a pleasant environment due to 60 percent forest cover. These have to be harnessed for a development strategy (Mittal *et al.*, 2008).

Many studies have focused on the analysis of livelihood strategies adopted by the rural people (Thennakoon, 2004; Shah *et al*., 2005; Adi, 2007 and Babulo *et al*., 2008). Livelihood strategies denote the range and combination of activities and choices that people make and undertake – ways of combining and using assets in order to achieve their livelihood goals. The concept of ‘sustainable livelihoods’ is increasingly important in the development debate. Sustainable livelihoods are achieved through access to a range of livelihood resources which are combined in the pursuit of different livelihood strategies (agricultural intensification or extensification, livelihood diversification and migration). Central to the framework is the analysis of the range of formal and informal organizational and institutional factors that influence sustainable livelihood outcomes (Scoones, 2005). The concept of sustainable livelihood approach was first introduced by Brundtland Commission on Environment and Development in 1987 and later expanded at United Nations Conference on Environment and Development in 1992 (IISD, 2013). As a concept, sustainable livelihoods approach is held to provide a more rounded picture of the complexities of living and surviving in poor communities than understandings based on measures of income, consumption and employment (Brocklesby and Fisher, 2003). A livelihood comprises the capabilities, assets and activities required for a means of living and it is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base (Chambers and Conway, 1992; Scoones, 1998). Vulnerability of rural households to shocks affects their livelihood assets and options (Kalaba *et al.*, 2012). The shocks of poor households is being addressed by devising mechanisms such as selling productive assets, temporarily reducing consumption, or searching for off-farm employment to buffer their consequences (Dercon, 2002). The adverse effect of shocks is generally more severe for the poor who are less insured against shocks and therefore are more likely to reduce consumption than their wealthier counterparts (Jalan and Ravallion, 1999).

****Low and declining farm productivity on one hand, and growing opportunities for employment in other part of country on the other, is encouraging more and more people to migrate to jobs outside of hill districts. Between one third and one half of households send migrants and, as it is mainly men who migrate,

Map 1 : Study Area

this places more and more of the burden of farm labour, as well as domestic work on women. Lack of labour, low productivity and wild animal damage are all contributing to land being abandoned, and it is said that as much as 30% of land in the hills that was once used to grow crops is no longer in production (ILSP, 2011). This study analyzes the livelihood strategy planning within the districts and implications for poverty reduction.

**Study Area**

The present study focuses on Rudra Prayag district of Uttarakhand that falls in Lesser and Higher Himalayan terrain. The study area is situated in the north western part of the Garhwal Himalaya. Administrative boundaries of the district are delimited by 30019' to 30049' N latitudes and 78049' to 79021' E longitudes. The district has four tehsils (Ukhimath, Jakholi, Rudra Prayag and Basu Kedar (newly formed)) and has three development blocks viz. Agastya Muni, Jakholi and Ukhimath and there are 688 villages in the district out of which 35 are uninhabited (Census of India, 2011).

**2. Material and Methods**

The present study was carried out in Rudra Prayag district of Garhwal Himalayan region. This study was intended to address the household level livelihood strategies and adoption pattern of different agriculture-based technologies/innovations. This study is based on primary data and analysis of these data. For the collection of primary data, a Multistage random sampling method was used and a complete inventory made at household level for each selected villages with the help of semi-structured questionnaires and personal interviews with local mature and knowledgeable persons. 64 villages were randomly selected from all the three blocks of district Rudra Prayag for collection of primary data (Table 1). Primary data were collected from 604 randomly selected households in between August 2014 and June 2016. Data collection on basic household's attributes such as gender of household head and income, various technologies and government services used by farmers were gathered. All the respondent participated for this study were read about the purpose of the interview verbally and prior oral consent was obtained. The data were analyzed by using SPSS 16 software.

