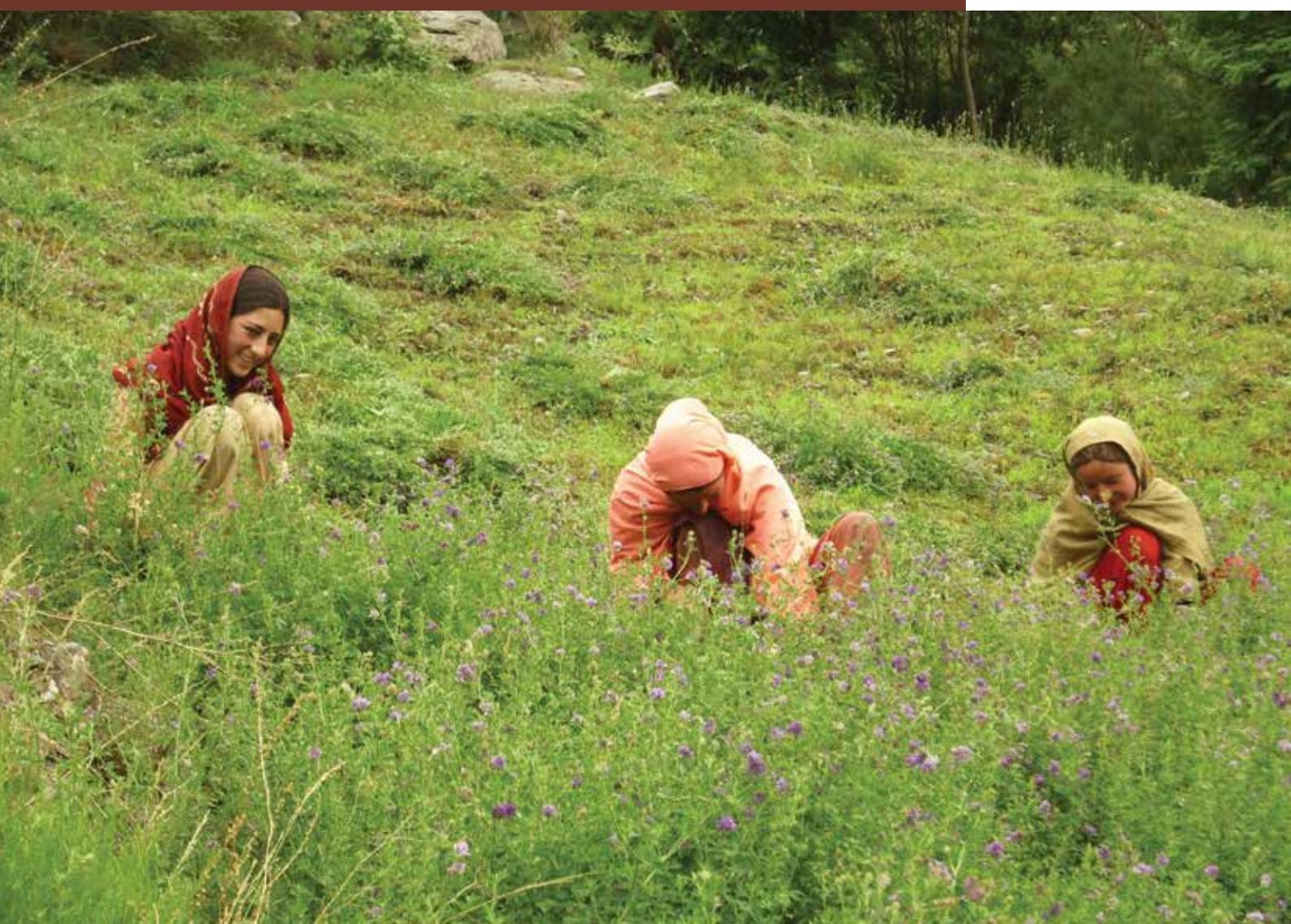


Towards a Framework for Achieving Food Security in the Mountains of Pakistan



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Published by

International Centre for Integrated Mountain Development
GPO Box 3226, Kathmandu, Nepal

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ISBN 978 92 9115 329 9 (printed)
978 92 9115 330 5 (electronic)

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Photos: Abid Hussain – 12; Alex Treadway – pp 4, 8, 11; Farid Ahmad – p 2; Faisal Mueen Qamar – 10;
Ghulam Muhammad Shah – 16; Hammad Gilani – 6; Muhammad Ismail – Cover, p 14

Printed and bound in Nepal by

Quality Printers Pvt Ltd, Kathmandu, Nepal

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This publication is available in electronic form at www.icimod.org/himaldoc

Citation: Rasul, G; Hussain, A; Khan, MA; Ahmad, F; Jasra, AW (2014) *Towards a framework for achieving food security in the mountains of Pakistan*. ICIMOD Working Paper 2014/5. Kathmandu: ICIMOD

Contents

Message from the Ministry of National Food Security and Research, Government of Pakistan	iv
Message from the Pakistan Agricultural Research Centre	v
Foreword	vi
Summary	vii
Acknowledgements	viii
Acronyms and Abbreviations	viii
1. Introduction	1
2. The Mountain Areas of Pakistan	3
3. Mountain Food Security: Status and Challenges	5
Food Security Status in Mountain Areas	5
Challenges to Food Security in Mountain Areas	6
4. Potential and Opportunities	9
Water Resources and Hydropower Potential for Agriculture	9
Potential and Opportunities for Agricultural and Non-agricultural Activities	11
5. Towards a Framework for Food Security in the Mountain Pakistan	16
Policy Framework Based on Area-Specific Approaches	16
General Approaches	18
References	20

Message from the Ministry of National Food Security and Research, Government of Pakistan

Agriculture is the dominant sector in Pakistan. It contributes more than 20% of gross domestic product (GDP) and employs 45% of the country's labour force. The agriculture development strategy in Pakistan promotes private sector led interventions, with the government providing an enabling environment through policy and capacity building initiatives.

Despite the government's emphasis on equitable socioeconomic development, economic growth remains disproportionate, particularly between the plains and mountain regions. Lack of accessibility and infrastructure have led to mountain areas generally remaining underdeveloped compared to the plains. The livelihoods and food security of mountain communities depend heavily on the local resource base at all elevations. Agriculture, livestock, and horticulture are the main sources of livelihood, with livestock becoming more important than arable farming at higher elevations. Remittances, small business, wage labour, tourism, and collection of medicinal plants and other herbs also contribute to livelihoods and food security. In recent years, various biophysical and socioeconomic factors, including increased demand for mountain resources driven by population pressure and changing aspirations, have led to the depletion of the natural resource base in mountain areas. This has resulted in a significant loss of ecosystem services, particularly in terms of soil nutrients, water, and biomass, and a resultant decline in food productivity. The reduced productivity has affected food security and increased the overall vulnerability of mountain people, as they have become more dependent on food from outside and thus exposed to market fluctuations. Mountain farming is also highly vulnerable to climate change, and this has added new challenges to food security in the mountain areas.

We recognize that the nature of food production and causes of food insecurity are different in mountain areas than in the plains. The International Centre for Integrated Mountain Development (ICIMOD) has contributed significantly to bringing the mountain perspective into the draft Agriculture and Food Security Policy of Pakistan. The mountain perspective is now well placed in the agriculture and food security policy and it is hoped that this will contribute to enhancing food security in Pakistan's mountain areas. I am very pleased to see the collaboration of ICIMOD, Pakistan Agricultural Research Council (PARC), and National Agricultural Research Centre (NARC) on mountain agriculture and food security and welcome this joint publication on 'Food Security in the Mountains of Pakistan'. I believe the publication will help stimulate discussion on food security issues in the mountains of Pakistan and contribute to finding solutions.



Seerat Ashghar

Secretary, Ministry of National Food Security and Research
Government of Pakistan

Message from the Pakistan Agricultural Research Council

The agriculture sector in Pakistan sustains the livelihoods of 45 per cent of the national population. Both the direct and indirect contributions of the agriculture sector to overall growth and wellbeing of the people in the country are significant. Agriculture constitutes one-fifth of the GDP and two-fifths of employment in the country. It provides food for domestic consumption, inputs to various food industries, and outputs for export that aids in earning foreign exchange revenue.

Poverty, marginalization, and vulnerability are key issues in mountainous areas of Pakistan, especially in rural areas, where the bulk of the population lives and is primarily dependent on agriculture for food and livelihoods. These issues are particularly severe in the country's most remote northern mountain region, including Gilgit-Baltistan and Chitral, where isolated communities, rugged terrain, and ecological fragility make agricultural production difficult and where difficulties of access to markets and services contribute to widespread chronic poverty. Poverty levels in mountain areas are higher than in other parts of the country. Moreover, poverty reduction rates in mountain areas tend to be lower than elsewhere, leading to a further increase in inequality between people in mountain areas and those elsewhere.

