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Recent Trends of Rural Out-migration and its Socio-economic and Environmental Impacts in Uttarakhand Himalaya

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Abstract In Himalaya, the environmental constraints impose severe restrictions on the carrying capacity of natural resources as well as on the efficiency of infrastructure and services. As a result, subsistence farming constitutes the main source of rural food and livelihood. Owing to constraints of subsistence economy a large proportion of youth male population out-migrates the rural areas in search of livelihood and employment creating scarcity of farm labour. As a result, large proportion of agricultural land and houses are now abandoned affecting food productivity and rural livelihood; and socio-economic and environmental sustainability. Secondly, women have become the primary resource developers and back-bone of economy leading to feminization of mountain farming system. Women make implicit contribution towards subsistence economy and sustainability of mountain socio-ecological systems. However, women enjoy highly restricted ownership of natural resources and limited access to the opportunities of social and economic development due to skewed power relations and traditional cultural and social norms, and this further leads to feminization of poverty in mountains. Moreover, the steady depletion of natural resources and climate change have further accelerated the trends of outmigration which have enhanced women's roles and responsibilities, and increased their workload both in farm as well as non-farm sectors rendering them more vulnerable to environmental changes, particularly climate change. Moreover, the women constitute the highest proportion of population affected by natural disasters primarily due to lack of preparedness, information and exposure.

However, it was observed that the increasing trends of male out-migration not only provided stability to rural economy in terms of income through remittance, but also marginally improved women's access to education, local institutions, resources, development opportunities, grass-root leadership, natural resource management and growing market from local to global level. These changes are not only contributing towards social, economic and political empowerment and main-streaming of rural women, but also providing them with the opportunities to involve in decision making process from family to village levels. Furthermore, women have developed critical traditional knowledge to understand, visualize and respond to environmental changes including the climate change. Nevertheless, increasing trends of outmigration and abandonment of agriculture and settlements are having severe and irreversible impacts on social quality of life. It is therefore highly imperative to improve rural livelihood and create opportunities for employment in traditional as well as non-traditional sectors in rural areas, and extend the good-practices of women's mainstreaming across the Himalayan States of India.

Key words subsistence farming, natural disasters, abandonment of agricultural land, loss of traditional knowledge, loss of agro-biodiversity

I. Introduction

Mountains include some of the most fragile ecosystems (ICIMOD, 2010) as they are highly sensitive to changes caused by natural and anthropogenic factors (Sonesson and Messerli, 2002; Tiwari, 2000). Mountain communities mainly depends on subsistence farming, livestock, and income generation through small scale trade, and wage and casual labour for their livelihood (Eriksson et al., 2009). The Food and Agricultural Organization (FAO) has identified more than 75% of the land surface of the world's mountain regions as unsuitable or marginally suitable for practicing agriculture. Further, it has been observed that the proportion of poor and vulnerable people increases with elevation (Huddleston and Atamam, 2003; Messerli and Ives, 1997; IFAD, 2001). There are indications that poverty inequality between mountain people and those living in other areas is increasing. Currently, mountain ecosystems as well as mountain communities are particularly threatened by the ongoing processes of global environmental change, population dynamics, and economic globalization, and the resultant exploitation of mountain resources (ICIMOD, 2010). As a result, mountain regions of the world are passing through a process of rapid environmental, socio-economic and cultural transformation and exploitation and depletion of their natural resources leading to ecological, social and economic un-sustainability (FAO, 2008; Tiwari, 2000). Moreover, the climate change is acting as an additional stressor which can multiply existing development deficits and may also reverse the process of socio-economic development in mountain regions particularly in poor, low-income and developing countries (UNDP, 2010). Further, these changes are likely to undermine the adaptive capacity of mountain commu-

nities to respond to changing environmental conditions, particularly climate change (Huddleston and Atamam, 2003; FAO, 2008).

Himalaya consists of the most extensive and high altitude areas on the planet, and the largest areas covered by glaciers and snow outside the polar regions. The mighty glaciers, snow and forests constitute headwaters of some of the largest trans-boundary basins on the planet that sustain 45% global population dependent primarily on subsistence agriculture in South Asia (ICIMOD, 2010). Himalaya is tectonically active, environmentally fragile and the most densely populated mountain inhibited by some the poorest and marginalized people of the world (Eriksson et al., 2009). In Himalaya, due to constraints of terrain and climate, forest based subsistence agriculture constitutes the main source of rural livelihood even though the availability of arable land is severely limited and agricultural productivity is low (ICIMOD, 2010; Maithani, 1996). High dependency on natural resources and increasing marginalisation are some of important factors for prevailing poverty, food and livelihood insecurity and poor community health in Himalaya which are further increasing the vulnerability of local communities to long-term impacts of global environmental changes (Huddleston and Atamam, 2003). Due to limitations of subsistence economy, a large proportion of adult male population out-migrates the region in search of livelihood (Maithani, 1996; ICIMOD, 2010). The main objective of the study is to analyze the recent trends and drivers of out-migration; and assess its social, economic and environmental impacts in the mountainous part of Uttarakhand with case illustration of Ramgad Watershed located in the densely populated Lesser Himalayan Ranges of Uttarakhand.