**Table 1: Sampling distribution in three blocks of district Rudra Prayag on altitudinal basis.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Block** | **Altitudes (above mean sea level (amsl)** | **Number of Villages** | **Number of Household** | **Percentage of sampling distribution (%)** |
| Agustmuni | High (>1650 amsl) | 5 | 66 | 10.93 |
| Middle (1151-1650 amsl) | 7 | 71 | 11.75 |
| Low (650-1150 amsl) | 15 | 135 | 22.35 |
| Jakholi | High (>1650 amsl) | 6 | 63 | 10.43 |
| Middle (1151-1650 amsl) | 4 | 41 | 06.79 |
| Low (650-1150 amsl) | 6 | 51 | 08.44 |
| Ukhimath | High (>1650 amsl) | 11 | 104 | 17.23 |
| Middle (1151-1650 amsl) | 7 | 56 | 09.27 |
| Low (650-1150 amsl) | 3 | 17 | 02.81 |
| **Total** | **64** | **604** | **100** |

**2.1. Determining the Livelihood Diversification Index**

Livelihood diversification, being an important livelihood strategy adopted by developing countries, is propitious in the reduction of vulnerability while ensuring food safety and reducing the threat of famine. A great interest in the practice of livelihood diversification has recently been seen in developing countries (Knutsson and Ostwald, 2006). Diversification within agriculture, combining agriculture with other activities, animal husbandry and labour are the primary methods practiced by farmers in livelihood diversification due to increasing populations, reducing agricultural productivity. Two major categories of livelihood diversification agricultural and non-agriculture with ten sub categories e.g. agriculture produce sale, livestock and livestock produce sale, salaried job, wage labour, remittances, tourism, carpentry/masonry, business/trade, pensions and social benefit schemes were determining.

**2.2. Model Estimation of Livelihood Strategy Sustainability (Binary logistic)**

In this study, logistic regression is used to describe the relationship between livelihood strategies and livelihood assets. When using the logistic distribution, we need to make an algebraic conservation to arrive at our usual linear regression equation, the logistic regression model will be (Hosmer and Lemeshow, 2000):

**Where,** p is the probability, b0 is the constant, and bi (i=1,2,3,……m) is the regression coefficient. In practice the dependent variable (p) is not continuous. Therefore, we convert P into the probability ratio (Ω) of non-agricultural livelihood strategies. The logistic formula is stated as follows:

**Where,** In symbol refers to a natural logarithm, and Ω is called log it (p). Then we further obtain the following equation:

**where,** is our familiar equation for the regression line. p can also be computed from the regression equation. Therefore, if we know the regression equation, we could theoretically calculate the expected probability for a given value of Ci. Eq. (6) is transformed as follows:

**where,** exp is the exponent function, and it is opposite to the natural logarithm. We are estimating the probability (e.g. non-agriculture and agriculture strategy), because the value of Ci increased and decreased in one unit. The derivative transformation of Eq .(7) is

where, exp (bj) is the elasticity of probability, and it will change when Ci increases or decreases by one unit. Here we define exp (bj) as the sustainability of livelihood strategies to livelihood assets. The explanatory variable (Ci) includes human, natural, physical, financial and social asset. Based on the Eq. (7), we can calculate the exp (bj) value. It should be noted, however, there is a positive relationship between livelihood asset and non-agriculture livelihood strategies if the regression coefficient is negative. This means that the probability of agricultural livelihood strategies is increases by exp (bj) times as the livelihood assets (Ci) increases by one unit. SPSS 16 is used to conduct statistical analysis in this study.

**3. Results and Discussion**

The way a household copes with environmental changes and withstands stressful situations directly depends on the availability and accessibility of the livelihood assets. A livelihood strategy is, to a large extent, the ways in which livelihood assets are arranged and selected (Fang *et al.,* 2014). Therefore, it is to say that different combinations of livelihood assets result in different abilities to follow livelihood strategies. In order to further understand the determinants of each livelihood strategy and compare the differences in sustainability in three altitudinal zones within three blocks, we divide livelihood strategies into two categories- farm and non-farm strategies. Table 2 clearly illustrates that the levels of livelihood assets possessed by households are closely related to livelihood strategies. Natural and human assets have positive effects on agricultural livelihood strategies, whereas financial and social assets have positive effects on non-agricultural livelihood strategies. The sustainability of livelihood strategies to assets varies greatly between and within blocks. An econometric analysis was carried out applying data from a random sampling of 604 households in the three altitudes of three blocks in Rudraprayag district to test the hypothesis. With the help of binary logistic regression applied to the asset-explanatory variables, the primary factors that determine a household’s livelihood strategy and its reliance on asset endowments were identified. The analyses indicate that different access to or endowment of livelihood assets is an important factor that determines the choice of a household’s livelihood strategy.