Agriculture in this high-mountain environment remains primitive and subsistence-oriented. Mountain communities living in this region depend directly on natural resources for their food, nutrition, and livelihoods. The region as a whole remains a net food deficit area. Increasing population pressure, diminishing landholdings, soil degradation, the high price of inputs, and climate change impacts are looming threats. This adds urgency to the need for a focused strategy to reduce vulnerability to food shortages, climate change impacts, and increased productivity and value addition in smallholder agriculture.

Despite its many constraints, the area has good potential for developing natural resources, i.e., water for irrigation and hydropower generation, high-value horticulture, tourism and trade, but due to limited resources and poor institutional capacity, these resources are not being exploited properly for the wellbeing of the people. The Government of Pakistan gives high priority to the improvement of livelihoods and the food security situation in Gilgit-Baltistan, Chitral, and other marginalized areas of Pakistan for bringing them at par with rest of the country.

The International Centre for Integrated Mountain Development (ICIMOD) has contributed remarkably in the development of a Strategic Plan for Sustainable Development of Mountain Agriculture and upgrading the Mountain Agricultural Research Centre (MARC) to a centre of excellence for mountain-specific agricultural research and development. These efforts will help in transforming local agriculture by enhancing the institutional capacity for strategic research on suitable technologies, generating knowledge for improving productivity and resilience in mountain agriculture to support food and livelihood security, and contributing to the development of a dynamic commercial sector of high-value mountain-specific products.

I am very pleased with the collaboration between PARC and ICIMOD, and hope that this joint publication on 'Food Security in the Mountains of Pakistan' will contribute towards highlighting the issues of food security in mountainous regions and help in creating solutions to current challenges facing mountain agriculture.

Chairman

Pakistan Agricultural Research Council

Foreword

Over the last decade, Pakistan has made significant progress in achieving food security. It is close to being self-sufficient in terms of the food dietary energy available to the population. However, the variation in topographic, socioeconomic, and physical conditions means that the situation is not uniform across the country. The challenges of ensuring food security are more daunting in mountain areas due to the limited amount of arable land, harsh climate, difficult terrain, and unfavourable biophysical conditions characterized by inaccessibility, fragility, and vulnerability. Mountain areas generally have higher levels of poverty and food insecurity than in the plains, and are experiencing an increase in outmigration and feminization of agriculture. The issues are exacerbated by problems of human-wildlife conflict and the impacts of climate change.

Although mountain areas are not very suitable for cereal crops, mountain regions of Pakistan have a huge potential for a wide variety of food and non-food products such as fruits, nuts, off-season vegetables, seeds, and medicinal plants. Because of increased connectivity and mobility, particularly the increased use of mobile phones and the Internet, mountain regions in Pakistan are now becoming increasingly connected to national, regional, and global markets where the demand for mountain products is growing. This offers new opportunities for exploiting the potential of mountain niche products and enhancing the food security of Pakistan's mountain communities. Better processing and marketing facilities for high-value mountain products and the sustainable use of natural resources and ecosystem services can offer huge opportunities both in the mountains and downstream.

Reducing poverty, hunger, and food insecurity are overarching goals of the Government of Pakistan. The government is committed to inclusive and equitable socioeconomic development and eradicating hunger, and as a part of this is currently preparing an Agriculture and Food Security Policy. To eradicate hunger, it will be important to place an additional focus on mountains and other marginal areas where the problems of food security are greatest. It is, therefore, essential to enhance and diversify the income of people that go beyond agriculture production which will be important enhancing food security. ICIMOD, together with the Pakistan Agricultural Research Council (PARC) and the National Agricultural Research Centre (NARC), has been making an effort to understand the special issues of food security and find solutions in the mountain areas of Pakistan. This publication is an integral part of this process. I hope that the paper will bring some insights into food security in the mountain areas of Pakistan and provide useful strategic input for dealing with them.



David Molden, Ph.D

Director General
ICIMOD

Summary

Agriculture contributes more than 20% of gross domestic product (GDP) in Pakistan and employs 45% of the country's labour force. The Government of Pakistan is committed to ensuring food security and eradicating hunger. However, economic growth remains disproportionate, particularly between the plains and the mountain regions. The challenges of ensuring food security are more daunting in mountain areas due to the limited amount of arable land, harsh climate, difficult terrain, and unfavourable biophysical conditions characterized by inaccessibility, fragility, and vulnerability.

Rapid socioeconomic and environmental changes, including climate change, have added to the problem of food insecurity in mountain areas. In the wet mountain ranges of Pakistan, in Azad Jammu & Kashmir and parts of Khyber Pakhtunkhwa, climate change has resulted in more frequent flash floods as a result of an increase in extreme rainfall events. In the western dry mountains and dry western plateau in Balochistan, prolonged droughts are having a severe impact on food security, particularly for those households whose livelihoods mainly depend on livestock. Degradation of pastures and rangelands has seriously affected the livestock population and food security, particularly in Balochistan and Gilgit-Baltistan. Socioeconomic factors such as inadequate transportation, infrastructure, storage, and marketing facilities; deterioration of local food systems; and higher outmigration are also influencing mountain food security. In Gilgit-Baltistan, an important producer of fruit and off-season vegetables, the lack of storage, packing, and transport facilities, and rough handling results in postharvest losses of 30–40%.

As the nature and causes of food and livelihood security (and insecurity) in mountain areas are quite different to those in the plains; a mountain-specific framework is needed to address the issues. This publication analyses the status, opportunities, issues, and challenges of food security in Pakistan's mountain areas. A framework is outlined for addressing the specific issues in terms of four different types of area differentiated by agro-ecological potential and access to markets, information, and institutional services (areas with high potential and good access to market and services; areas with high potential but poor access to markets and services; areas with low potential but good access to markets and services; areas with low potential and poor access to markets and services). The general approaches suggested include developing local food systems; strengthening existing institutional support; developing an organized marketing system; developing storage and processing facilities; enhancing export competitiveness; developing an organic certification system; strengthening the existing agricultural marketing information system; encouraging the productive use of remittances; managing water resources for irrigation and hydropower; managing the northern mountains for water and other ecosystem services; community engagement in natural resource management; and non-farm income opportunities for youth in mountain areas. The suggested framework will be helpful in designing policies and programmes to enhance food security in the mountains of Pakistan and elsewhere.

Acknowledgements

The authors benefited from discussions with Dr David Molden and Dr Eklabya Sharma of ICIMOD. The paper was reviewed by Dr Tashi Dorji and Dr Rucha Ghate. We are grateful to all of them. We would like to acknowledge Dr A. Beatrice Murray for her valuable editorial inputs. This study was partially supported by core funds contributed to ICIMOD by the Governments of Afghanistan, Australia, Austria, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Switzerland, and the United Kingdom. The views and interpretations in this publication are those of the authors.

Acronyms and Abbreviations

AJK	Azad Jammu & Kashmir
AU	administrative unit
FATA	Federally Administered Tribal Areas
GB	Gilgit-Baltistan
KPK	Khyber Pakhtunkhwa
MAF	million acre feet

Note:

MAF = million acre feet; 1 acre foot = 1,233 m³; 1 acre = 0.4 ha

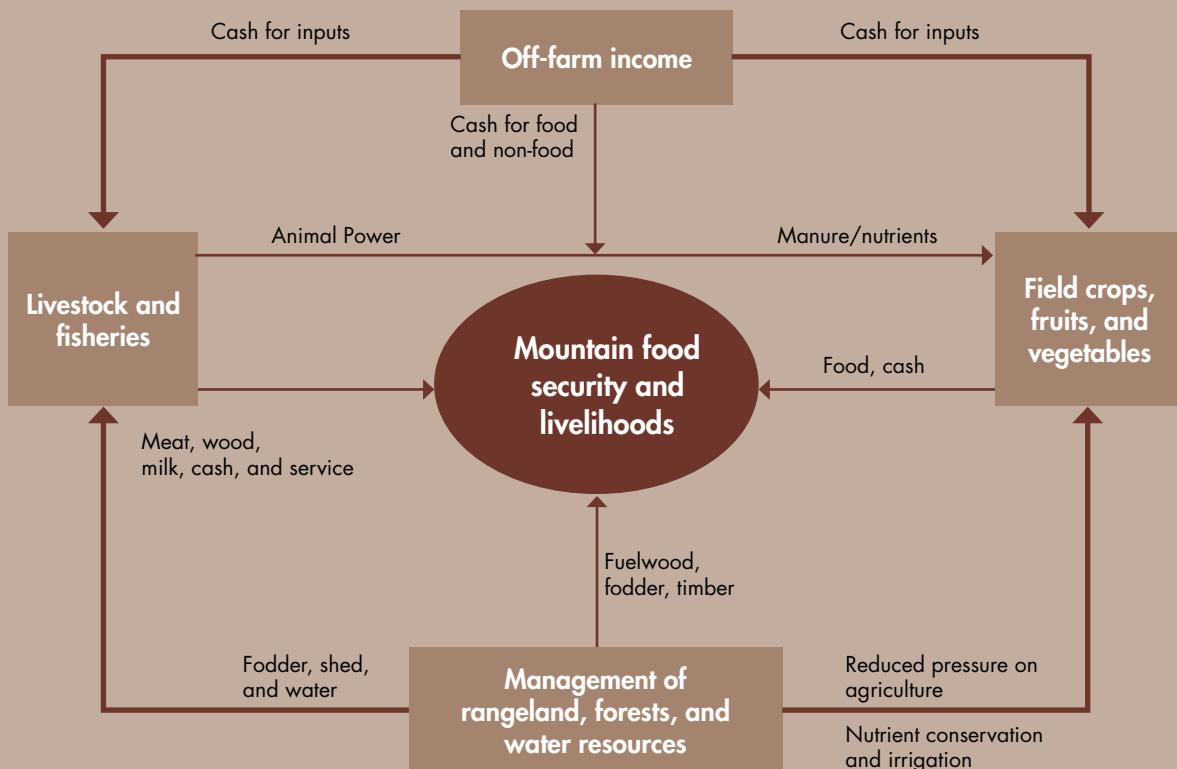
1 Introduction

Mountains occupy more than a fifth of the Earth's land surface and are home to some 12% of the world's population, approximately half of them in the Asia Pacific region (Akramov et al. 2010; Huddleston et al. 2003). Around 245 million people living in mountain areas in developing and transition countries are estimated to be vulnerable to food insecurity as a result of low productivity, subsistence economies, the constraints of terrain and climate, poor infrastructure, limited access to markets, physical isolation, vulnerability to natural risks, and high cost of food production and transportation (Rasul 2011; Tiwari and Joshi 2012; Ward et al. 2012; Huddleston et al. 2003; FAO 2008).

Agriculture contributes more than 20% of the gross domestic product (GDP) in Pakistan and employs 45% of the country's labour force. The Government of Pakistan is committed to ensuring food security and eradicating hunger. Within the Hindu Kush Himalayan region, Pakistan has made significant improvements in achieving food security in recent years, and is close to being self-sufficient in terms of the food dietary energy available to the population. However, the situation is not uniform across the country due to the variation in topographic, socioeconomic, and physical conditions across the regions, and not all areas are food secure. Especially the mountain areas tend to have higher levels of both poverty (Khan 2011) and food insecurity (SDPI 2009) than the plains areas.

In Pakistan, the livelihoods and food security of mountain communities depend heavily on the local resource base at all elevations, although the specific agro-ecological and livelihood potentials vary considerably. Agriculture, livestock, and horticulture are the main sources of livelihood (Figure 1), with livestock becoming more important

Figure 1: Sources of mountain food and livelihood security



than arable farming at higher elevations. Remittances, small business, wage labour, tourism, and collection of medicinal plants and other herbs also contribute to livelihoods and food security. However, in recent years, various biophysical and socioeconomic factors have led to a depletion of the natural resource base across the Hindu Kush Himalayan (HKH) region. This has resulted in a significant loss of ecosystem services, particularly in terms of soil nutrients, water, and biomass, and resultant decline in food productivity (Tiwari 2000). The reduced productivity has affected food security and increased the overall vulnerability of mountain people, as they have become more dependent on food from outside and thus exposed to market fluctuations. Climate change is adding new challenges in terms of water availability and changing temperature conditions.

Pakistan's mountain areas are highly diverse and vary considerably in agroecological potential and access to institutional services, thus the food security issues also differ. To successfully address these issues, a framework is needed that takes this variation into account. The main objective of the present publication is to describe the status, challenges, opportunities, and potentials in mountain food security, and to outline a specific policy framework for improving the situation. The framework addresses the specific issues in terms of four different types of area differentiated by agro-ecological potential and access to markets, information, and institutional services. The paper is divided into five sections: this introduction is followed by an overview of the mountain areas, a summary of the status of and challenges to food security in mountains, and a description of key opportunities and potentials that may help in improving food and livelihood security. Finally the outline policy framework for mountain food security is presented.

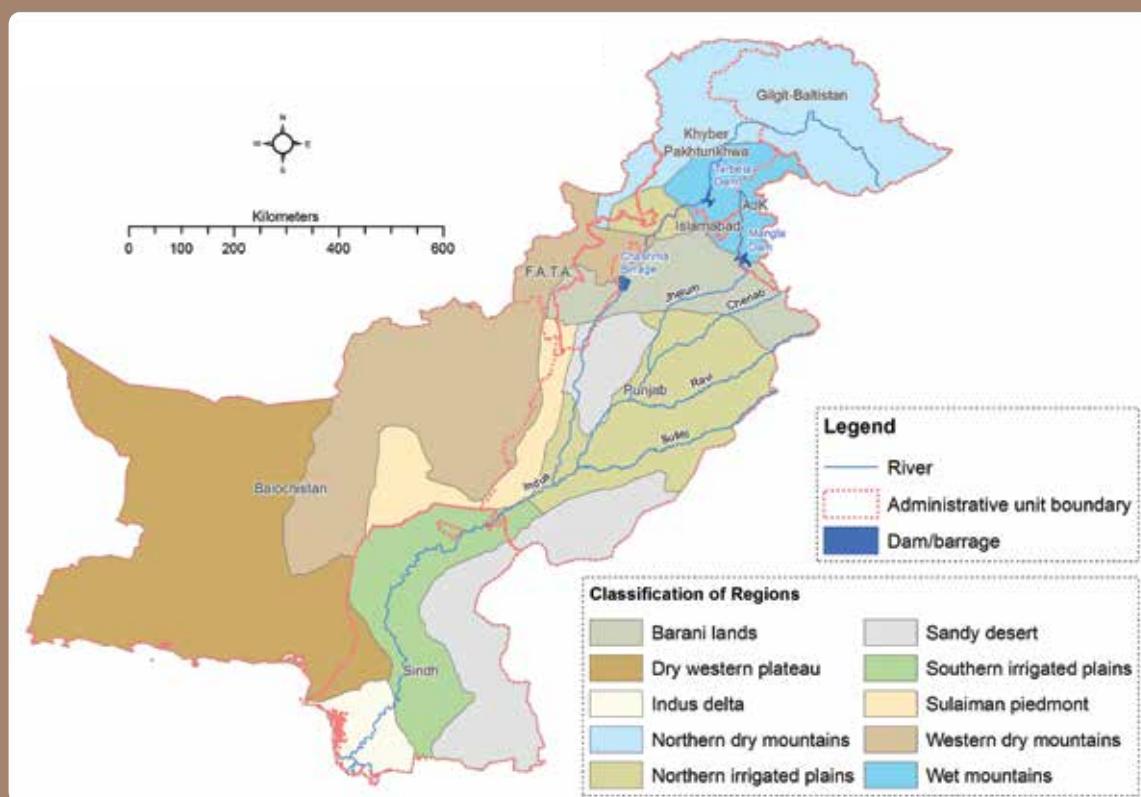


2 The Mountain Areas of Pakistan

Five of Pakistan's eight administrative units (AUs) are mainly mountainous: from west to east, Balochistan, Federally Administered Tribal Areas (FATA), Khyber Pakhtunkhwa (KPK), Azad Jammu & Kashmir (AJK), and Gilgit-Baltistan (GB) (Figure 2). The mountain areas are rich in natural resources such as water, forests, pasture, and valuable minerals, including antimony, aragonite (marble), baryte, chromite, fluorite, coal, magnesite, manganese, and soapstone, particularly in KPK, FATA, and Balochistan. They deliver a quarter of the country's total annual production of crude oil and natural gas, and KPK and AJK generate almost three-quarters of the country's hydropower electricity (PBOS 2011). Thus the mountain areas can play a vital role in Pakistan's development. However, the country's endowment of rich resources does not necessarily translate into equitable access and benefit sharing for the mountain communities.

As in other mountainous regions in developing countries, livelihoods in the mountains of Pakistan are based primarily on subsistence agriculture, livestock, common pasture and rangeland, forest, and some non-farm activities. The amount of cultivable land is limited and average landholdings are generally small and insufficient to fulfil the food requirements. Currently, a substantial share of household income is derived from livestock rearing. Livestock products are generally used for subsistence, although some households use them as a source of cash income (Ahmad et al. 2012, PDDNA 2003). Although a substantial proportion of income is from agriculture and livestock, non-agricultural income from small businesses, services, remittances, non-farm wages, forests, and social safety nets also plays an important role (Israr and Khan 2010). However, local products such as handicrafts, woodcarving, embroidery, and products from local gemstones are not properly promoted and the marketing system is poor, reducing the potential for income generation.

