

Chapter 3

Sustainability of Himalayan Environment: Issues and Policies



Masaud-ul-Haq Wani and Saima Masood Wani

Abstract The Himalayan region has three major areas of interest, mountain environment, forest resources and fresh glacial water. Mountain people mostly follow agricultural livelihood system for their sustenance and economic wellbeing. However, contraction of resources and climate changes demand a shift from the conventional to improved management systems. The process of economic growth is reaching the unreached mountain societies, which are seen as a transition from total dependence to partial dependence on farming, through improved education, skill development and exploitation of potential niche areas for development. The unpredictable weather, fast depleting resources, inadequate infrastructure, low productivity of animals and heavy disasters witnessed during the recent past are some of the challenges to be met in the Himalayas. However, opportunities exist for resilience to these challenges through cultivation of high-value off-season vegetables, medicinal/aromatic plants/flowers and a path of reversing the shift from desirable to undesirable ecology. To enable the Himalayan people to promote sustainable farming, achieve sustainable livelihood and maintain mountain ecosystem services, these people need access to natural resources and empowerment of their women, which are supposed to be the key determinants for development and are required to be extended to them under specific legislations. Public investments in education, health, transport, research, extending credit, extension services, compensation for watershed management and conservation of biodiversity are some of the policy options suggested to achieve sustainable Himalayan development.

M.-ul.-H. Wani (✉)

Rajiv Gandhi Chair in Contemporary Studies on Livelihood and Food Security,
Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir,
Srinagar, Jammu and Kashmir, India
e-mail: rgckashmir@gmail.com

S. M. Wani

Division of Biotechnology, Sher-e-Kashmir University of Agricultural Sciences &
Technology of Kashmir, Srinagar, Jammu and Kashmir, India
e-mail: sayawani@gmail.com

© Springer Nature Switzerland AG 2019

R. Peshin, A. K. Dhawan (eds.), *Natural Resource Management: Ecological Perspectives*, Sustainability in Plant and Crop Protection,
https://doi.org/10.1007/978-3-319-99768-1_3

Keywords Environmental degradation · Economic growth · Climate uncertainties · Natural resource management

Abbreviations

WTO	World Trade Organization
SPS	Sanitary and phytosanitary
IPCC	Intergovernmental Panel on Climate Change
HKHM	Hindu Kush Himalayan Mountains
USD	United States dollar

3.1 Introduction

The Himalayas account for most of the vastly distributed mountainous areas, spreading over 12 states of India, namely, Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Sikkim, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and West Bengal. It covers up to 2500 km in length and 250 to 400 km in breadth. Longitudinally, the Himalayas are classified as Shiwalik flat summits (600–1200 m msl altitude), middle Himalayas (65–75 km width, average height 3000 m), Greater Himalayas (average altitude 5200 m, 92 peaks over 8000 m) and Trans-Himalayas (average width 60 km, average altitude 4500 m), in addition to the mighty Himalayas. The Himalayan region is inhabited by 51 million people covering 18% of geographical area and 6% of Indian population (Wani 2011).

Himalayas have dispersed land available for cultivation with huge altitudinal variations, having diverse microclimatic conditions, with lesser potential for commercialization. However, some Himalayas niche areas possess vast potential for production of exportable commodities that are by nature organic and get accommodated under WTO (World Trade Organization) regulations, such as SPS (sanitary and phytosanitary), etc. In addition, the Himalayas provide valuable ecosystem services like fresh water, capacity to reduce disasters, huge biodiversity and a lot of space for tourism and recreation.

Considering the poor scope of industrialization in mountains and perspective of rural livelihood, agriculture remains an important source of livelihood and economic growth, despite its declining share in the economy (Table 3.1). However, in developing countries, poor accessibility to the basic benefits such as education, health, communication, road network, markets, transport and extension services remains always the major problems in the development of mountain farming. These problems are referred to as the mountain specificities. Being away from the economic, political and power centres, these populations have almost no role in decision-making, and thus people get marginalized. In addition to being insecure, these areas are affected by outmigration. Although those who leave can provide remittances, however, migration results into heavier workloads for those remaining behind such as women, children and elderly persons. Limited availability of land,