**3.1. Calculating Index in the Sustainable Livelihood Framework**

Table 2 shows that the gender of household head has the maximum weight value (0.87) within all the altitude of three blocks, in terms of human capital in the evaluation index system of the Sustainable Livelihoods Framework for rural households. As most of the families were male headed families. The water facilities has a maximum weight value of 0.87 because of the fact that majority of household has their personal tap within house and the household which has no personnel tap fetch water from a distance of less than 0.5 Km. with year around availability of water, in the study area. The energy availability has the maximum weight value 0.95. This is because of the fact that around 99% of household have the electricity connection and access to LPG but the LPG use is very limited in villages due to irregular supply and comparatively high cost from urban areas (due to extra transport charges from delivery post to home). Household savings has a maximum value of 0.55, due to better facilities of banks, insurance and large population of livestock which provide income source for poor farmers round the year and also provide liquidity during emergencies or crises. The organizational membership has the maximum value 0.49. Therefore, the education level, household assets, household income, and financial support, affect the livelihood level of farmers.

**Table 2: The effective index value of measuring indicators in the district**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Household Assets** | **Indicators** | **Agustmuni** | | | **Jakholi** | | | **Ukhimath** | | |
| **High** | **Middle** | **Low** | **High** | **Middle** | **Low** | **High** | **Middle** | **Low** |
| **Human Assets (C1)** |  | **0.42** | **0.40** | **0.38** | **0.36** | **0.38** | **0.44** | **0.40** | **0.36** | **0.40** |
| HHGen | 0.73 | 0.79 | 0.75 | 0.83 | 0.85 | 0.80 | 0.87 | 0.70 | 0.71 |
| HHAge | 0.54 | 0.55 | 0.58 | 0.45 | 0.47 | 0.65 | 0.55 | 0.62 | 0.50 |
| HHEdu | 0.41 | 0.37 | 0.49 | 0.30 | 0.35 | 0.40 | 0.35 | 0.36 | 0.38 |
| FamilySize | 0.17 | 0.19 | 0.16 | 0.15 | 0.18 | 0.17 | 0.16 | 0.18 | 0.17 |
| Family Labour Ability | 0.51 | 0.46 | 0.45 | 0.42 | 0.47 | 0.60 | 0.37 | 0.37 | 0.41 |
| ***Health*** | ***0.27*** | ***0.25*** | ***0.21*** | ***0.24*** | ***0.25*** | ***0.22*** | ***0.22*** | ***0.22*** | ***0.25*** |
| Family Education | 0.48 | 0.48 | 0.35 | 0.37 | 0.38 | 0.59 | 0.47 | 0.33 | 0.59 |
| Vocational Training | 0.23 | 0.14 | 0.07 | 0.14 | 0.07 | 0.06 | 0.18 | 0.09 | 0.18 |
| **Natural Assets (C2)** |  | **0.29** | **0.36** | **0.33** | **0.37** | **0.41** | **0.36** | **0.35** | **0.34** | **0.32** |
| Land Holding | 0.33 | 0.35 | 0.27 | 0.37 | 0.49 | 0.30 | 0.33 | 0.23 | 0.29 |
| Irrigated Land | 0.03 | 0.18 | 0.12 | 0.05 | 0.14 | 0.15 | 0.05 | 0.03 | 0.01 |
| ***Environmental condition*** | ***0.25*** | ***0.29*** | ***0.29*** | ***0.31*** | ***0.38*** | ***0.34*** | ***0.36*** | ***0.35*** | ***0.28*** |