II. Methodology

Ramgad Catchment, situated in the Lesser Himalayan ranges of the Himalayan State of Uttarakhand, India, has been selected as the area of study for the proposed work (Figure 1). The catchments encompasses a geographical area of nearly 75.8 km^2 between 1,025 m and 2,346 m altitude. Ramgad is the one of principal tributaries of River Kosi in its mountainous part. The catchment is

Figure 1. Map of Uttarakhand
Source: made by Joshi based on Census of India maps 2011

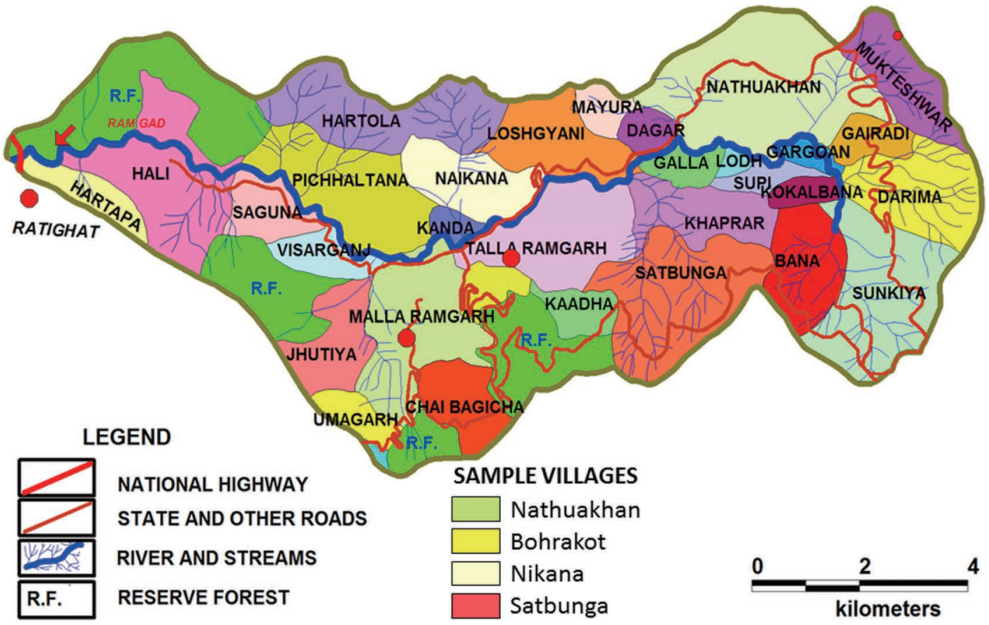

Figure 2. Ramgad watershed villages & rural settlements
Source: made by Joshi based on Village Map of Census of India 2011, District Nainital

characterized by diversified terrain and geomorphic landscape which are clearly reflected in varying magnitudes of slopes, variety of soils, natural vegetation, hydrological regimes, and the climatic complexities. In 2015 the total population of the watershed was 22,085 persons inhabiting 24 revenue villages (Figure 2). The activities of cultivation, horticulture, tourism and grazing are extended over large areas which are leading to exploitation of natural resources, land use intensifications, and disruption of mountain ecosystem services. The study area was divided up into three micro-watersheds employing stream ordering techniques. These micro-watersheds have been taken up as lower level geographical units for various types analytical studies and mapping in the present work. This exercise was carried out with the help of Survey of India Topographical sheet at scale 1:50,000. The three micro-watersheds of the Ramgad Watershed are: Upper Ramgad Micro-watershed (28.88 km^2); Middle Ramgad Micro-watershed (26.53 km^2); and (iii) Lower Ramgad Watershed (20.39 km^2).

The information and data required for the study have been generated and collected from diverse sources. The primary information has been generated through intensive field investigations, field mapping, observations, monitoring and by socio-economic surveys. The secondary methods mainly included the interpretation of Survey of India (SOI) topographical maps of the area at scale 1:50,000, forest maps, cadastral maps; and intensive survey of available published and un-published literature including government reports. The data pertaining to the number of rainy days, amount of rainfall, and extreme weather events have been collected from local meteorological stations operated by various government agencies. The status of water resources has been assessed through long-term monitoring of water discharge in springs and streams and analyzing their environmental status. The annual average flow has been considered for the interpretation of water discharge in streams and springs. Besides, the environmental status of water resources (streams and springs) was also determined through interviewing elderly people in the each of the villages of the study region. The information with respect to impact of climate change and extreme weather events on water availability and local agricultural, food and livelihood systems was generated through conducting household surveys in all the 24 villages within the catchment. The information pertaining to trends of rural out-migration and its causes have generated and collected respectively through household surveys and village population register. The sample size for household surveys constituted 33% or 725 of the total households (2,197 total households) and was composed of selected women headed households (25%), households below poverty line (as classified by the Government of Uttarakhand State) (40%), households solely dependent on agriculture (15%) and families dependent of agriculture and other means of income (20%) from each of the 24 villages of the catchment. The coverage of sample from different micro-watersheds of Ramgad was in proportion to number of households, and out of total 752 households surveyed, 340, 249 and 136 were from Upper, Middle and

Lower Ramgad micro-watersheds respectively.