Table 3.1 The Himalayan region: demographic and agricultural indicators

State	Area (km ²)	Population (N.)	Net cropped area (000 ha)	Cropping intensity (%)	Average size of holdings per family (ha)
Northwestern hill region					
Himachal Pradesh	55,673	6,077,900	551	174	1.16
Jammu and Kashmir	222,236	10,143,700	733	147	0.67
Uttarakhand	53,483	8,489,349	788	164	1.01
Total	331,392	24,710,949	2072	160	0.97
Northeastern hill region					
Arunachal	83,743	1,097,968	166	159	3.31
Assam	78,438	26,655,528	2701	152	1.17
Manipur	22,327	2,388,634	140	142	1.22
Meghalaya	22,429	2,318,822	240	111	1.33
Mizoram	21,081	888,573	91	100	1.29
Nagaland	16,579	1,988,636	261	113	4.82
Sikkim	7096	540,851	95	127	1.65
Tripura	10,486	3,199,203	277	152	0.60
Total	262,179	39,078,215	3971	145	1.92
India	3,287,240	1,028,830,774	141,231	134	1.41

Source: <http://indiastat.com/labourandworkforce/380987/employment/85/unemploymentsituation/281124/stats.aspx>

which often has low productivity, coupled with poor marketability makes these fragile ecosystems get transformed into unsustainable to maintain systems, owing to over-exploitation of natural resources.

The Himalayan ecosystem is at a disadvantage for expanding livelihood opportunities. With the outmigration, while men migrate for earning livelihood, the farming land gets deprived of labour force for cultivation; therefore, family labour must be mobilized for agricultural operations. This results in poor schooling of children as they become most likely the individuals who perform such tasks. Further, the global climate change is more pronounced in the Himalayan regions having rich environments. Therefore, these regions require equally more attention for their preservation, sustenance and also fast response to changes, compared to downstream areas.

3.2 The Himalayan Environment

The Himalayan environment has three distinct features. Forest resources maintain and balance the ecology and environment, provide firewood for cooking and timber for construction and supply fresh water stored in glaciers to meet the needs of the human society and to provide national security. However, this environment has been observing multi-faceted changes affecting temperatures, weather conditions, hydrological regimes of water bodies, extended growing periods and reduction in the

number and size of glaciers, resulting in the shortened snow cover. Changing the dynamics of land use system coupled with the soil health degradation and loss of biodiversity has collectively adversely impacted the socio-economic status of the mountain populations. The Himalayas are exposed to increased vulnerability and decreased resilience of the mountain sustainability, considered in the frame of the economic references. These are the transition from inaccessibility to accessibility and from poor infrastructure to improved upgraded metalled roads, high tech market infrastructure and the establishment of intra-sectoral linkages within the agricultural sector and with the overall economy. Socio-economic changes affect the livelihoods both positively and negatively, especially in the agricultural sector which is the mainstay of the Himalayan people.

Mountains and uplands in the Himalayan ranges have great potential for off-season vegetable and fruits, though these are constrained by poor market infrastructure, lack of local-specific technologies and poor extension services for transferring technology from lab to land. Additionally, mountain specificities, such as inaccessibility, fragility, poor mobility, etc., are issues contributing to either over-exploitation or nonexploitation of productive resources in these areas. At the same time, the region is bestowed with niche areas for development, especially for horticulture, including medicinal plants which provide better opportunities for a paradigm shift from traditional subsistence agriculture in favour of modern and high tech commercial agriculture (Sharma et al. 2009).

3.2.1 Climate Change Impacts and Changing Dynamics

The most visible evidence of global warming is the melting of the glaciers across the region that once possessed a cover of 9575 glaciers, with 37,466 km² area and a total ice volume of 2000 km³ (Table 3.2). These values are now expected to shrink by around 40% by 2035 (IPCC, Intergovernmental Panel on Climate Change) (Raina and Srivastava 2008).

The demand for fresh water is increasing on sustained basis, partly because of urbanization and partly due to the normal population boom. On the other hand, gradual but sustained decrease in the number and volume of glaciers will put additional pressure on the scarce water resources, giving rise to disputes among rural

Table 3.2 Himalayan glacier system in India

State	Glaciers	Area (km ²)	Average size (km ²)	Glacier (%)
Jammu and Kashmir	5262	29,163	10.24	61.8
Himachal Pradesh	2735	4516	3.35	8.1
Uttarakhand	968	2857	3.87	18.1
Sikkim	449	706	1.50	8.7
Arunachal Pradesh	162	223	1.40	3.2