| **Physical Assets (C3)** |  | **0.47** | **0.51** | **0.52** | **0.46** | **0.49** | **0.50** | **0.47** | **0.50** | **0.46** |
| House type | 0.79 | 0.81 | 0.89 | 0.78 | 0.70 | 0.84 | 0.85 | 0.90 | 0.79 |
| Toilet | 0.89 | 0.93 | 0.96 | 0.70 | 0.78 | 0.73 | 0.85 | 0.86 | 0.82 |
| ***Energy*** | ***0.85*** | ***0.95*** | ***0.94*** | ***0.71*** | ***0.80*** | ***0.92*** | ***0.81*** | ***0.91*** | ***0.79*** |
| Road | 0.33 | 0.37 | 0.39 | 0.67 | 0.35 | 0.51 | 0.38 | 0.51 | 0.29 |
| Household Assets | 0.09 | 0.11 | 0.08 | 0.09 | 0.32 | 0.11 | 0.11 | 0.12 | 0.23 |
| Transport | 0.38 | 0.43 | 0.50 | 0.37 | 0.30 | 0.29 | 0.41 | 0.45 | 0.24 |
| Communication | 0.95 | 0.94 | 0.96 | 0.73 | 0.85 | 0.90 | 0.93 | 0.82 | 1.00 |
|  |  |  |  |  |  |  |  |  |  |
| Access to Market | 0.23 | 0.53 | 0.40 | 0.44 | 0.54 | 0.43 | 0.34 | 0.43 | 0.46 |
| ***Access to Education*** | ***0.49*** | ***0.67*** | ***0.62*** | ***0.49*** | ***0.74*** | ***0.54*** | ***0.58*** | ***0.58*** | ***0.44*** |
| Access to Health facilities | 0.38 | 0.24 | 0.47 | 0.44 | 0.29 | 0.55 | 0.29 | 0.41 | 0.29 |
| Animal health care centre | 0.49 | 0.28 | 0.30 | 0.40 | 0.44 | 0.53 | 0.29 | 0.34 | 0.31 |
| Agriculture tools and equipment | 0.07 | 0.10 | 0.06 | 0.05 | 0.02 | 0.06 | 0.07 | 0.09 | 0.06 |
| Government Services (e.g. Horti/Agri) | 0.11 | 0.20 | 0.26 | 0.17 | 0.20 | 0.06 | 0.19 | 0.14 | 0.24 |
| **Financial Assets (C4)** |  | **0.41** | **0.35** | **0.34** | **0.33** | **0.35** | **0.31** | **0.41** | **0.36** | **0.40** |
| Savings | *0.49* | *0.47* | *0.45* | *0.45* | *0.48* | *0.43* | *0.55* | *0.44* | *0.48* |
| Credits | *0.42* | *0.29* | *0.29* | *0.21* | *0.25* | *0.22* | *0.37* | *0.33* | *0.43* |
| Income Sources | *0.31* | *0.30* | *0.28* | *0.32* | *0.32* | *0.27* | *0.31* | *0.32* | *0.31* |
| **Social Assets (C5)** |  | **0.36** | **0.25** | **0.32** | **0.37** | **0.36** | **0.40** | **0.40** | **0.27** | **0.25** |
| Friends/ Neighbour | 0.41 | 0.31 | 0.39 | 0.35 | 0.37 | 0.43 | 0.42 | 0.30 | 0.29 |
| Membership (SHGs, CBOs, NGOs, Farmers federation, political party etc.) | 0.36 | 0.20 | 0.33 | 0.48 | 0.49 | 0.47 | 0.46 | 0.23 | 0.35 |
| Reciprocity and Exchange | 0.32 | 0.25 | 0.24 | 0.27 | 0.22 | 0.29 | 0.31 | 0.27 | 0.12 |

**3.2. Analysis of the Livelihood Assets**

The data used in this study was acquired and calculated by way of a social survey that was carried out in three blocks of district Rudra Prayag on altitudinal basis. The object of the investigation is households who live in different altitudinal

zones of three blocks in the district under examination and the design of questionnaire that includes the aforementioned five livelihood assets of household. A total of 604 questionnaires were used for collection of data. General scores were calculated by means of an Index on the basis of the standardized process of the above data. /

|  |  |
| --- | --- |
|  |  |
|  |  |
| **Figure 1: Livelihood pentagons describing the status of five capital assets (human, natural, physical, financial and social) in district Rudra Prayag on altitudinal basis the higher, middle, lower and overall.** | |