Figure 2: Agro-ecological regions and administrative units in Pakistan





Almost 60% of the geographical area of Pakistan is rangeland. Most of this rangeland is degrading due to increasing pressure from human and livestock populations coupled with frequent drought. In addition to providing environmental services, such as carbon sequestration, watershed management, biodiversity, and ecotourism, rangelands are the major free grazing areas for livestock in general, and small ruminants (goats and sheep) in particular, throughout the year (Ahmad and Islam 2011; Mirza et al. 2006). In Balochistan, these small ruminants directly or indirectly support the food security and livelihoods of close to 90% of the population (Ahmad et al. 2012). Unfortunately, most of these rangelands are degrading due to increasing pressure from human and livestock populations coupled with frequent drought. The fragile mountain ecosystem is suffering from degradation of vegetation cover, deterioration of soil, and reduction in livestock productivity, which has further impoverished the pastoral communities. Thus there is a need to take corrective action to conserve and enhance the productivity, sustainability, and ecological health of the rangeland ecosystem (Afzal et al. 2008).

3 Mountain Food Security: Status and Challenges

Food Security Status in Mountain Areas

The overall food security situation in Pakistan's AUs is summarized in Table 1. The two predominantly plains areas of Punjab and Sindh produce a surplus, although they do have food insecure districts. All five mountain AUs show a food deficit, which is highest in FATA, AJK, and GB. The mountain areas are particularly deficient in the production of cereals and pulses, which contribute 50–60% of the average calorie intake. The main source of cereals in GB is subsidized wheat from the plains areas; this is why there were a series of protests following the withdrawal of the wheat subsidy for GB in April 2014. The proportion of the population that is food insecure is also higher in the mountain areas than in the plains, with more than half the population food insecure in all mountain AUs except AJK. Nineteen of the 20 most food insecure districts in Pakistan are in mountain AUs: ten in Balochistan, five in FATA, three in KPK; and one in GB (SDPI 2009).

There are several food security issues in the mountain areas that need to be addressed. For example, although mountain areas have considerable potential for the production of fruits and vegetables as cash crops, farmers lack institutional support to intensify production. In Gilgit-Baltistan, less than 10% of total cultivable land was used for fruit production and 9% for vegetable cultivation in 2011/12 (Government of Pakistan and IUCN 2003), and in Balochistan only 22% and 3.7%, respectively (of the cropped area) (GOP 2013a; GOP 2013b). Mountain farmers also face particular problems such as inadequate supply of credit and inputs, weak extension services, and low adaptive capacity for climate change (ICIMOD 2008; Shahbaz et al. 2012).

There are also many problems that adversely affect livestock production, especially poor promotion, low yielding local breeds, inadequate veterinary services, low capacity of flock owners, and poor market infrastructure. However, although the local livestock are low yielding, their requirements are minimal and they survive in water and forage stress situations (Raziq et al. 2010) producing environmentally friendly quality organic products in a very low input system that contribute significantly to both local and national food security.

Table 1: Food security in the mountains and plains of Pakistan*

Administrative Unit (AU)		Local food production		Food accessibility index	Food insecure population (%)	Food security index
		Net food availability (kcal/day/ capita)	Food deficit/surplus (%)			
Mountains	Balochistan	1,779	-24	1.7	61.2	4.5
	FATA	496	-79	0.1	67.7	0.3
	KPK	1,677	-29	2.7	56.2	5.3
	AJK	540	-77	0.8	46.9	2.2
	GB	1,280	-46	0.6	52.4	1.0
Plains	Punjab	3,022	+29	3.4	38.5	8.7
	Sindh	2,563	+9	3.0	44.3	7.1
Pakistan total		2,562	+9	-	48.6	-

*No data for the Capital Territory, which is urban

Data source: Hussain and Routray 2012; Hussain 2010; SDPI 2009

Challenges to Food Security in Mountain Areas

Although there is a wide range of potentials and opportunities, mountain farmers face several biophysical and socioeconomic constraints and challenges which limit optimal exploitation of the potential and affect food and livelihoods security.

Biophysical and environmental challenges

The shrinking resource base is posing serious environmental constraints across Pakistan's mountain areas. Mountain agriculture is highly integrated with a high degree of interdependence among cropping, forestry, fruit growing, and livestock production. However, the mountain areas are experiencing accelerated deforestation; soil erosion; siltation of rivers, irrigation systems, and reservoirs; desertification; loss of biological diversity; and degradation of rangeland and pastures. Combined, these have led to a loss of soil fertility, reduced agricultural productivity, and reduced food security.

Over the past 20 years, land rehabilitation with monoculture afforestation in Pakistan's mountains has obstructed transhumance routes for herders and forced their migration to upland pastures in the summer. Early arrival at the summer pastures has accelerated degradation as the animals graze on newly sprouted grass hindering maturation. Afforestation programmes that included plantation of fodder species would have been an effective means for fulfilling land rehabilitation needs while providing fodder to pastoralists for their livestock (Rahim et al. 2011). This lack of planning and resultant increased degradation may have also contributed further to climate change.

The threat of drought is also posing serious problems of ecosystem degradation and water stress in almost all zones (Shafiq and Kakar 2006). Annual precipitation in the western dry mountains and dry western plateau (Figure 2) has decreased, and drought conditions have become more common. These areas experienced a bad drought from 1998



to 2002; in Balochistan, on average only 50% of normal rainfall fell in summer and 37% in winter (PMD 2014). Some districts such as Pishin, Mastung, Killa Abdullah, Lasbilla, Chaghi, Kharan, Awaran, Panjgoor, and Ketch did not receive any rain at all (Shafiq et al. 2005). The drought resulted in a serious water shortage for agriculture which affected nearly 2 million acres of cultivable land and 9.3 million livestock. Drastic changes in the structure of plant communities in the degraded rangeland ecosystem, and shortages of fodder and water, led to the death of 1.76 million livestock; close to 80% of apple orchards were destroyed. Food prices rose, and the food security and livelihoods of nearly 2 million mountain people were affected, resulting in reduced food consumption and the migration of people from drought-affected areas to areas downstream. As a coping strategy, livestock owners substituted bigger animals and sheep with local goats, which are more resilient to water and fodder/forage-stress but can have negative long-term environmental impacts (Shafiq and Kakar 2006). With climate change, droughts continue to be a problem. The continued water stress has led to excessive pumping of groundwater, resulting in further lowering of the water table, especially in some parts of Balochistan, with a significant impact on local food systems and food security.

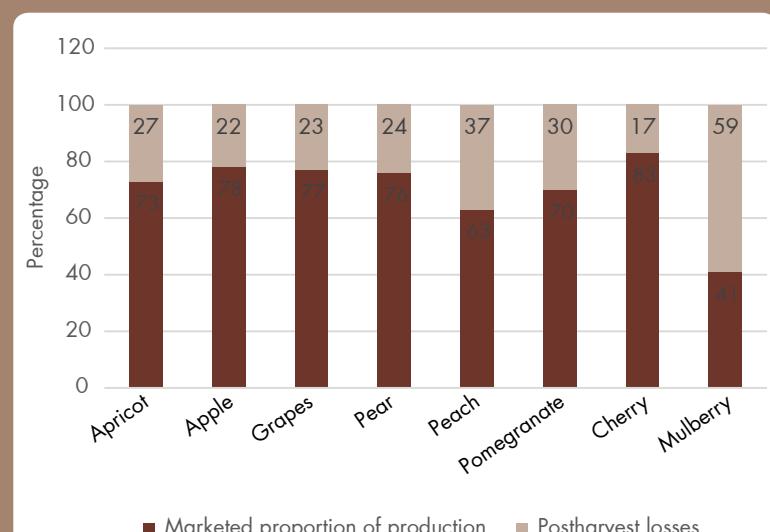
In contrast, in the wet mountain areas and northern dry mountains (Figure 2), frequent fluctuations in the intensity of precipitation have led to an increase in flooding, especially flash flooding, affecting the resource base and infrastructure in both upstream and downstream areas. The devastating floods of 2010 left close to 8 million people vulnerable to long-term food insecurity, the majority of them in mountain areas (WFP 2010). This has led to renewed concerns about food insecurity and calls for further investigation of the vulnerability of mountain communities with respect to food security.