Source: [http://niti.gov.in/content/statedata.php?type=ECONOMY &var=GSDP%20at%20constant%20\(2004-05\)%20prices,%20Percent%20Growth%20\(2004-05%20to%202014-15\)](http://niti.gov.in/content/statedata.php?type=ECONOMY &var=GSDP%20at%20constant%20(2004-05)%20prices,%20Percent%20Growth%20(2004-05%20to%202014-15))

and urban communities on water use and rights. This phenomenon has been observed in many states of India for the past three decades. The scientists observed that the global warming is inflicting changes in usual rainfall patterns, making farmers stop rainfed crop productions, due to the lesser reliability of rains (Haller 2012; Behnke and Kerven 2013). In addition, lessening of freezing periods and extension in warm seasons have reduced the scope for producing the traditional crops consumed mostly by local population. This has shifted the conventional agricultural paradigm to a modern and consumer-based production system. Thus, making traditional climate-resilient farming less relevant, compared to the nonfarm activities, which offer better economic revenues for the majority of the region's rural population, is non-sustainable. This transition forced many young people to abandon the traditional mountain communities and migrate to the towns in search of a better life. Increased prices for minerals in the world market led to the reopening of old mining areas and over-exploitation of the unexploited areas, by medium and small enterprise operators, led by local groups.

The Himalayan farmers are therefore searching for strategies to cope with this global change. These farmers employ traditional patterns of risk management. They are conscious of the regions geography, bestowed with diverse altitudinal variations and topography, which they use for herding and growing diverse crops. This helps them to minimize the risk of total failure. Potential of employment generation existing in urban areas, especially in the mining sector, has enabled these farm families to follow a new strategy, i.e. to pursue various economic activities at different time periods of the year by its individual members. This strategy has reduced the risks and increased the livelihood opportunities, thereby, reducing dependence on local and nonpredictable factors such as weather and climate, while increasing dependence on nonfarm economies of regional and global scope (Pratap 2015).

We know that the transformation of the Himalayan region has now settled, which is the outcome of the global warming that induced climate/environmental change processes. Climate change mitigation has been observed to be carried out by the farmers themselves by shifting the conventional system of production to commercialized, nonconventional systems of production. The economic opportunities in the Himalayas have increased and are reaching the unreached communities. The liberalized global economy has induced a dynamic change process in the Himalayan region, due to the global liberalization. There is exploitation of natural resources beyond the economic optima, due to population growth with decreasing per capita land availability. This very factor has inflicted a multidimensional change impacting the Himalayan agriculture and its sustainability. The dynamic multidimensional changes (Pratap 2015) include the virtual cycle of economic growth, owing to the convergence of policies and development. Under this change the exploitation of the niche areas of mountains will account for a sizeable income due to their exportable produce. This would further mean to redefine the poverty of states in response to the increase in per capita income and other factors contributing towards the economic development.

The rising population in the mountainous states is keeping pace with the population bloom at global level. However, a new dimension in terms of improved education and skill development has come up in these states, which will certainly push

their growth beyond the targeted 4%, owing to the unprecedented economic opportunities within and outside the farm sector (Templeton and Scherr 1997). The mountainous states can experience a positive growth stimulus with a better future ahead. However, whether it can be sustained for a longer period is a question to be answered in the backdrop of receding natural resources.

The Himalayan people thus need to change from complete dependence to partial dependence on agriculture, shifting this pattern towards nonfarm sources. The past colder glaciers are rapidly melting due to longer sun exposure, and there is not as much water as before. Also when it used to rain in the past, there was more water and wetlands, enabling the pastures to remain maintained throughout the dry season. Now the situation is that the complete hydrological regime of water bodies has changed, and extended summers are observed. This has resulted in the growing of a variety of crops, increased the cropping intensity and marked the shift in favour of high tech commercialized agriculture, which leads to increased unplanned urbanization due to outmigration that has long-term negative effects on productivity and ecology. The biological degradation of support lands, farm lands, air and water, unsustainable agroecosystem, etc. could be some of the examples in this regard. The reduction in the carrying capacity of agroecosystem in the region and the natural processes going at unprecedented scale are most likely to hit the Himalayan environment, producing environmental crises bigger in magnitude, with far-reaching consequences (Wani 2011). The tendency of young people to move towards urban areas in search of white-collar jobs has been observed. These people pursue quality of higher education to get better opportunities to increase their standard of living. They lose interest in working on their fields but exploit the niche areas of production, increase their income, settle somewhere else, manage their business through remote control and enjoy their life. This way the region is put to a complete disadvantage.