III. Trends of Migration

Migration is considered as one of the adaptive measures to environmental constraints and changes affecting carrying capacity of natural resources. However, since millennia mountain communities have developed mechanisms to adapt to these typical conditions (ICIMOD, 2010; Leduc and Shrestha, 2008; UNEP, 2004). Migration of male youth is one of the important adaptive measures to constraints of subsistence economy and changing environmental conditions and associated natural and socio-economic risks all across the mountain regions of the world (Sherpa, 2007; ICIMOD, 2009). On one hand, labour migration improves economic conditions and ensures food security in terms of remittance (Hoermann and Kollmair, 2007; Kollmair et al., 2006). On the other hand, it has inadvertently created a vacuum in mountain societies putting extra responsibilities on women (Sherpa, 2007). During 1991–2000, the level of adult male out-migration in the mountainous regions of South Asia exceeded 40% (Rasmussen and Parvez, 2002). The draining away of productive human resource from mountains has serious implications not only for the economic development, but also for the enrichment of socio-cultural life in the region (Maithani, 1996).

Uttarakhand had a total population of 10.09 million in 2011, of which nearly 70% lived in rural areas. The mountainous region of the State which is constituted by 10 districts account for about 48% of its population (Office of the Registrar General and Census Commissioner, 2013). The State has observed remarkable changes in its population pattern, particularly during the decade of 2001–20 when the State attained high economic growth. During 2001–11 the overall growth of population in the State has been 1.74% which was comparatively higher than the national average population growth. Whereas, the mountainous part of Uttarakhand recorded only 0.70% growth which was much lower as compared to plains districts of the State where the population increased 2.82% during the same period. Further, the rural areas of the mountainous districts of State registered 0.38% growth in population during 2001–2011 which was much lower than the growth of population in urban areas. As a result, the urban population in mountainous districts increased substantially during the period. Similarly, the growth of population in foothill part consisting of *Bhabar* and *Tarai* regions was much higher compared to the growth of population in the mountainous part of Uttarakhand. The very high growth of population in urban areas and in foothill region was mainly contributed by the increasing trends of rural out-migration from the rural areas of the State. This observation is substantiated by the fact that Almora and Pauri districts which are located in the mountainous parts of Uttarakhand registered an absolute decline in population with negative compound annual growth of −0.13 and −0.14 respectively during the period 2001–2011 (Mamgain and Reddy, 2015; Office of the Registrar General and Census Commissioner, 2013). Further, Tehri Garhwal, Bageshwar, Chamoli, Rudrapryag and Pithoragarh districts located in mountainous part of Uttarakhand recorded very low rate of population growth that decreased the proportion of the mountainous region in the population of Uttarakhand. During the recent years, the districts located in foothill region have developed important centres of economic and industrial activities and hub of educational facilities attracting a huge out-migration from the mountainous districts. This clearly indicates out-migration has become a prevalent demographic phenomenon in the mountainous part of Uttarakhand (Mamgain and Reddy, 2015). The study carried out in Ramgad watershed revealed that during the last 30 years, the region has experienced prevailing trends rural outmigration. The migration is of both temporary and permanent nature, and migrants include both educated and uneducated youths, particularly males. In 2001 only 701 people out-migrated the region, whereas the number of out-migrants increased after 13 years in 2013 to 18,974 thus registering an overall increase of 25.36%

Table 1. Trends of rural outmigration during 2001–2013

Years	Total Migrants
2001	701
2002	795
2003	1,007
2004	1,105
2005	1,121
2006	1,155
2007	1,191
2008	1,195
2009	1,291
2010	2,111
2011	2,185
2012	2,197
2013	2,425
Total	18,479

Source: Field Surveys by Joshi from January 2001 to December 2013 in Ramgad Watershed

Table 2. Pattern of rural outmigration during 2001–2013

Micro-watersheds	Total Migrants	Permanent Migrants (%)	Temporary Migrants (%)	Educated Migrants (%)	Uneducated Migrants (%)
North Kosi	4,076	37.00	63.00	75.21	24.79
East Kosi	4,560	21.55	78.45	81.55	18.45
West Kosi	5,230	37.11	62.89	77.59	22.41
South Kosi	7,630	15.51	84.49	91.57	8.43
Total	21,496	27.79	72.21	81.48	18.52

Source: Field Surveys by Joshi from January 2001 to December 2013 in Ramgad Watershed

(Table 1).

Out of the total migrants during 2001–2013 (18,974 persons) 32% migrated on a permanent basis whereas 68% have migrated temporarily with their families returning back to the watershed. Most of the migrant population included both educated and uneducated. However, the proportion of educated migrants is much higher than uneducated ones. It was observed that the a large number of educated migrants are skilled and trained in various professions (Table 2). The results of the study carried out in Kosi Catchment of Almora District in Kumaon Himalaya also indicated the similar trends of migration. In Kosi Catchment 21,496 persons migrated from the region during 2001 and 2010 of which 81.48% were educated. Out of the total migrants (21,496 persons) during the period as much as 97% were males, and out of that 27.79% migrated permanently and 72.21% migrated on a temporary basis. The study observed that the male outmigration has shown consistently increasing trends during recent years as between 2001 and 2013 male outmigration registered an increase of nearly 686% (Tiwari and Joshi, 2015b). The interpretation of primary data revealed that poverty, decline in agricultural productivity, loss of livelihood opportunities and increasing incidences of natural disasters have been the most pressing factors for increasing trends of male out-migration in the watershed (Table 3). It was observed the magnitude of out-migration is much higher in small villages and the rural settlements located far away from the road and market centres. Further, studies show that a large number of households have completely out-migrated with all family members abandoning their houses. These observations clearly indicate that out-migration is becoming a prevalent phenomenon in the mountainous parts of Uttarakhand during recent years (Mamgain and Reddy, 2015).