Socioeconomic challenges

Transportation infrastructure, storage and marketing, income generation, diversification of food resources, and capacity building all have an important role to play in improving mountain food security. Poor marketing facilities and inadequate policy and institutional support mean that mountain farmers do not receive a fair price for their products, which affects their agricultural and food security. Especially the producers of vegetables and fruit suffer from poor access to markets as a result of the poor road network and infrequency of collection centres. This allows intermediaries to charge very high commissions, which reduces the returns to farmers. The agricultural marketing system and storage facilities are particularly underdeveloped in Balochistan, FATA, and GB. For example, GB is an important producer of fruit and off-season vegetables, but the lack of storage, packing, and transport facilities and rough handling result in post-harvest losses to fruit and vegetables of 30–40% (Ali 2012), with a high proportion of wastage for perishable commodities such as apricot, cabbage, and tomatoes. Figure 3 shows the post-harvest losses for different types of fruit in GB; they range from 22 to 59%. In Balochistan, GB, and FATA, people feed a substantial portion of harvested fruit and vegetables to their livestock due to the limited access to markets (Hussain 2010).

The poor harvest technology, lack of storage facilities, and poor marketing, combined with disease, water stress, and vegetation scarcity, mean that the production of fruits and nuts such as walnut and apricot is stagnating, or even decreasing, in spite of increased prices in national and global markets. Mountain areas also lack connectivity to markets for livestock and livestock products. Trade in livestock appears to be more important in the less well-connected areas, but there is less focus on livestock production and commercialization to generate household cash income in this area (Rahman et al. 2008).

Figure 3: Post-harvest losses to fruit production in Gilgit-Baltistan



Source: Government of Gilgit-Baltistan, 2009

Although the agricultural system and food production depend on local biophysical conditions and access to services, overall cash crop production has been increasing and cereal crop production has been declining. Moreover, there is a huge shift from traditional varieties to new varieties and from traditional farming practices to new farming practices. This has led to deterioration in the local food system and increased dependence on external sources for food grain. Although integration into the market system has increased mountain farmers' access to food through cash crops, it has made them more vulnerable to food insecurity due to frequent price shocks and disruptions in the transportation of food as a result of natural hazards.

Inflow of remittances from outmigrants is undoubtedly a potential source for improving local food security and livelihoods through enhancing local small businesses, transferring new technologies, and creating job opportunities for local skilled and unskilled labour. But outmigration has also added to the challenges in mountain areas. Increased outmigration and decreased interest of the younger generation in farming also contribute to the low productivity in agriculture. In areas such as Chitral (KPK) and Hunza-Nagar (GB), which have the highest agro-ecological potential for fruit, vegetables, and other crops, almost 70% of farming households face frequent labour shortages during the sowing and harvesting months due to outmigration of active household members, particularly youth (ICIMOD 2014). Old farmers are very slow to adopt new technologies. The absence of young people is impeding the efforts being made to develop mountain agriculture as a business enterprise. Involvement of youth is very important because they are generally more progressive and willing to adopt new technologies related to production, harvesting, post-harvest handling, and marketing.



4 Potential and Opportunities

Water Resources and Hydropower Potential for Agriculture

The northern mountains are the main sources of surface water in the country and provide the basis for irrigation and hydropower. Precipitation, snowmelt, and glacier melt in the northern mountains are the major sources for the Indus, and thus the Indus irrigation system. Almost 52% of the total area of the Indus basin lies in Pakistan; the Astor, Beas, Chenab, Chitral, Gilgit, Hunza, Jhelum, Kabul, Ravi, Sutlej, Swat, Shigar, Shingo, and Shyok tributaries all originate or flow through the country.

The agricultural sector is the main user of water and its consumption will continue to dominate water requirements. Irrigated agriculture is the mainstay of Pakistan's food security and economy. About 105 of 155 million acre feet (MAF) of surface water is being withdrawn annually for irrigation, while around 48 MAF is pumped from ground reserves. Pakistan has 72.7 million acres of cultivable land, of which 47.6 million acres are irrigated, including 27 million acres under canal irrigation. Pakistan still has a potential 20.3 million acres of land that can be brought under irrigation (WAPDA 2013). The existing water storage capacity of 15 MAF (which was reduced to 11.4 MAF in 2012 due to excessive sediment inflows) needs to be at least tripled to bring the remaining cultivable land into production and feed the population of nearly 184 million people (WAPDA 2009, 2013). The average annual outflow of water to the Arabian Sea (1976 to 2008) is 32.3 MAF; of which 18 MAF is available for water development purposes. The Diamer Basha Dam will store 6.40 MAF of water, indicating that 11.4 MAF will still be available for storage (WAPDA 2009).

The Indus River and its tributaries have abundant hydropower potential, particularly in the mountain areas of Pakistan. The country has potential hydropower resources of about 60,000 MW (Table 2), most of which lies in the mountainous areas with 41% in KPK, 35% in GB, and 11% in AJK. Only 11% (6,720 MW) of the hydropower potential has been exploited so far, in 33 small and three large projects: Tarbela (3,478 MW), Mangla (1,000 MW), and Ghazi Barotha (1,450 MW). Three-quarters of the total operating capacity is installed in mountain areas (Table 3). In response to the

Table 2: Hydropower resources in Pakistan

Provinces/ AUs	Projects in operation (in 2010)		Projects under implementation			Projects with feasibility study completed (MW)	Identified resources (raw sites) (MW)	Total hydropower resources			
	MW	%	Public sector (MW)	Private sector (MW)				MW	%		
				Province level	Federal level						
Mountain AUs											
Balochistan	-	-	-	-	-	1	0	1	0		
KPK	3,849	57	9,482	28	2,370	77	8,930	24,736	41		
AJK	1,039	16	1,231	92	3,172	1	915	6,450	11		
GB	133	2	11,876	40	-	534	8,542	21,125	35		
Plains AUs											
Punjab	1,699	25	720	308	720	3,606	238	7,291	12		
Sindh	-		-	-	-	67	126	193	0.3		
Total	6,720	100	23,309	468	6,262	4,286	18,751	59,796	100		

Source: MWP 2013

Table 3: Proportion of fruits and nuts grown in the mountains of Pakistan

Crop		Proportion of administrative unit in total country production (%)					
		Mountain AUs				Plains AUs	Pakistan total
		Balochistan	FATA	KPK	Gilgit-Baltistan	Punjab and Sindh	
Fruit	Apple	73.4	8.9	14.4	2.8	0.5	100
	Apricot	58.2	1.4	4.5	35.8	0.1	100
	Cherry	47.0	0	0	53	0	100
	Fig	19.7	24.5	55.8	0	0	100
	Grapes	88.3	1.2	1.6	8.9	0	100
	Loquat	2.5	8.6	42.7	0	46.2	100
	Mulberry	0	2.2	11.0	75.9	10.9	100
	Peach	33.6	6.8	53.9	5.3	0.4	100
	Pear	2.3	4.0	81.8	11.4	0.5	100
	Persimmon	0	4.3	95.7	0	0	100
	Pomegranate	64.8	2.3	3.1	7.9	21.9	100
Nut	Plum	45.9	5.1	43.8	4.9	0.3	100
	Almond	88.3	1.7	2.5	7.3	0.2	100
	Walnut	0	13.6	53.4	33.0	0	100

Note: data for AJK not available

Data source: Government of Gilgit-Baltistan 2007; KPK 2011; GOP 2013a; PDDNA 2003

current energy crisis, a number of new hydropower projects are now in the process of being implemented or are being studied for feasibility, including big projects such as Diamer Bhasha (in GB), Dasu (in KPK), and Bunji (in GB) (MWP 2013).

Electricity is an important driver for socioeconomic advance. However, about 30% of Pakistan's population has no access to electricity (MWP 2013). Construction of big water reservoirs will not only help address the energy crisis faced by industries and households, it will also contribute to agricultural productivity by providing more water for irrigation in the plains. A large area of rangeland and barren cultivable land in Punjab and Sindh could be available for agricultural activities, especially in the tail areas of canals and in deserts. Improved food production in the plains will improve the food supply to mountains at affordable prices. At present, Pakistan generates around 64% of its electricity from thermal sources such as gas and oil, which is very expensive. The importance of cheaper hydropower has increased following the rise in fuel prices (GOP 2013b). A move in the energy sector from thermal to hydropower could also improve the availability of subsidized fuel to the transportation sector, which could lower food transportation costs from the plains to the mountains.

Both water storage and hydropower development can benefit the communities living in mountain areas. However, appropriate benefit-sharing mechanisms are necessary to ensure that mountain people get equitable access to

these benefits. Large reservoirs are generally located in mountain areas and close to 90% of total potential hydropower resources are located in the mountain districts, but the greater part of the water and electricity is used in the plains. Benefit-sharing mechanisms can ensure that such developments provide mountain people with improved livelihood and food security through direct payments that can be used to develop the mountain potential, (e.g., in the form of payment for ecosystem services), piped water, electricity, and lower cost access to the food produced in the plains.