3.3 Urbanization and Consequences

Urban growth has its consequences for land use and livelihoods of smallholders who live on the rural-urban fringe. The increasing demand for land and water has increased resource scarcity in the valley floor, which is the most favourable area for agricultural production. This has driven up the land prices. Many smallholders of the region own very small plots, which they mostly use for subsistence production. Thus, they depend on renting additional land for production of market-oriented crops, such as fruits, vegetables, spices, maize, etc. which provide them cash income. However, today's rising land prices have diminished smallholders' possibilities for renting such additional plots. In fact, the landowners, mostly large real estate owners, are not willing to lease their land to farmers, fearing it might restrict their ability to develop and make them fearful of selling their property as and when needed. Local smallholders perceive the urbanization as a threat to their food and income security. Many of them cope up by increasing production of home-based

breeding of small animals, such as sheep and goat, and selling the meat in urban markets. They are also expanding or intensifying crop production on nearby common property resources and trying to compensate for what they have lost on the valley floor (Satterthwaite et al. 2010).

Due to socio-economic disparities in the peri-urban interface, it is crucial to consider the different stakeholders' perceptions of the urban growth impact. Peri-urban decision-making should hence be based on multiple criteria that also include the local agriculturalists' assessment, in order to prevent land use conflicts and negative effects on smallholder food and income. The peri-urban smallholders of the Himalayas understand the challenges and opportunities of urban growth and hope to profit from a growing urban market. They have developed new ways to generate income at different altitudes as an alternative to the ground lost in the valley. However, in order to create a flourishing rural-urban interface, they need the support of planners and policy-makers, especially relating to strengthening smallholder-market linkages (Mukwaya et al. 2012).

3.4 Economic Growth and Livelihoods

Economic growth is an important determinant of employment and is essential to create livelihoods and improve the standard of living of people. In the Himalayan region, the income distribution is comparatively rational, because in these regions few people are very rich and few are very poor. Though the economic activities are restricted, however, food, clothing and shelter are available to majority of the population. In order to protect the Himalayan ecology and biodiversity, an appropriate developmental strategy for creating alternative livelihoods is essential.

There are two types of economy which can normally be thought of, i.e. green economy and digital economy (Mahajan and Rahman 2015). Both these economies need to be clubbed together in order to establish a link to achieve growth. While green economy (Perlik and Kohler 2012) especially in the Himalayan states spans agriculture and its subsectors, like horticulture, animal husbandry, forestry, etc., manufacturing, like green construction, green manufacturing and green services, addresses forward and backward linkages from trade to tourism. On the other hand, digital economy could include manufacturing using light materials like electronics, information technology, the digital financial services like e-banking, etc. Therefore, while green economy generates employment through production and product differentiation, having international market, the digital economy helps in creating demand through advertisements, regulating supplies through doorstep distribution. This kind of economy would be helpful in providing employment to nearly 18–20 lakh (1.8–2 million) unemployed persons in the Himalayan states, which add up more than 2 lakh (0.2 million) every year to the workforce and make the challenge for creating livelihood even more difficult.

The wealth distribution of the Himalayan region is an important component of the growth determinants. While the Himalayan region has many potential for productive

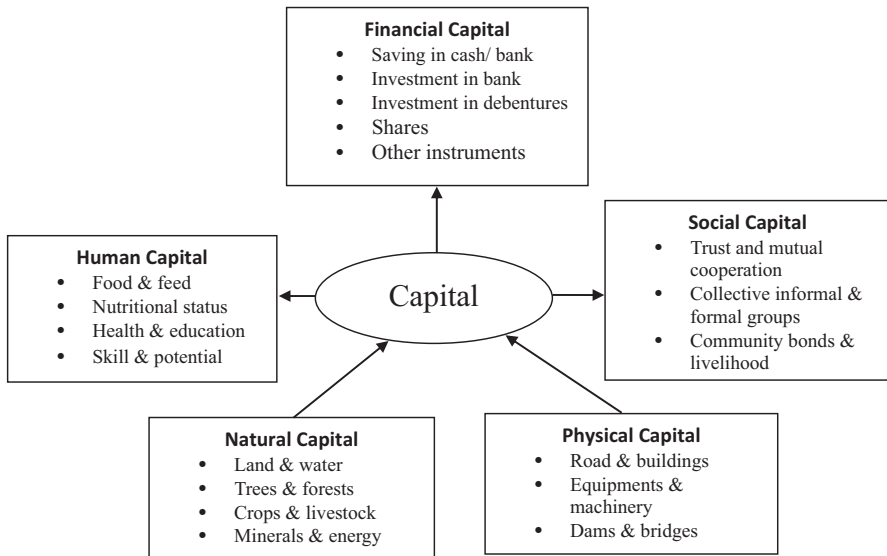


Fig. 3.1 Capital and investment requirements for the Himalayas

gains, however, it has to be followed in a rational way, taking into consideration the sustainability of resources. We will therefore necessarily need to access potential of our capital against the following forms, for its equitable distribution and sustainable consumption. For the economic advancement of Himalayas, capital requirements are needed for infrastructures, human resource development, natural resource management, community development, etc., as shown in Fig. 3.1.