Table 3. Drivers of male out-migration: a community perception

Reasons to be Drivers of Rural Outmigration	Community Response (%) (N=4,000 Persons)
Poverty	37.0
Lack of Livelihood Opporunities	27.0
Decline in Agricultural Productivity	21.0
Extreme Weather Events and Natural Disasters	11.0
Landless and Marginalized	2.0
Lack of Services and Facilitirs	1.0

Source: Field Surveys by Joshi from January 2001 to December 2013 in Ramgad Watershed

IV. Drivers of Migration

During recent years, our understanding about the dilemmas of mountain regions and approach to their sustainable development has gone drastic changes which is reflected in the deepening concern over the depletion of natural resources and resultant environmental changes, and the realization of the ecological significance of mountain areas for global population (UN, 1992). Until recently some of the parts of the Himalayan mountains were almost cut-off from the process of development from the rest of areas on the country. The process of planned development started in the country including the Himalayan region only after independence. However, no serious attempts were made to understand the distinctive geographical characteristics of mountains and the issues involved in their development. As a result, the hilly and mountainous areas of the country were treated as the mere extension of plains for the formulation and implementation of various development programmes, schemes and projects. Despite specific provision made in the Fourth, Fifth and Sixth Five Year Plans for the formulation and implementation of special development programmes for the mountainous and hilly regions of the country by the Planning Commission of India, they did not meet the developmental requirements of the Himalayan region. This underlined the need of identifying the characteristics features of mountain region which contribute to the distinctive geographical personality of the region uniqueness of problems and requirement of specific approach to their development.

In Himalaya, the rising heights, steep slopes and climate imposes severe restrictions on the productivity and carrying capacity of natural resources. As a result, subsistence farming system constitutes the main source of food and livelihood for more than 75% population although the availability of arable land is severely limited and agricultural productivity is considerably low. The cultivated land as proportion of total geographical area was only 1.4% in Arunachal Pradesh; 3.7% in Mizoram; 6.3% in Manipur; 8.4% in Sikkim; 11.0% in Nagaland; 3.2% in Jammu and Kashmir; 10.1% in Himachal Pradesh; and 15.0% in Hilly Region of Uttar Pradesh (Now Uttarakhand). The agricultural land all across the Himalayan States have further declined due population growth, depletion of natural resources and rapid urbanization. Since, the availability of arable land is very limited; the land holding sizes are very small as nearly 90% land holdings are of less than 1 ha; and availability of per capita land is severely low (Maithani, 1996). In order to preserve soil fertility level and productivity of land under sustained cropping, in such an agro-ecosystem, there must be a net transfer of energy from forests to arable land. This flow of energy from forest to cultivated land is mediated through livestock, usually in form of fodder of stall-fed cattle whose manure and labour form the main source of energy to the Himalayan agricultural system (Figure 3). In order to meet the energy requirement of 1 ha of arable land nearly 5–12 ha of well-stocked forest is required, and on an average one unit of agricultural production involves nine units of energy from surrounding forests (Singh et al., 1984). However, due to land use intensification the availability of forests to per ha cultivated land ranges between only 0.10 and 0.22 in different parts of Uttarakhand (Maithani, 1996).

A minimum of 0.2 hectare per capita arable land is necessary for practicing agriculture on sustainable basis in Himalaya. Whereas, the average availability of cultivated land in merely 0.16 ha/person, in mountainous part of Uttarakhand. Land holding size is very small, and not adequate to carry out agriculture on a sustainable basis both in terms of productivity and food security in the region (Ashish, 1983). Approximately, 87% households belong to the category of small farmer with land holding size less than 1 ha. Consequently, agricultural productivity is declining and livelihood opportunities in traditional sectors are decreasing. Since there is almost lack of other viable means of rural livelihood and employment in the region partially owing to ecological constraints and partially due to inappropriate and ineffective process of development, a considerably large proportion of rural population depends on subsistence agriculture. The people are carrying out agriculture in most compelling circumstances as the availability of arable land is severely limited (less than 0.2 ha/person), agricultural productivity is low, and there are no other viable means of livelihood in the region. In order to raise food production from