Potential and Opportunities for Agricultural and Non-agricultural Activities

The mountains of Pakistan are heterogeneous in terms of elevation, topography, climatic conditions, and environment. They can be classified broadly into different agro-ecological zones (Figure 2), each of which has different issues and potentials in terms of food and livelihood security. In general, mountain areas are not very suitable for growing cereals, but they have a huge potential for the production of a wide variety of food and non-food products such as fruits, nuts, off-season vegetables, seeds, and medicinal plants, which can be critical for improving livelihoods and food security.

The potential varies with elevation and location. In GB, for example, the mountain ranges can be classified into four subzones with different agricultural characteristics, and also a considerable variation in the supply of institutional services: double cropping (<1,900 masl), marginal double cropping (1,900–2,300 masl), single cropping (2,300–3,000 masl), and alpine pastures with no cultivation (>3,000 masl). The higher ranges have relatively less vegetation and are snow covered for the greater part of the year, but are still suitable for some agricultural production. The double cropping subzone has potential for cultivation of wheat, maize, vegetables, and fruits; the marginal double cropping subzone for wheat, barley, buckwheat, vegetables, fruits, and nuts; and the single cropping subzone for potato, wheat, barley, peas, fava bean, and apricot and other fruits. Livestock rearing, either by landowners or transhumant pastoralists, is common to all four subzones (Government of Gilgit-Baltistan 2013).

In Balochistan and FATA, the mountains are mainly dry with less vegetation; they are vulnerable to drought but have a high potential for fruit, vegetable, and livestock production. Balochistan is divided into seven agro-ecological subzones in terms of cropping practices based on elevation and climatic factors (IUCN 2006). All subzones are suitable for fruits and nuts, with some variation in terms of fruit species and varieties, and most have a potential for vegetable cultivation, particularly onion, potato, and pulses (IUCN 2010). Balochistan is also divided into six different subzones in terms of livestock potential based on climatic factors and plant biodiversity (Kakar 2012). There is a huge diversity in the species of animals and plants in these subzones; sheep, goats, and camels can survive in all of the subzones, with some variation in breeds, but cattle are only found in three. The mountain ranges in major parts of KPK and AJK have a much denser vegetation cover as a result of the higher annual precipitation. These ranges have the highest potential in terms of cereal, fruit, vegetable, and livestock production.

Due to increased connectivity and mobility, particularly the increased use of mobile phones and the Internet, mountain regions are now becoming increasingly connected to national, regional, and global markets. There is also a growing demand for mountain products from these markets. This offers new opportunities for exploiting the potential of mountain niche products and enhancing the food security of Pakistan's mountain communities. Some of the key potentials and opportunities are presented briefly below.





Fruits and nuts

Mountain areas have a substantial comparative advantage for fruits, nuts, and other high-value products, and in Pakistan's mountain areas, the cultivation of horticultural crops is increasing.

The proportion of the total country production of major fruit and nut crops grown in the different AUs is shown in Table 3. Balochistan contributes substantially to the national production of apple, apricot, cherry, fig, grapes, peach, pomegranate,

plum, and almond; KPK contributes significantly to the national production of apple, fig, loquat, peach, pear, persimmon, plum, and walnut; while the smaller mountain AUs of FATA and GB contribute significantly to the production of apricot, cherry, fig, mulberry, and walnut.

There is a considerable opportunity to generate income from exports of mountain fruits and nuts – almond, apple, areca nut, cashew nut, grapes, pomegranate, and pistachio all have a huge production potential, which could not only fulfil domestic demand but also provide sufficient for export. Pakistan already exports several types of fruits and nuts produced in the mountains including apricots, cherries, figs, plums, sloes, peaches, pine nuts, and walnuts (Table 4).

Off-season vegetables and medicinal plants

Mountain areas also offer considerable opportunities for the production of high-quality seed potato, vegetable seeds, off-season vegetables, and medicinal plants. The climatic conditions are conducive and the mountain areas could potentially meet the whole country's requirement for seed potatoes and vegetable seed. The area under potatoes is increasing year by year, and there is a huge potential especially for beans, cucumber, ladyfinger, onion, peas, spinach, and tomato (GOP 2013a; KPK 2011, IUCN 2006; PDDNA 2003; Government of AJK 1998). It is notable that even in alpine pasture areas (e.g., Babusar, KPK, and the Deosai plains, GB) local people have started cultivating off-season potatoes and peas. Production of potato and pea in the summer from these areas not only meets local demand, a considerable proportion of produce is also exported to lower mountain areas and the plains. The export of potatoes from GB to other parts of the country fluctuates but is slowly increasing (Figure 4).

The conditions in mountain areas are also highly suitable for the production of medicinal and aromatic plants and other high-value products. For example, GB has a huge agro-ecological potential for the production of seabuckthorn, wild thyme, black cumin, chamomile, stevia, and salajeet. Seabuckthorn production with the development of the value chain has become a success story in GB. At present, around 100 tonnes of dry berries

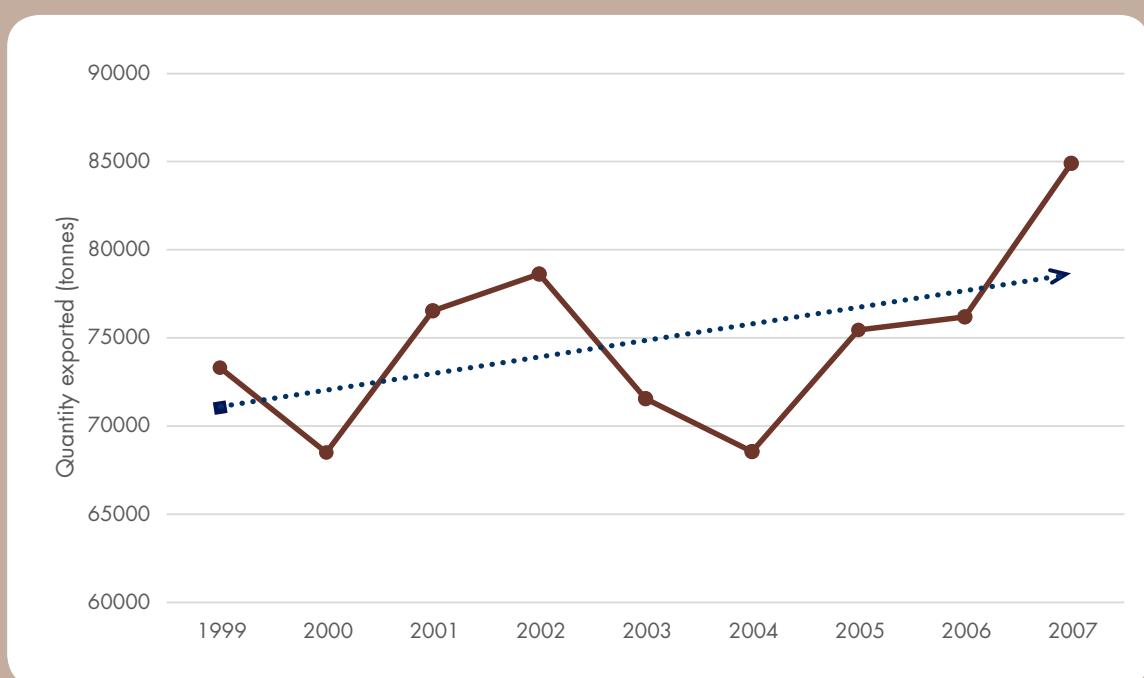
Table 4: Exports of mountain fruits and nuts

Fruit/nut	2010/11		2011/12	
	Quantity exported (tonnes)	Export value (million PKR ^a)	Quantity exported (tonnes)	Export value (million PKR)
Apricots (fresh and dried)	802.3	182.0	481.2	96.9
Cherries	3.3	0.7	8.3	1.7
Figs	40.7	10.1	78.2	15.1
Plums and sloes	35.1	6.2	41.8	11.9
Peaches	671.2	26.9	786.8	36.1
Pine nuts	1,737.8	2,103.4	1,461.1	2,010.3
Walnuts (shelled and in shell)	192.5	36.1	56.1	12.3

Source: GOP 2013a

^a PKR 1= USD 0.86 (approx in 2011)

Figure 4: Annual export of potato from Gilgit-Baltistan to other parts of Pakistan



Source: Government of Gilgit-Baltistan 2007

and seeds from seabuckthorn with a value of USD 0.5 million are exported annually to European countries (MAFSO 2014). Similar efforts are required to capitalize on the potential of other medicinal plants, not only in GB but also in other mountainous areas in Pakistan.