The livelihood status of each block was summarized in terms of different pentagons describing the five capital assets; human, natural, physical, financialand social,(Fig. 1). Marked differences were observed within and between the blocks, in particular between the three altitudinal zones. Of the five livelihood assets, in all the altitudes (high, middle, low) of

district physical asset possessed the highest value (0.47, 0.51, 0.52 respectively) (Fig. 2, Table 2) however, the contributing indicators had differential share for all the altitudes. The higher physical assets index shows that the household have a better access to physical assets such as Pakka houses, better toilet facilities, energy availability, access to education, market, road and other necessary infrastructural facilities. The combination of these indicators provides a higher Physical security index for higher altitude villages. This result indicated that although households were among those with low incomes and even having an income below the poverty line, but their basic needs such as home condition (almost pakka houses), household possession, and access to water resources and electricity were adequate. The infrastructural facilities in the whole block are also adequate in terms of presence/quantity but the services are very poor in quality e.g. health center is available but lack of professional health service provider, almost all the villages have road facility but lack of good transport services creates health hazard and excess crop wastage. This represents that even area has good quantity of physical assets but there is a strong need to strengthen the access of these services which enhances the production and lifestyle in order to improve the livelihood of farmers. The area is under the early flooded zone and its lower altitude was highly affected by the event and about 17 Hectare agriculture land was washed away. Of the five livelihood capitals, financial capital provided the most significant influence. The lack of financial asset would inhibit farmers to increase production scales and develop infrastructures that would, consequently, make it difficult to achieve livelihood diversification. Lending policies to farmers should produce a certain offset by improving investments, strengthening the effect of cooperative organizations and associations, and improving the financial capital of farmers overall. This would enable motivation in the improvement of other capitals, thereby contributing to the improvement of the livelihood level of farmers.

As for human asset, highest value is observed for higher altitude (0.42) followed by middle (0.40) and lower (0.38). The quantity and quality of human asset directly determine the ability and scope of the household to control the other types of capital (DFID, 1999). Eight indicators were selected in the study to measure human asset: household size, household labour ability, gender of household head, the age of the household head, the highest education of the household head, the maximum years of education of household members and family health status. Among the indicators to represent human asset in this study is the high education level attain by household members including head of household (HH) affect the wellbeing of household. Education level of HH reflects the level of awareness of the importance of higher education of children, access to information and capability to improve family economic status. From the analysis, it was showed that maximum 36.6% of the HH has no qualification. The assistances particularly in terms of financial support or subsidies were given by the government at the present time might be appropriate for the poor that having low sustainable livelihood index (SLI) in most of the livelihood’s asset. However, this kind of assistance does not guarantee the sustainability of the poor’s livelihood, otherwise it will promote their reliance on government assistance. Assistance in term of entrepreneurial project or vocational training is the better safeguard to the sustainability of the poor’s livelihood. Training and intensive coaching are necessary to increase their technical knowledge and skill to ensure the sustainability of the scheme and thus the sustainability of their livelihood. Moreover, to address this problem in the long term, it is necessary to raise awareness of education among the poor children.

Natural asset possessed relatively low index value in higher and lower altitudes (0.29 and 0.33 respectively) compared to physical, financial and human assets since accessibility of financial capital requires human capital for more sustainability of natural assets and certain social capital as well. The natural asset was slightly higher (0.36) in middle altitude. The natural asset is the strength of the mountainous but the region is vulnerable to this resource. This can be attributed to the relatively poor climatic conditions (erratic rainfall, landslide/land erosion etc.), poor quality of soil, the lack of good access to grazing land due to protected forest, poor means for irrigation (maximum rainfed area) and the small average plot size. Thus, the diversification of traditional agriculture with high value crops along with water harvesting practices and introduction of entrepreneurial activities must not be based on land use. The home-based entrepreneurial activities such as food processing, retailing, sewing and crafts may be more appropriate. However, the agro-entrepreneurial activities might be possible with the full utilization of agricultural land in rural areas, especially in the areas that inhabited by the poor. Even they also can involve in the activity within the value chain of agricultural activities such as marketing and retailing job. Attention should also be given towards increasing their financial asset.