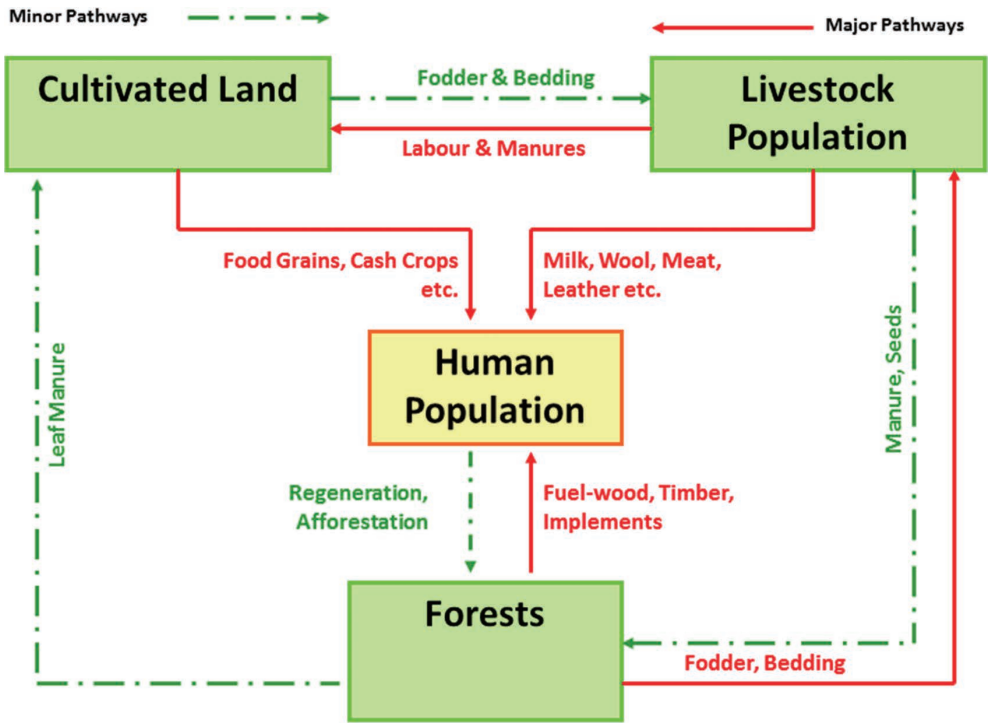

Figure 3. Himalayan agro-ecosystem
Source: Joshi, October 2015

severely limited agricultural land farmers try to increase the number of crops grown in an agricultural year which enhances cropping intensity but ultimately stresses limited agricultural resources and declines agricultural productivity. This is increasing the intensity of cropping (168%), but decreasing farm productivity which symbolizes distress husbandry of land. As a result, the region faces an annual food deficit of 65% affecting food and health security of more than 75% population consisting mainly poor households of the watershed. The constraints of subsistence economy compels a large section of rural population, mainly male youths, to out-migrate the mountains in search of livelihood and employment. The development potential in traditional subsistence agriculture-livestock system has declined mainly due to population growth and depletion of natural resource bases and consequent loss of ecosystem services in the region over past decades. The subsistence agricultural economy with high cropping intensity and low productivity has not been able to absorb the increasing population, and thus accelerated the magnitude of rural out-migration (Maithani, 1996).

In the recent past, a variety of changes have emerged in traditional resource utilization patterns in response to population growth and resultant increased demand of natural resources, and global environmental changes, particularly economic globalization, urbanization, and climate change in Himalaya including Uttarakhand (ICIMOD, 2010; Tiwari and Joshi, 2012a). These changes have exerted sharply accentuated pressures on local subsistence economy through depletion of land, water, biodiversity and forest resources thus collapsing conventional production systems and increasing community vulnerability to livelihood and food insecurity and increased risks of natural disasters (Eriksson et al., 2009). Economic globalisation has further increased the vulnerability of mountain communities to environmental risks through exploitation of natural resources even in remote and inaccessible areas. This seems to have further strengthened poverty imbalances between highlands and lowlands (Hassan et al., 2005; Huddleston and Atamam, 2003).

Moreover, changing climatic conditions have stressed the Himalayan ecosystem through higher mean annual temperatures and melting of glaciers and snow, altered precipitation patterns, and more frequent and extreme weather events which are likely to intensify the impacts of other natural as well as socio-economic drivers of change (IPCC, 2014; UNEP-WCMC, 2012). The study indicates that climate change has further increased the trends of rural out-migration in the entire region (Tiwari and Joshi, 2012b). The amount of rainfall as well as the number of rainy days have declined respectively by 52% and 34%, and the incidences of high intensity rainfall and droughts have increased during last 15 years. These changes have disrupted hydrological systems and reduced the availability of water for drinking and crop production resulting into frequent crop failures, decline in irrigation potential, decreased agricultural productivity and loss of rural livelihood in traditional rural sectors (Tiwari and Joshi, 2015a; Rawat, 2009; Malhotra and Schuler, 2005) which are increasing the vulnerability of rural communities to food and livelihood insecurity (Rasul, 2014; Singh et al., 2010; Sharma et al., 2007; Sah et al., 2006; Singh and Bengtsson, 2004; Beniston, 2003; Tiwari and Joshi, 2012a and 2012b; ICIMOD, 2011). The natural as well as socio-economic sustainability of the fragile Himalayan mountains is being disrupted by increased instances and severity of flash floods and landslides. The Ramgad Watershed was devastated by an average of 25 flash floods and 46 landslides every year during 2001–2013. The constant decline in annual rainfall and the decrease in the number of rainy days have also created and intensified drought conditions across the watershed as an average of 13 villages in the region faced drought during 2001–2013 Taken together, these extremes have been responsible for an increasing incidence of crop failure in approximately 11 villages each year undermining the disaster resilience of rural socio-ecological systems (Table 4).