3.5 Sustainability Issues and Transformation of Livelihoods

Himalayan mountains have traditionally been home to farmers accustomed to difficult conditions and the need for hard work to survive the harsh winters. When commercialization started setting in, over-exploitation of natural resources occurred, non-farm sector becoming stronger. Dividends induced many farmers to leave their villages and move to towns, to work in nonfarm sector. This scenario, however, could not be sustained for a long time, due to increased urbanization which mounted more pressure on the existing infrastructure, and available but receding resources, giving rise to major economic crisis and hampering significant investments in mountain areas/states. As nature is being destroyed nowadays, arable land is drastically reduced. Those who sell land for construction are not aware of the damage they cause and are not aware from where will the food for villages come. Many residential projects are being constructed by real estate firms, which are driving this business, and the smallholders are only the spectators in this development.

Major changes due to political transition or economic crisis can open up new opportunities if addressed in an appropriate and sustainable way. Without external support, it is difficult for small organic producers to fulfil the demanding requirements of certification schemes and to access new markets in cities or major tourist locations, which are often the first markets for organic products. Successful organic farmers could generate enough income, stay with their farming and ensure steady rural development. In turn, this will help to reduce the significant development gap between mountains and other areas.

The fact is that the Himalayas are potentially remunerative farming areas unlike mountain areas in temperate zones. Horticultural products (vegetables, flowers and spices) fetch good prices and provided quick cash, compared to other agricultural crops, like cereals and millets. Households now depend on the prices paid for these commodities at the national or world markets and at the institutions handling the products. In addition, changes in climate are reported across the Himalayas, but not much data is available to provide solid evidence of the impact. Land pressure, due to increasing rural population density, and high levels of poverty could undermine the sustainable use of these highly productive and high potential mountain agroecosystems. The outmigration of youth may help ease this pressure but represents a loss of active human capital for the Himalayan rural areas. This may negatively affect the innovative potential of these areas, including family farms.

The interplay of the above factors has transformed the traditional family farm significantly.

- Fewer social assets and weakened social cohesion within an extended family and rural community has come in, resulting in poor mobilization of community resources.
- Small-sized farms constraint agricultural productivity and hence incomes, and rural food insecurity is high.
- Less use of external inputs, such as fertilizers and pesticides, with the exception of commercial crops, due to non-enabling environments which make them inaccessible to most of small farmers. This negatively affects household and regional food security.

3.6 Future Strategies

3.6.1 Capacity Building

Farmers of the Himalayan region in India are expected to benefit from capacity building focused to develop technical and managerial skills, promoted by both the public and private sectors. Co-operative action is key to increase productivity and remove shortcomings. The collective efforts are expected to help in establishing producer's authority to negotiate in the value chain (Hoermann et al. 2010). Establishing direct links among producers, sellers and consumers will benefit

farmers and reduce their vulnerability to exploitative practices of intermediaries in a market system. Moving ahead, appropriate technologies and infrastructure, such as decentralized and renewable energy supply, will be required to establish or enhance processing activities in the Himalayan areas and, in turn, provide off-farm jobs (Bradbear and Joshi 2012). Producers and processors need to maintain and communicate the quality and uniqueness and also reflect the origin of their products under a specific trade name, signifying Himalayan products to consumers, to obtain higher prices that will cover the higher labour cost required for maintaining the ecosystem services of the Himalayan areas. Certified Himalayan products guaranteeing quality through proper labels will also help in making all out efforts to market these products through information technology. Otherwise this will be beyond the capacity of marginalized groups of farmers, who always fail in being recognized in a promising market. It, therefore, needed a revisiting of the formal certification schemes, with an objective to smoothen them to be more relevant and easy to pursue. It has been observed that owing to lack of formal certification, the products of this region do not get access to international markets. This aspect needs to be considered, while revisiting the certification procedure for Himalayan produce, as marketing in national and global markets can provide a better cost-benefit ratio, improving the status of these farmers.

3.6.2 The Himalayan Product Development

The weak, Himalayan smallholder farmers integrated in commodity markets are unable to compete with downstream large-scale producers. These farmers are now able to enter into the emerging market system specialized in nutritious, healthy and organic products. Here these smallholder farmers can capitalize on such markets, owing to the differentiated organic and nutritious food products, produced by these farmers in the Himalayan region (Ramesh et al. 2010). Developing pro-poor sustainable value chains in these emerging markets with formal certification schemes that guarantee the value added of Himalayan products will help bring premium prices and can go a long way in achieving better and remunerative prices for Himalayan produce.