Livestock and livestock by-products

About two-thirds of the mountain area – 60 million hectares – is rangeland. The rangelands extend from the alpine pastures in the northern mountains, to the temperate and Mediterranean ranges in the western mountains and the arid and semi-arid desert ranges of the dry western plateau. They are an important resource for raising livestock, which is a key source of mountain livelihoods and plays a pivotal role in the lives of rural farmers (Table 5). Livestock

Table 5: Non-crop options for mountain food and livelihood security

	Mountain AUs					Plains AUs	
	Balochistan	FATA	KPK	AJK	GB	Punjab and Sindh	
Livestock	Livestock heads per capita	3.7	1.8	1.0	0.9	1.1	0.8
	Livestock units per capita*	0.6	0.4	0.3	0.2	0.2	0.3
	Sheep and goats	24,589	4,784	12,962	1,577	1,565	42,723
	Population ('000)	3.2	1.3	0.6	0.5	0.9	0.4
Rangelands	Proportion of rangelands in total geographical area (%)	78.9	48.3	45.1	53.9	46.0	
Forest	Proportion of forest in total geographical area (%)	4.1	13.1	11.6	9.2	4.4	
	% share in total revenue generated from forest products	1.9	34.6	13.8	0.1	49.6	
Remitting overseas workforce	Ratio of workers migrated for overseas employment (1981–2013) to the population (%)	1.1	8.8	8.3	13.1	0.4	3.2

*Method for estimating livestock units adapted from FAO 2005

Data source: GOP 1990; GOP 2013b; BEOE 2013; Government of AJK 1998, 2012; Government of Gilgit-Baltistan 2013; KPK 2011; PBOS 1996, 2006, 2010; PFI 2012



not only produce food items such as milk, butter, and meat, but also provide valuable by-products like wool. In the absence of other means of subsistence, livestock provide the mainstay of more than 75% of the rural population (Shafiq and Kakar 2006). Balochistan, FATA, and GB have a higher proportion of rangelands, which provide a source of fodder for grazing livestock, particularly goats and sheep. Opportunities to increase livestock productivity and the volume of by-products such as pashmina wool are growing. In KPK, the Ajar pastoralist community (around 7,500 landless households) market small ruminants worth USD 68 million per year (Ojeda et al. 2012). Mountain pastoralists in Pakistan have a highly treasured livestock genetic pool with special traits that are adapted to the rugged terrain, steep slopes, and poor-quality forage, and resistant to diseases. These resilient breeds are optimally suited to fulfil mountain pastoralists' needs for food, cash, and coverage against drought. Their productive and reproductive performances relative to body weight are higher than those of advanced breeds (Rahim et al. 2013; Saleem et al. 2013).

Non-farm income

A rise in non-farm income may help improve people's ability to purchase food items coming from plains areas when mountain production is insufficient. Some additional non-crop income options based on forest products and migration are also summarized in Table 5. Forest products provide substantial revenue in KPK and FATA and improved forest management may also provide additional income opportunities for local people. The mountain areas in Pakistan also have a high potential for the production of products such as embroidery, woodcarvings, shawls, blankets, carpets, baskets, gemstones, and many others (MAFSO 2014).

Migration

FATA, KPK, and AJK have a higher proportion of workers who migrate overseas for employment than other provinces, suggesting that the inflow of remittances to these AUs is substantial. Remittances offer a possibility for investment to improve local food and livelihood security both directly and indirectly, through enhancing income opportunities. AJK is the area with the highest rate of outmigration to overseas (Table 5). A case study on migration in AJK (Chaudhary and Hamdani 2002) found that among migrating households, 61% decided to migrate in order to improve their income and livelihoods; while 11%, 10%, and 8%, migrated to seek better technical skills, a better environment, or education, respectively. The study also found that nearly 74% of those households who had established some form of business prior to migration used the remittances efficiently and improved their business enterprises significantly in terms of equipment, staff skills, communication technology, management skills, and marketing style. Expansion of this type in small businesses not only resulted in improved food and livelihood security for the remitters' families, but also provided job opportunities for local people.

The outmigration rate from KPK and FATA is also very high (Table 5). Although agriculture remains the most common livelihood activity in the mountains of KPK and FATA; remittances and non-agricultural activities are also very important sources of income (Shahbaz et al. 2014). In some parts of KPK such as the Lower Dir and Swat districts, more than 40% households have at least one overseas or in-country migrant, and the inflow of remittances is very high (Table 6). In these areas, households choose outmigration as an adaptation strategy to cope with the food and livelihood insecurity risks arising from frequent disasters and agriculture damage due to conflicts (Shahbaz et al., 2014). The outmigrants are mainly young; the average age is 36 (SLRC 2012).

In lower Dir and Swat, agriculture and livestock contribute to the cash income of almost 60% of households; but only 17% consider this to be the primary source of income. Remittances contribute to the livelihoods of 31% households (Table 6) and are the primary source of cash income for 26% of households. Among the migrant sending households, almost 70% consider that remittances have helped them either reduce or eradicate the food shortages they faced before receiving such funds (Table 6). However, the most vulnerable groups such as the non-literate and extremely poor have fewer opportunities to migrate due to their lack of knowledge and lack of funds to meet travel expenses (Hagen-Zanker et al. 2014).

Table 6: Remittances and food security in KPK*

Indicator	%
Households with at least one overseas migrant	34
Households with at least one in-country migrant	8
Households for whom remittances are the primary source of cash income	26
Households for whom remittances are a secondary source of cash income	5
Households who perceive that they never face food shortages due to remittances**	32
Households who perceive that they rarely face any food shortages due to remittances**	37

* 2114 households surveyed in Swat and Lower Dir districts of KPK

**Percentage of migrant-sending households

Source: SLRC 2012

5 Towards a Framework for Food Security in the Mountains of Pakistan

Policy Framework Based on Area-Specific Approaches

Food is fundamental to human existence and critical for social stability. In order to enhance food security and social stability, the government needs to strengthen efforts to remove existing constraints and challenges and convert potentials into opportunities in mountain areas through policy, institutional, and technical support. Mountain food security cannot be achieved without secured livelihood options, and mountain livelihoods cannot be improved unless the productive resources, such as water, land, forest, rangeland, biodiversity, and the natural environment are conserved and their access and optimal utilization ensured. Thus from the mountain perspective, it is necessary to take a holistic approach. At the same time, in formulating strategies for food security, it is necessary to take into account the mountain specificities, including the ecological and environmental conditions and the challenges, needs, and opportunities for mountain communities.



Table 7: Area-specific approaches based on agro-ecological potential and access to markets and services

		Access to markets, information, and institutional services	
		Good	Poor
Agro-ecological potential and suitability	High	Areas with high potential and good access to markets and services <ul style="list-style-type: none"> Enhance support for high-value cash crops, e.g., fruit and vegetable cultivation Establish fruit processing and storage facilities Promote horticulture, commercial dairy, and intensive food crop production Encourage private investment in irrigation, land management, and the agro-processing industry through institutional support Provide incentives for overseas workers to invest remittances in small and medium businesses in mountain areas 	Areas with high potential but poor access to markets and services <ul style="list-style-type: none"> Improve marketing facilities for fresh fruit, nuts, dried fruit, vegetables, and livestock products Improve transportation facilities, ICT access, and others Promote high-value, low-volume crops such as non-timber forest products (NTFPs) and medicinal plants Promote subsistence food crops Develop infrastructure to enable utilization of the mountains' high agro-ecological potential Promote livestock, and livestock products and by-products
	Low	Areas with low potential but good access to markets and services <ul style="list-style-type: none"> Promote local products such as crafts (e.g., woodcarving, shawls, carpets, caps) and services for markets Promote conservation technologies that enhance agricultural potential and utilize local niches, and provide incentives for conservation Encourage agro-forestry, tree farming for timber, and NTFPs and medicinal plants Develop local off-farm employment opportunities to reduce outmigration, e.g., the Prime Minister's youth loan scheme Develop trading centres 	Areas with low potential and poor access to markets and services <ul style="list-style-type: none"> Provide incentives for conservation and sustainable use of resources and develop mechanisms for payments for ecosystem services Encourage outmigration and non-farm activities. Promote subsistence agriculture with zero-tillage, mixed cropping, and livestock production Promote ecotourism and recreation Develop and harness environmental services

Essentially, Pakistan's mountain areas can be divided into four types depending on whether they have high or low agro-ecological potential and good or poor access to markets, information, and institutional services (Table 7). Different development strategies are needed for each of these different types of area. Strategies for **areas with high potential and good access to market and services** should focus on exploiting the existing potential as much as possible through land use intensification, efficient water use, crop diversification, commercial dairy, and growing of cash crops that offer higher incomes. Private investment in production and post-harvest facilities should be encouraged.

In **areas with high potential but poor access to markets and services**, the focus should be on removing the marketing constraints and developing infrastructure and institutional support so that the existing potential can be exploited optimally and sustainably.

In **areas with low potential but good access to markets and services**, strategies should focus on improving the use of existing facilities to promote non-farm activities, and providing economic incentives and appropriate regulations to promote the sustainable use and management of resources.