In Ramgad watershed, water related natural disasters devastated 75 ha of productive agricultural land, 110.36 km irrigation channels, 133.56 km road network declining nearly 18% food production and restricting food import of about 25% during 2001–2013 (Table 5). The extreme weather events consistent with climate change adversely affected the livelihoods and food security of a large, proportion of the population in the region. The climate change and climate change induced natural hazards and disasters have destabilized traditional subsistence agricultural sector (Tiwari and Joshi, 2012b). As a result, rural livelihoods opportunities agriculture have declined considerably. In 2001, 6,747 persons were engaged in as agricultural labour and in agricultural tool making in the watershed, whereas in 2013 this number was reduced to 4,437 persons thus decreasing overall livelihood opportunities by 34% in these conventional rural sectors (Table 6). However, mountain communities have developed mechanisms to adapt to these typical conditions (ICIMOD, 2010; Leduc and Shrestha, 2008; UNEP, 2004). Migration of male youth is one of the important adaptive measures to constraints of subsistence economy and changing environmental conditions and associated natural and

Table 4. The numbers of incidences of droughts, flash floods, landslides and crop failure

Years	Incidences of Droughts (villages)	Incidences of Flash Floods	Occurrence of Landslides	Incidences of Crop Failures (villages)
2001	2	21	14	2
2002	0	11	11	0
2003	1	11	27	0
2004	5	9	31	6
2005	9	10	35	11
2006	9	17	55	10
2007	11	24	55	10
2008	17	27	61	15
2009	21	35	65	17
2010	27	47	77	17
2011	31	55	75	21
2012	30	57	77	20
2013	5	7	21	11
Average	13	25	46	11

Source: Records of Nainital Sub Division Office, 2013

Table 5. Losses of agricultural land, irrigation channels, road network, food production, food import due to extreme weather events during 2001–2013

Years	Losses of Agricultural Land (ha)	Irrigation Channels Disrupted (km)	Decline in Agricultural Production (%)	Road Network Damaged (km)	Food Import Decreased (%)
2001	3.66	7.10	11.0	3.40	15.0
2002	3.50	7.00	14.0	3.47	17.0
2003	3.79	7.70	14.0	3.53	17.0
2004	4.25	6.90	7.0	3.02	12.0
2005	4.80	6.90	8.0	3.00	11.0
2006	4.75	7.11	17.0	3.70	19.0
2007	4.90	7.50	16.0	4.15	23.0
2008	5.00	8.00	18.0	4.30	17.0
2009	6.10	8.25	21.0	4.77	21.0
2010	7.55	9.80	25.0	5.57	37.0
2011	7.25	9.65	25.0	27.11	35.0
2012	7.37	8.80	25.0	21.75	35.0
2013	11.57	15.65	39.0	45.79	67.0
Average			18.46		25.0
Total	74.49	110.36		133.56	

Source: Records of Nainital Sub Division Office 2013; Field Survey in December 2013

Table 6. The numbers of loss by rural livelihood opportunities in ramgad watershed

Micro-watersheds	Number of Villages	Total Population (2013)	Persons Engaged in Traditional Livelihood Sectors (in 2001)	Persons Engaged in Traditional Livelihood Sectors (in 2013)	Total Decline in Rural Livelihood (2001–2013)	Percentage of Decline in Rural Livelihood (2001–2013) (%)
Lower Ramgad	6	4,559	1,215	775	440	36.0
Middle Ramgad	5	6,456	1,977	1,147	830	42.0
Upper Ramgad	13	11,070	3,555	2,515	1,040	29.0
Ramgad Watershed	24	22,085	6,747	4,437	2,310	34.0

Source: Field Surveys by Joshi from January 2001 to December 2013

socio-economic risks all across the mountain regions of the world (Sherpa, 2007; ICIMOD, 2011). The depletion of natural resource base, climate change and consequent loss of livelihood opportunities and decline in food production have accelerated the process of male out-migration in the region (Tiwari and Joshi, 2015a).

Himalaya representing tectonically alive, densely populated, and one of the most underdeveloped and marginalized mountain regions of the world has experienced rapid urban growth during last three decades. More recently, comparatively less accessible areas have also come under the process of rapid urbanization mainly owing to improved road connectivity, publicity and marketing of new tourist sites and the resultant growth of domestic as well as international tourism; development of horticulture; economic globalization and gradual shift from primary resource development practices to secondary and tertiary sectors; and due to absence of urban land use policy (Tiwari and Joshi, 2016). Uttarakhand has emerged as the foremost State in terms of the number urban centres in 2011 with almost 86 towns cities (Office of the Registrar General and Census Commissioner, 2013). This speedy urbanizations has been acting as strong pull factor for the rural population stressed by poverty, decline in agricultural productivity, unemployment and natural disasters, to migrate to growing urban areas within the mountains.

The process of development in Uttarakhand has been quite encouraging during the last 17 years, particularly with respect to achieving high economic growth. However, the so called economic growth has neither been inclusive nor spatially balanced. The development process has not been able to disseminate and push the benefit of growth into large mountainous parts of the State. As a result, economic growth and development has been mainly concentrated in the foothill region constituted by Dehradun, Haridwar and Udham Singh Nagar districts of the State; and the mountainous part of the State could not join the mainstream of development. The Government could neither improve the viability of agriculture in mountain nor create livelihood and employment opportunities in other traditional and non-traditional sectors. As a result, the rate of out-migration from the mountainous part of the State has further accelerated during the recent years (Mangain and Reddy, 2015).