However, smallholder Himalayan farmers are constrained by low, dispersed and unreliable production levels, remoteness, lack of processing technology and knowledge and difficult access to market information, as well as inadequate negotiation and management skills. It remains difficult for them to raise sufficient money to meet their basic needs, invest in their farm infrastructure and fulfil personal aspirations.

The Himalayan farmers manage integrated farming systems with low input of chemical fertilizers and pesticides, all of which adds up to the potential for producing attractive, healthy and organic food for new markets. Consumers, including mountain tourists, and the private sector are rediscovering the highly nutritious and medicinal value of indigenous, underutilized and wild species (Ramesh et al. 2010).

They appreciate the qualities of organically grown or specialty products and are willing to pay heavily for these products. At the same time, some mountain areas also offer markets for locally grown products.

3.6.3 Cash Crop Production

Transitions from age old practices have taken place, giving a new dimension to the agricultural development. The horticultural crops, being cash crops, have great promise for economic upliftment of people in this region and are suited to most of the ecological zones of the Himalayan states. These have been using horticulture as a means of transforming subsistence agriculture to the commercial activity. The productivity per unit of area has increased only due to vegetables, fruits and spices, which invite attention of most of the present day society that became more healthy diet conscious. The produce, being mostly organic, have several export potential and thus provide better avenues for economic development of these areas (Sharma et al. 2009).

Cash crops, largely fruits and vegetables, suited to different agroecological conditions of Himalayan areas, have proved to be the most powerful tool that farmers across the Himalayan states have so far been able to use to transform non-viable subsistence farming into improved, high tech, food- and income-secure, commercial agriculture. For over two or more past decades, in pockets of the Himalayan region, farmers, government agencies and markets have been joining hands to develop success stories of cash cropping systems. There are now good examples of converting unsustainable subsistent agriculture into a better proposition, providing food and income security to the Himalayan farming families. Farmers, research and development agencies and markets have been improving their understanding of the potentials of developing mountain farming niches, helping harness the comparative advantage of an area/agroecological zone, valley or landscape.

Over a century ago, the 2.9 million population (1901) of the Kashmir Valley reached 8 million population in 2011, land resources remaining the same. Therefore, population growth produced a pressure due to land scarcity with no other real option but to generate enough income from cash crops in the available farm land. Even while this occurs, the 6159 million US dollars [Rs. 4000 crore, (1 crore = 10^7)] fruit economy, of which 85% comprise apples, 6% walnuts and the rest other fruits, has been sustaining the farming family's economic productivity, as much as 3.7 million people, farmers and others, of the valley. Large-scale technological inputs and wider adoption by producers are required to build a base for sustainable livelihoods and enhance growth of fruit economy, raising incomes from 61.59 US dollars to 615.81 US dollars (i.e. Rs. 4000 crores to 40,000 crores, at a conversion rate, 1 USD = 64.98 INR) or more, for the farming activities for which the Kashmir Valley has potential (DES 2013).

The highland farmers of Kargil, who own dry stony sloping farmlands, are turning the old subsistent wild apricot into a good cash crop, which flourishes under

such edaphic and climatic conditions. Herein, value addition and improved market access to products of wild *Prunus armeniaca* (apricots), apricot oil and dried fruits have emerged as potential products. There are more such niche fruits of Ladakh waiting to be harnessed, such as *Trichogramma* sp.-managed Kirkichoo apples of Kargil and *Hippophae rhamnoides* subsp. (Thakush) of Leh district. The widely known Leh berry “sea buckthorn” (*H. rhamnoides* L.) a wild thorny bush of Ladakh helped farmers extend benefits of farming on nonfarm government lands, i.e. forest land. Market interventions are expected to improve value of this shrub to local farmers.

Himachal Pradesh performed far better compared to other states in improving the agriculture economy of the state. Here the subsistent food grain farming is being converted to cash crops farming. The vegetable and fruit farmers have confidence of improving their livelihoods. The tribal highland farmers of Lahul are engaged mostly in cash cropping of vegetables, new fruit crops, apple and medicinal plants. The dependence of low hill areas of the state on agriculture is continuously declining and moving to the nonfarm sector. Among the Indian Himalayan farmers, higher economic returns are observed by uphill farmers compared to low hill farmers. Earlier, only Solan was known as vegetable district of Himachal, but now farmers of most districts of Himachal, Shimla, Kullu, Mandi, Sirmour, Kangra and Chamba have turned to vegetable farming (Pratap 2015). The viable farming households turned into vegetable farming for taking triple benefits: (1) there is comparative advantage of growing vegetables in the off season, (2) family labour is put to effective use, and (3) farmers are taking three crops in a year in place of one or two. In a sense, family labour is engaged on their own farms round the year, with more productivity. The positive effect of vegetable farming on small farming families is visible through the 4615 million US dollars (Rs. 3000 crore) vegetable economy. There could be further examples of success stories of cash cropping, based on improved livelihoods in villages, districts and watersheds of the northeastern states also.