Result showed that all respondents were obtained relatively low SLI for the financial asset ranged between 0.41 for higher altitude and 0.34 for lower altitude. The lower and middle altitude has a lower index value 0.34 and 0.35 respectively as both the altitude has highly affected by flood and their livelihood sources are destroyed due to it. Thus, approaches toward enhancing their financial status such as encouraging them to involve in microcredit system and cooperative might be alleviating the poor out of poverty trap. The social assets which people can draw on including informal relationships of trust, reciprocity and exchange with families, friends and neighbor’s as well as more formalized groupings (e.g. community and faith groups). Social capital in the block shows the highest value for higher altitude (0.36) followed by lower (0.32) and middle (0.25). These results obtained because of a lower index value of households for reciprocity and exchange and lower households’ membership of any formal and informal organization in all the three altitudes. This means a higher percentage of households that has not been member of any organization. These results indicate a need for strengthening community networks and local organizations such as Woman Union (Mahila Mangal Dal), Youth unions (Yuvak Mangal Dal), Farmer associations etc. at the village level to reduce social capital vulnerability and increase the livelihood sustainability through networking. This lower index also related to the location of the villages as the lower altitude comes under the early flood zone and can be improved by social programs.

In overall the block has a good access to physical assets (0.50) and it can be said that as the block has better availability of physical infrastructure need to be enhance the quality of services in the areas of health care, livestock improvement, agriculture extension services and market linkages of agriculture produce for enhancing income opportunities of rural poor. Human asset (0.40), the quantity and quality of human asset related to the ability of household to control and utilize the other assets. As the good quantity and quality of human asset available, scope of agriculture expansion increases and good education level of household members encourage them to diversify their income through non-agriculture activities, as the high degradation of agriculture land due to flood in the block. The financial asset (0.36), lower than the human and physical asset. Due to flood low intake of tourist affect the livelihood opportunities in the region so there is a need to enhance financial asset by improving entrepreneurial and other skill. Access to natural asset (0.33) is necessary for enhancing income of poor household as they are dependent on agriculture and allied activities for income. Better social asset (0.31) provides economic security to the household and support during emergencies, this asset is very low in the study area so need to be enhance through better social networking.

Within the blocks, physical and natural assets index were higher in all the three altitudes, and access to financial, human and social assets considerably less than these two assets. Natural assets were good in all the altitudes with the exception of lower altitude (0.41), which has higher value of human asset (0.44) in terms of access to natural assets.In higher altitudes villagers had a reasonable access to the physical and natural assets but limited access to financial, human and social assets. Middle zone was characterized by low access to financial assets, reflecting the poor access to credit facilities and income sources (Table 2). The lower altitude has a moderate access of all the assets accept social asset.

**3.4. Livelihood Strategies**

In the analysis of income-generating activities (Table 2, Fig 2), different strategies of livelihood were identified. Sources of household income differed between the higher, middle and lower altitudes of all three blocks. In high altitude of Agustmuni block, the majority of households depended on livestock & livestock produce (0.58) and agriculture produce sale (0.50) as their main source of income, whilst few households (0.45) depended on salaried job outside the village in the form of government or private jobs. Chaulai, potato, kidney bean and spices are the major cash crops of the region soil conditions are relatively good in the region and sale of these products provides a better income opportunity for poor farmers. Pensions (0.36), remittances (0.27) and government social benefits (0.26) mainly in the form of oldage, widow, disabled pension and food-aid were the next major activity in which the majority of households involved. Other non-agricultural activities i.e. village level business/trading (0.15), carpentry/masonry (0.12), wage laborers (0.23), tourism (0.15) involved only a few households or low index value in all altitudes of the total households of middle altitudes, households mainly dependent on salaried job and pensions, as same value observed for the both (0.49), followed by livestock & livestock produce sale (0.48), agriculture produce sale (0.35), remittances (0.32), government social benefits (0.18), wage labour, carpentry & masonry, tourism observed same value for these three (0.17) and other business/trade (0.15). Of the total households of low altitudes, majority of households dependent on salaried job (0.46), followed by livestock & livestock produce sale (0.42), pensions (0.39), tourism (0.27), remittances, government social benefits & carpentry/masonry observed same value (0.24), agriculture produce sale (0.19), other business/trade (0.17) and wage labour (0.15). In contrast, the majority of households of high altitude of Jakholi block, principally dependent on remittances and salaried job (0.65), followed by livestock and livestock produce sale (0.59), wage labour (0.32), other business/trade (0.29), government social benefits (0.27), pensions (0.16), carpentry/masonry (0.13) and agriculture produce sale & tourism (0.08) (Table 2, Fig. 2), of the total households of middle altitudes, households mainly dependent on remittances and salaried job (0.59), followed by livestock and livestock produce sale (0.51), government social benefits (0.29), wage labour, agriculture produce sale & other business/trade (0.24), pensions (0.20), carpentry/masonry (0.17) and tourism (0.10).