V. Socio-economic and Environmental Impacts

The increasing trends of rural outmigration has great impact on the entire process of development planning and sustainable resource development; and on the programmes of disaster risk reduction and climate change adaptation in the entire region. The severity of the out-migration can be estimated from the fact that 9% of the villages of Uttarakhand are currently virtually uninhabited. Out of the total 16,793 villages of Uttarakhand in 2011 as many as 1,053 have no population and in another 405 villages have a population of less than 10 persons. The number of such abandoned villages has reportedly risen particularly after the massive disaster of 2013 (Mamgain and Reddy, 2015). As many as 280,615 houses have abandoned in 10 mountainous districts of Uttarakhand between 2001 and 2015 with a minimum of 11,609 houses in Rudraprayag district and maximum of 38,764 abandoned houses in Pauri Garhwal district (Table 7). Moreover, Uttarakhand has lost 10.32% of its prime agricultural land during 2001 and 2015. All the districts of the State have registered loss of agricultural land between 1.60% in Almora and 36.07% in Champawat district. A large proportion of cultivated land in Dehradun (22.43%), Haridwar (3.42%) and Udham Singh Nagar (7.05%) located in the foothill zone of the State has been encroached by the process of urbanization and industrialization (Table 8). Whereas, the loss of agricultural land in 10 mountainous districts of the State was due to out-migration and resultant abandonment of cultivated land. The increasing trends of abandonment of agricultural land in mountainous part of Uttarakhand in undermining the food and livelihood security of poor and marginalized households across the region.

The exodus of human resource from rural areas of the mountains has very serious implications not only for the

Table 7. The number of abandonment of rural houses in Uttarakhand during 2001–2015

Districts	Abandoned Houses
Uttarkashi	12,844
Pauri	38,764
Chamoli	20,765
Tehri	37,450
Dehradun	46,489
Rudraprayag	11,609
Pithoragarh	25,904
Almora	38,568
Nainital	23,939
Bageshwer	11,556
Champawat	12,727
Total	280,615

Source: Department of Statistics, Government of Uttarakhand, 2015

Table 8. Abandonment of agricultural land in Uttarakhand during 2001–2015

S. No.	District	Geographical Location	Agricultural Land (in ha) (2001)	Agricultural Land (in ha) (2015)	Decline (in ha)	Decline (%)
1	Chamoli	Mountain	34,377	32,302	2,075	6.04
2	Dehradun	Mountain and Doon Valley	53,726	41,671	12,055	22.43
3	Haridwar	Plains	120,926	116,801	4,125	3.42
4	Pauri Garhwal	Mountain	76,802	64,829	11,973	15.58
5	Rudrarayag	Mountain	21,035	19,982	1,053	5.00
6	Tehri Garhwal	Mountain	63,835	54,281	9,554	14.95
7	Uttarkashi	Mountain	29,109	28,616	493	1.68
8	Almora	Mountain	78,090	76,842	1,248	1.60
9	Bageshwer	Mountain	24,024	22,939	1,085	4.51
10	Champawat	Mountain	27,362	17,493	9,869	36.07
11	Nainital	Mountain and Foothill Plains	47,710	44,021	3,689	7.72
12	Pithoragarh	Mountain	44,273	40,655	3,618	8.16
13	Udham Singh Nagar	Plains	149,923	139,350	10,573	7.05
Total			771,192	699,782	71,410	10.32

Source: Department of Statistics, Government of Uttarakhand, 2015

sustainable development, but also for improving the quality of rural life. The increasing trend of out-migration among male youths has not only affected the life quality of rural women through feminization of mountain agriculture, resource development process and poverty; but this has also eroded the rich traditional knowledge which rural communities have developed through their long experimentation with nature and changing natural conditions (Leduc and Shrestha, 2008). Consequently, Himalayan women have been often designated as 'primary resource developers' (Malhotra et al., 2002). As a result, the burden of living under difficult mountain-conditions falls mainly on women who have to bear the drudgery of scrounging for all primary natural resources including collection of fuel-wood and fodder from shrinking forests and fetching water from increasingly long distances in addition to taking care of agriculture, livestock, children, and aged family members. The study revealed that 75% adult women and 35% girls of the Ramgad Catchment have to bear the major responsibility of carrying potable water from increasingly long distances consuming a lot of their physical energy and time. Moreover, the dwindling water resources have increased the hardships of rural women by increasing the water fetching distances. On the other hand, there is severe shortage of adult male labour to work in agriculture and other sectors of rural economy which further acts as a drag on agricultural productivity and retards the process of socio-economic development in the mountains (Maithani, 1996).