The central Himalayan state of Uttarakhand is generally known for its money order economy, as the farming economy of the hill state, barring its Tarai zone, shows various indicators of unsustainability of farming-based livelihoods. Rainfed farming on the sloping landscape is marked by water scarcity, drought periods, small farms, fodder scarcity and wild animal intrusions, including monkeys. Uttarakhand, in many ways, exhibits indicators of shrinking carrying capacity and outmigration as public response, in the absence of public interventions helping to expand the carrying capacity of farming-based improved livelihoods. Weakening forestry-farming linkages leading to poor nutrient cycling and maintaining water availability is visible (Choudhary et al. 2011, 2013). There is an increasing need for chemical fertilizers to sustain crop production. Mounting difficulties of increasing costs and unsure supplies is faced by the Himalayan farmers across states, except Sikkim and few others, who opted to promote alternative systems of organic agriculture. Problems are highlighted concerning increased biological degradation of support lands across the Himalayas by unpalatable invasive species and consequent expanding threats to crop-livestock mixed farming-based livelihoods. This is a key concern of farmers in low and mid-hills (Sharma et al. 2009).

Learning from the experience of thousands of farming families inhabiting several Himalayan states, who switched over from food grain-based subsistent agriculture to fruits and vegetables-based agriculture and benefitted from marketing supply chain mechanisms and infrastructure support services of the states, it is obvious that non-viable subsistent farming by hill farmers has a chance to become viable through cash crops (Wani 2011).

3.6.4 Value Chain Development

It is necessary to develop value chains that enable the Himalayan farmers and particularly poor households to participate in and benefit from these emerging markets. Such value chains need to be developed jointly by representatives from all stakeholder groups. They need to be based on a sound analysis of mountain-specific challenges, natural resources and market potential as well as farmer's socio-economic capacities and relations among the value chain actors. Moreover, the development of a new value chain must not jeopardize the farmers' own food security and sustainable production systems (Hoermann et al. 2010).

3.6.5 Establishment of Niche Markets

Establishing niche markets under the prevailing liberal market regime in many countries requires enabling policies that acknowledge the added value of mountain products as a means to improve mountain livelihoods and regional development and, at the same time, compensate the higher labour input for maintaining critical ecosystem services. The Himalayan areas have vast potential for producing niche products, like spices, medicinal plants, fruits, vegetables, honey, mushrooms, etc., which have export potential. The efficient and proper market infrastructure will benefit the farmers to export these commodities to other countries, which will not only help them to achieve a better livelihood but will also boost tourism, thus creating additional means of earning (Pasca et al. 2010).

3.6.6 Pastoralism Nomadism

The Himalayan pastoralists graze their animals as migratory flocks. Transhumance system of pastoralism is very commonly practiced in the upper belts of Himalayan region. The pastoralists provide regulating ecosystem services such as climate regulation, flood and erosion control, food, water, genetic resources and fuel-like provisioning services, cultural services of heritage and landscaping and supporting services of nutrient cycling, habitat and primary production (Ojeda et al. 2012). A study conducted in the Naran Valley in the Pakistan Hindu Kush Himalayan

Mountains (HKHM) (Shah et al. 2012) showed that high-altitude pasture management contributes more to climate change mitigation with a superior carbon store averaging 12.2 t C per ha, as compared to cropping. The services provided by the mountain pastoralists can attract investment and benefit the society.

3.7 Policy Suggestions

- Ensured access to resources and empowering women are key requirements for promoting sustainable mountain development.
- Public investment in education, health, transport, research and extension services.
- Strengthening the availability of credit and financial inclusion of mountainous states.
- Regulation needs to be put in place for conserving biodiversity and management of degraded lands, to create resilience to global environmental changes.
- Processing units need to be created at least at *tehsil* (local administrations) level, so that grading, standardization, packaging and labelling of the Himalayan organic products is done.
- Creation of alternative livelihood through combining green economy and digital economy, to address forward and backward linkages and regulate supplies in response to market demand.
- Policies needed to be framed at national level to compensate services provided by the Himalayan people to the downstream areas in respect of eco-tourism, watershed management, biodiversity conservation, generation of hydroelectricity and supplying drinking and irrigation water.
- Specific market structure needs to be created for organic products, produced by the Himalayan region to foster trade of these commodities into the international market.
- Establishing farmer producer organizations as a strategy to lift small and marginal farmers out of poverty and enhance their competitiveness in agricultural markets.
- Ecosystem services produced by mountain farming, which are vital for downstream areas, be compensated.