**Figure 2: Shows the variation in livelihood strategies in three altitudes of Agustmuni block**

**3.5. Relationship between Livelihood Capitals and Livelihood Strategy Choice**

A multivariable livelihood strategy is one in which the allocation of asset use and managerial choice are made in order to achieve livelihood objectives that include management, investment, and bearing of arrangements. This study analyzed the relationship between the choice of livelihood strategy and livelihood asset by way of binary logistic regression. In order to analyze the influence of all five livelihood assets on the choice of livelihood strategies, this study designated all five livelihood assets as regressive independent variables and designated livelihood strategies as regressive dependent variables in order to analyze them by means of binary logistic regression. Independent variables of regression were used with the forward LR method that is based upon P<0.1. Results are shown in table 3. The livelihood strategies were divided into agriculture and non-agriculture and presented as agriculture, 1 and 0 otherwise. All five indexes adopted by way of binary logistic regression represent the status of livelihood assets. Results coincide with the analysis are carried out.

**Table 3: Relationship analysis between livelihood assets and livelihood strategies**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assets** | **Regression coefficient (B)** | **Standard error (S.E.)** | **Wald test** | **Significance** | **Exp (B)** | **95.0%CI for Exp(B)** | |
| **Lower** | **Upper** |
| Human asset | 1.665 | 0.887 | 3.526 | 0.060 | 5.286 | 0.930 | 30.055 |
| Natural asset | -0.855 | 0.843 | 1.029 | 0.310 | 0.425 | 0.081 | 2.219 |
| Physical asset | -2.431 | 1.067 | 5.191 | 0.023 | 0.088 | 0.011 | 0.712 |
| Financial asset | -6.239 | 0.791 | 62.278 | 0.000 | 0.002 | 0.000 | 0.009 |
| Social | 0.619 | 0.325 | 3.637 | 0.057 | 1.857 | 0.983 | 3.508 |
| Constant | 3.792 | 0.699 | 29.405 | 0.000 | 44.356 |  |  |
| Percent concordant = 78.7, -2 Log likelihood = 67.489, Cox & Snell R2 = .383, Hosmer and Lemeshow Goodness-of-Fit Test = 0.55 (.79), Nagelkerke R2 = 0.59 | | | | | | | |

As shown in table 3, a particularly close relationship exists between livelihood strategies and livelihood assets. The results demonstrate that the association between natural asset and farm strategy is generally positive. Household with higher

level of proximate natural asset are more likely to engage in farm activities. In contrast to natural asset, household which have better access to financial asset improves their access to better non-farm opportunities. This implies that financial asset is an important driving force for rural households to choose non-farm livelihood strategies. From the analysis perspective, an increment of one unit of natural asset should reduce the occurrence of choosing non-agricultural activities by 0.855 times. While an increment of one unit in financial asset should decreases the occurrence of choosing agricultural activities by 6.239 times. An increment of one unit in physical asset should reduce the occurrence of choosing agricultural activities by 2.431 times. With an increase in natural asset, farmers tend to engage in agricultural production and make farming or animal husbandry to be the primary source of household livelihood. The abundance of natural asset tends to make farming a more profitable enterprise overall. However, with an increase in financial asset, farmers tend to engage in non-agricultural production and rely on outside enterprises or engage in household sideline production as a way to supplement income and to achieve livelihood diversification. Farmers with access to more financial asset tends to engage in secondary and tertiary sources to gain more revenue that is redirected into technology, equipment, or infrastructure to be cycled back into production.