The cumulative impact of all these physical, socio-economic and cultural constraints occurring in the mountains is grinding poverty, hardship, constant fear of insecurity, a feeling of helplessness, and complete dependence on outside help. The environment thus created is not conducive for attaining the goals of sustainable mountain development. Women experience these changes differently and disproportionately and respond to them in varying manner because of socially constructed gender relations and environmental sensitivity of mountain ecosystems (Joshi and Tiwari, 2013). However, it was observed that the increasing trends of male out-migration not only provided stability to rural economies in terms of remittances, but also marginally improved women's access to education, development opportunities, leadership, decision-making power, natural resource management and growing market in some villages. These changes are contributing towards social, economic and political empowerment of rural women. Furthermore, women have developed critical traditional knowledge to understand, visualize and respond to environmental changes including the climate change (Tiwari and Joshi, 2015b). They make use of their critical traditional knowledge and experience in natural resource management and adapting agricultural and food systems to multiple drivers of environmental change including climate change, globalization and economic processes, out-migration, and land-use changes in mountain environments, which helped women to become an important agent of sustainable mountain development (Anmol, 2011; Eriksson et al., 2009). However, this also increased the vulnerability of women to the impacts of

Table 9. Environmental impacts of rural outmigration in Uttarakhand

Environmental Parameters	Status
Increase in Wasteland and Degraded Land	1.5%–3.7% of Total Area
Loss of Traditional Varieties of Paddy	25 Varieties
Loss of Wheat	7 Varieties
Loss of Maize	11 (almost all varieties)
Loss of Barley	7 Varieties
Loss of Millets	5 Varieties
Loss of Pulses	7 Varieties
Loss of Oilseed Crops	5 Varieties
Root-crops	5 Varieties

Source: Field Surveys from January 2011 to December 2015

climate change due to skewed power relations and inequitable cultural and social norms, and consequently they are often exposed to increased risks associated with environmental changes (ICIMOD, 2010). These risks include further marginalization and exclusion from decision-making processes and access to resources for survival. Strikingly, women generally have far less access to and ownership of the natural resources they manage and conserve (Sherpa, 2007).

The increasing trends of rural out-migration has created the severe shortage of labour to work in agricultural sector which is not only affecting food productivity, but also having serious environmental implications. The field surveys conducted in Ramgad Watershed revealed that there has been a huge loss of agro-biodiversity mainly due to scarcity of labour and resultant abandonment of agricultural land in the region. The proportion of waste, degraded and environmentally degraded land has increased between 1.5% and 3.7% in different micro-watersheds. The watershed has lost nearly 25 varieties of paddy; 7 of wheat; 11 of maize; 7 of barley; 5 of millets; 7 of pulses; 5 of oilseeds and 5 varieties of root-crops during the recent past due out-migration and abandonment of agricultural land (Table 9). Besides, the watershed is losing its traditional resource conservation and management practices; traditional coping and adaptation practices to environmental changes and natural disasters; and diverse institutional mechanism developed through thousands of years. These are increasing the vulnerability of rural socio-ecological system to climate change and natural disasters.

VI. Conclusion

Inappropriate development policies and programmes; constraints of livelihood; rampant poverty; rapid urbanization; climate change; and increasing frequency and severity of natural hazards and disasters and the resultant risks of food and livelihood insecurity have accelerated the process of rural out-migration in Uttarakhand Himalaya during the recent years. The trend of out-migration has particularly increased after the creation of Uttarakhand State in the year 2000. Both the proportion of agricultural land as well as the farm-productivity have declined steadily and significantly; and contribution of agriculture to the economy of the State has declined considerably. As result, the household level income from agriculture is much lower than the total household income contributed by rural off-farm sectors. This clearly indicates that people are practicing agriculture in highly compelling circumstances in the absence of other viable means of livelihood. It also shows that the conventional land based economic sectors, specifically, crop-animal husbandry combination is not capable of generating adequate surplus to meet the needs of growing population and a livelihood above subsistence level in Himalaya, particularly keeping in view, the ongoing process of land use intensifications and resultant depletion of natural resources and the impending threat of changing climatic conditions. The situation therefore calls for looking beyond the traditional agricultural system and generation of rural employment opportunities in off-farm and non-traditional sectors in the region.

The increasing trend of out-migration has affected the overall quality of rural life by increasing the responsibilities, hardship and workload of rural women; and retarding the process of development. Nevertheless, the enormous value of large forest areas with water-bodies and high altitude pastures characterized by charismatic landscapes, natural splendour, variety of flora and fauna, enthralling wilderness and rich biodiversity have so far not been linked to the improvement of rural livelihoods and rural income generation. The situation therefore calls for looking beyond the traditional agricultural system and to the generation of rural employment opportunities in off-farm and non-traditional sectors, particularly through development of village based ecological tourism, value chain development and linking production systems with other sectors of the economy from local to global levels. This further underlines the need for restoration of ecosystem services through sustainable utilization and conservation of critical natural resources, particularly, land, water, forests, and biodiversity; and evolving effective climate change adaptation and disaster risk reduction strategies; and their mainstreaming into the overall process of development, particularly at watershed level.

Picture 1. Intensively cultivated rain-fed slopes in Kosi Valley, Almora, Uttarakhand
Source: Joshi, November 2015

Picture 2. Intensively cultivated irrigated valley floors in Kosi Valley
Source: Joshi, November 2015

Picture 3. Abandoned house in Kosi Valley, Almora
Source: Joshi, November 2015

Picture 4. Partially abandoned house in Kosi Valley, Almora
Source: Joshi, November 2015

Picture 5. Abandoned agricultural land used as pasture in Kosi Valley, Almora
Source: Joshi, November 2015

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