References

- Behnke, R. C., & Kerven, C. (2013). *Climate resilience, productivity and equity in dry lands* (Climate Change Working Paper No 4). London: IIED.
- Bradbear, N., & Joshi, D. R. (2012). *Evaluation report of the project: Improving livelihoods through knowledge partnerships and value chains of bee products and services* (Unpublished report). Thimphu.
- Choudhary, D., Pandit, B. H., Kinhal, G., & Kollmair, M. (2011). *Pro-poor value chain development for high value products in mountain regions: Indian Bay Leaf*. Kathmandu: ICIMOD.

- Choudhary, D., Ghosh, I., Chauhan, S., Bhati, S., & Juyal, M. (2013). *Case studies on value chain approach for mountain development in Uttarakhand, India* (Working Paper 2013/6). Kathmandu: ICIMOD.
- DES. (2013). *Economic survey*. Directorate of Economics and Statistics, Government of Jammu and Kashmir.
- Haller, A. (2012). Vivid valleys, pallid peaks? Hypsometric variations and rural–urban land change in the Central Peruvian Andes. *Applied Geography*, 35(1–2), 439–447.
- Hoermann, B., Choudhary, D., & Kollmair, M. (2010). *Integrated value chain development as a tool for poverty alleviation: An analytical and strategic framework*. Kathmandu: ICIMOD.
- Mahajan, V., & Rahman, F. (2015). *Paper presented at SMDS-IV summit of IMI*, held between November 7–9, at Itanagar, Arunachal Pradesh.
- Mukwaya, P., Bamutaze, Y., Mugarura, S., & Benson, T. (2012). *Rural-urban transformation in Uganda* (Working Paper). Kampala: Uganda Strategy Support Program and IFPRI.
- Ojeda, G., Rueff, H., Rahim, I., & Maselli, D. (2012). *Sustaining mobile pastoralists in the mountains of northern Pakistan* (Evidence for Policy Series). Regional edition Central Asia, No 3. Bishkek: NCCR North-South.
- Pasca, A. G., Uitto, M., & Rouby, A. (2010). *Guidelines for the development, promotion and communication of mountain food*. Brussels: Euromontana. https://www.euromontana.org/wp-content/uploads/2014/08/Policy_Recommendations_EN_doc.pdf
- Perlik, M., & Kohler, T. (2012). Green economy and urbanization in mountains. In T. Kohler & others (Eds.), *Sustainable mountain development: Green economy and institutions*. From Rio 1992 to Rio 2012 and beyond. Bern.
- Pratap, T. (2015). *Himalayan agriculture challenges and opportunities*. Paper presented at SMDS-IV Summit of IMI, held between November 7–9, at Itanagar, Arunachal Pradesh.
- Raina, V. K., & Srivastava, D. (2008). *Glacier atlas of India Bangalore*. Published by India Geological Society of India.
- Ramesh, P., Panwar, N. R., Singh, A. B., Ramana, S., Yadav, S., Shrivastava, R., & Subba Rao, A. (2010). Status of organic farming in India. *Current Science*, 98(9), 1190–1194.
- Satterthwaite, D., McGranahan, G., & Tacoli, C. (2010). Urbanization and its implications for food and farming. *Philosophical Transactions of the Royal Society B*, 365(1554), 2809–2820.
- Shah, I., Rahim, I., Rueff, H., & Maselli, D. (2012). *Landless mobile pastoralists: Securing their role as custodian of northern Pakistan's mountains* (Workshop Proceedings). Bern: Centre for Development and Environment, University of Bern.
- Sharma, G., Liang, L., Tanaka, K., Subba, J., & Sharma, E. (2009). Sikkim Himalayan agriculture: Improving and scaling up of the traditionally managed agricultural systems of global significance. *Resources Science*, 31(9), 21–30.
- Templeton, S., & Scherr, S. J. (1997). *Population pressure and the micro economy of land management in hills and mountains of developing world* (Discussion Paper 26). Washington, DC: Environment and Production Technology Division.
- Wani, M. H. (2011). Hill agriculture in India: Problems and prospects of mountain agriculture. *Indian Journal of Agricultural Economics*, 66(1), 64–66.