**3.5. Variation in Livelihood Strategies within District**

The limited accessibility to assets is identified as a universal challenge faced by rural household in mountain areas. However, livelihood assets are likely to have a significant effect on the livelihood options although the effect on different type of communities/settlements varies. The probability of agricultural livelihood strategies reduced by 6.239 times as the financial asset increases by one unit. Results show that the households of higher altitudes depend on agriculture and allied activities (0.50 and 0.58) for livelihood. Closely and symbiotically interlinked, both of them are deeply dependent on the neighbouring forests and ecosystem for sustenance and viability. Land resources were high (0.33) in the region but lower than middle altitude due to its rich vegetational (mainly oak forest) surroundings which creates wonderful nutrient cycles and micro-climate for crops and enhance livelihood security and accessibility. As the forest resources are low (0.10), people willing to rear one or more cattle and buffaloes due to its social acceptance and feeding them by waste land grasses, village forest, agroforestry system with forest resource. The dependency on agriculture and allied activities is also due to lack of non-agriculture income sources and low physical assets and higher human asset (family labour ability 0.51). Amaranths, potato, pulses (kidney bean, soyabean etc.), fruits, vegetable, spices and milk and milk produce selling are the main cash generating options of the households.

In the middle altitude, peoples depend on non-agricultural activities e.g. salaried job and pensions, obtained same value (0.49). As the higher value of natural assets (0.36) was recorded for middle altitudes peoples depend on non-agricultural livelihoods due to high accessibility of physical and human asset (high family education level 0.48) and rainfed agriculture, uncertain environmental condition caused insecurity in production. The irrigated land was higher (0.18) compared to other two altitudes but owned by only few villages. Due to the poor access to government services (0.20) for agriculture promotion, lack of improved tools, timely delivery of improved agriculture input, poor environmental condition reduces the scope of agriculture expansion in the region. Accessibility of forest resources were also higher (0.38) in the region which makes the livestock rearing second most important livelihood strategy in the region.

In the lower altitude salaried job was also the main occupation; this may be due to the high physical asset (0.52), higher education level of household head and lack of agriculture expansion facilities. As the irrigated land was higher 0.12 than high altitude but due to erratic rainfall mostly land converted into rainfed year by year and interns unable to provide sufficient food for household consumption. This situation compels the people to search secure income sources in urban and semi-urban areas.

**4. Conclusion**

The amount of natural asset and financial asset endowed by farmers affected the choice of livelihood strategies to a certain extent. It can be concluded from the correlation coefficient values, that influence of financial and physical assets on the choice of livelihood asset were significant. The target of this investigation was to reveal the differences of livelihood strategies within and between the blocks and it was found in all the three blocks that those households were more affluent that have expanded into other non-farm employments and do not solely rely on the land as their primary means of livelihood. Therefore, the influences of human asset, natural asset, and social asset on livelihood strategy options are insignificant. As the different livelihood activities have different requirements, but a general principle is those farmers who are amply endowed with assets are more likely to make positive livelihood choices.

This study shows how the residents of district Rudra Prayag obtain their livelihood from various livelihood activities; an increasing livelihood diversification among the residents was observed in this study area and how these relate to assets, and access within the livelihood framework. The implications for policy reform are numerous and need attention from both state and national institutions. Among the respondents, activities being engaged are categorized into agricultural and non-agricultural. Agricultural activities are basically agriculture and allied activities while non-agricultural activities are salaried jobs, trading, tourism, local small entrepreneur etc. that generate income or support for households. Internal household dynamics based on age and household education is shown to affect positively the livelihood outcomes (income and well-being). Then, the study indicates that the role of assets such as social capital, land, property, savings and labour is central in determining the outcomes of livelihood activities as measured by income and well-being. The findings of this study are the following recommendations:

1. Government needs to encourage efficient and sustainable use of the existing cultivable land, by further investing in agricultural research, extension and development, with a view to increase the agricultural output as well as the corresponding income for households that take to farming as a major or alternative means of obtaining livelihood.
2. In addition, government should encourage the existing social organizations (thrift and credit societies) in the communities, to be formally integrated into legal and functional rural banking activities.
3. There is also a need for provision of basic infrastructural facilities such as good and accessible roads, potable water, health care centers, storage facility, market, and electricity supply among others by the government. This will ensure proper preservation of the perishable agricultural produce as well as unsold stocks, minimize costs of transportation to the market which is very far from the communities, ensure good health status of the community members, then make access to the communities easy by the prospective customers and in the long run, guarantee optimal livelihood outcomes (income generated and well-being among others).
4. **Availability of data and material**

All relevant data and material are presented in the Research Review Paper.

1. **Consent for publication**

Not applicable.

1. **Ethics approval and consent to participate**

Not applicable

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