Finally, in **areas with low potential and poor access to markets and services**, strategies should focus on the subsistence use of resources and facilitation of outmigration to reduce the dependence on local resources and ensure food security.

General Approaches

In addition to the area-specific approaches suggested above, some general approaches are suggested for consideration.

- **Developing local food systems.** Mountain food security is different to food security in plains areas because mountain people's livelihoods depend heavily on ecosystem services (provided, for example, by forests, pastures, rangeland, and surface water), and livestock and niche farming products such as fruits and vegetables. Agriculture is heavily dependent on water from glaciers, snowmelt, and springs, but traditional irrigation systems such as the 'karez' system in Balochistan are deteriorating as a result of low investment and poor maintenance. It may not be possible to achieve complete food self-sufficiency in mountain areas due to the land and environmental constraints, but revitalizing the traditional irrigation systems would help to increase local food production and reduce the dependence on external food supplies. Furthermore, technical assistance and institutional support need to be strengthened to increase livestock productivity and improve rangeland management in order to improve the food security of livestock-dependent communities.
- **Strengthening existing institutional support** can also help to improve local production systems, for example action research, extension services, supply of subsidized credit and inputs, and crop and livestock insurance schemes for mountain farmers.
- **Developing an organized marketing system.** Although considerable quantities of fruits and nuts are grown in the mountain areas of Pakistan, mountain farmers do not receive a fair price for these products due to poor transportation and marketing systems, which discourages increased production. The low volume of production, and the scattered and disorganized marketing system, is a major challenge in marketing mountain products. It is important to improve transportation and marketing systems and to organize farmers into groups to help strengthen their bargaining power, increase the efficiency of marketing, and enhance economies of scale in marketing fruit and vegetables. Developing economic corridors and promoting cross-border trade of mountain products should also be considered.
- **Developing storage and processing facilities.** Fruit and nut growers also suffer as a result of the lack of storage, processing, packaging, and standardization facilities, which again leads to farmers receiving lower prices for their products, as well as increased post-harvest losses, which reduce overall food availability. Policy support is needed to encourage private sector investment in the storage, grading, processing, and packaging industries. The government could offer financial and other incentives for private sector investment in mountain areas and strengthen ongoing efforts to develop infrastructure in these areas. Poor farmers do not have the resources to develop storage and processing facilities, thus common facility centres where farmers can bring their produce for processing should be established at least at the provincial headquarters. Introducing solar drying at the community level would also be useful for drying fruits and nuts.
- **Enhancing export competitiveness.** To utilize the full potential of fruits and nuts, ongoing efforts to improve market access need to be further strengthened. Measures should be taken to enhance the export competitiveness of fruit and nuts, especially in the dried form, including strengthening technical support, and financial assistance to improve processing, packaging, and marketing. Special incentives and support might be given to the transport of high-value and perishable products with a high demand in export markets.
- **Developing an organic certification system.** Demand for organic fruits and nuts is growing, both in Pakistan and in international markets, but this potential cannot be utilized at present due to the lack of an accreditation and certification system. Although most fruits and nuts are actually grown according to organic criteria, farmers cannot obtain the premium 'organic' price due to the absence of such a system. Furthermore, most of the fruits and nuts grown in Pakistan are grown by poor mountain farmers in remote mountain areas; the government could lobby for duty free access to developed country markets for products from these areas.

- **Strengthening the existing agricultural marketing information system.** Information from the existing marketing information system does not reach mountain communities in a timely or useful way. The system needs to be strengthened through the use of ICTs such as mobile phones, local FM radio, e-information systems, and other mechanisms to improve farmers' access to market information.
- **Encouraging the productive use of remittances.** In many mountain areas communities receive considerable amounts of remittances from overseas workers. However, these are rarely properly invested in the mountain areas. Adequate incentives and awareness-raising are needed to encourage mountain communities to invest in their local area to generate income opportunities and contribute to food security.
- **Managing water resources for irrigation and hydropower.** To bring the potential cultivable land (20 million acres) under canal irrigation, there is an urgent need to construct water reservoirs to store the water available for development projects (18 MAF). The government is already taking substantial steps to construct three big (Diamer Bhasha, Dasu and Bunji) and several small reservoirs to store water for irrigation and hydropower. In the mountain areas, the government could also encourage public-private partnerships for constructing small hydropower plants on streams, and installing solar pumps in areas where sufficient groundwater is available. Improved hydropower generation will enable more fuel to be supplied to the transport sector, which could help reduce food transportation costs to mountain areas. Appropriate benefit sharing mechanisms are necessary to ensure that mountain people get equitable access to the benefits derived from developing water and other mountain resources.
- **Managing the northern mountains for water and other ecosystem services.** In order to ensure the continued flow of water and other ecosystem services to downstream areas, mountain watersheds need to be properly managed. Appropriate incentive mechanisms such as payments for ecosystem services need to be developed to encourage mountain communities to use and manage the watersheds sustainably. Managing the natural resources and ecosystem services will help improve livelihoods and food security in both mountain and downstream areas.
- **Community engagement in natural resource management.** Forests and livestock are an integral part of livelihoods and food security for mountain people. They provide food, wood, fodder, fuel, medicine, and many more goods and services to the rural people in these areas. Involving the mountain people in the management of the forests and rangelands would help both to improve the management and to improve the livelihoods and food security of the mountain communities.
- **Non-farm income opportunities for youth in mountain areas.** Young people are migrating from mountain areas due to the lack of income opportunities. There is a need to generate non-farm income opportunities to reduce outmigration and improve local livelihoods and food security. The Prime Minister's 'Youth Business Loan' scheme, with subsidized service charges for youth, could provide a very important step towards improving the non-farm economy in mountain areas. Capacity building of youth on small and medium enterprises will be required to ensure the use of loans is effective and productive. Value chain development and the promotion of cottage industry type products will be especially useful for enhancing the income of young women in mountain areas.
- **Reducing vulnerability of the farm resource base.** The phenomenon of too much and too little water availability, with frequent natural disasters particularly floods, is eroding not only the meagre amounts of cultivated land, the shelters of local communities have also become highly vulnerable. Community-based early warning systems and capacity building at the household level to develop coping mechanisms could help conserve the local resource base. Capacity development in terms of developing commercial agriculture would

References

- Afzal, J; Ahmed, M; Begum, I (2008) 'Vision for development of rangelands in Pakistan – a policy perspective.' *Quarterly Science Vision* 14(1): 53–58
- Ahmad, S; Islam, M (2011) 'Rangeland productivity and improvement potential in highlands of Balochistan, Pakistan.' In Matovic, D (ed), *Biomass - detection, production and usage*, pp 289–304. Rijeka, Croatia: InTech
- Ahmad, S; Islam, M; Mirza, SN (2012) 'Rangeland degradation and management approaches in Balochistan, Pakistan.' *Pakistan Journal of Botany* 44: 127–136
- Akramov, KT; Yu, B; Fan, S (2010) *Mountains, global food prices, and food security in the developing world*, IFPRI Discussion Paper 00989. Washington, DC, USA: International Food Policy Research Institute (IFPRI), Development Strategy and Governance Division
- Ali, T (2012) *Untapped potential of dry fruits and export*. <http://tahirkatlang.wordpress.com/2012/05/12/untapped-potential-of-dry-fruityield-and-export/> (accessed 09 June 2014)
- BEOE (2013) *Statistics on province-wise workers registered for overseas employment by Bureau of Migration and Overseas Employment during the period 1981–2013*. Islamabad, Pakistan: Government of Pakistan. Bureau of Emigration & Overseas Employment
- Chaudhary, MA; Hamdani, SNH (2002) 'Return migrants and international transfer of technology: A case study of Azad, Jammu and Kashmir.' *Journal of Economic Integration* 17(2): 339–362
- FAO (2005) *Livestock sector brief: India*. Rome, Italy: Food and Agriculture Organization of the United Nations; Livestock Information, Sector Analysis and Policy Branch
- FAO (2008) *Food security in mountains – High time for action. Brochure of the International Mountain Day 2008*. http://www.fao.org/fileadmin/templates/mountainday/docs/pdf_2008/IMD08_brochure_En_LR.pdf (accessed 11 March 2014)
- GOP (1990) *Agricultural Census of Pakistan*. Islamabad, Pakistan: Pakistan Bureau of Statistics, Government of Pakistan
- GOP (2013a) *Fruit, vegetables and condiments statistics of Pakistan 2011–12*. Islamabad, Pakistan: Ministry of National Food Security and Research, Government of Pakistan
- GOP (2013b) *Agricultural statistics of Pakistan 2012-13*. Islamabad, Pakistan: Pakistan Bureau of Statistics, Government of Pakistan
- Government of AJK (1998) *Agricultural statistics of AJK*, Muzaffarabad, Pakistan: Department of Agriculture (Planning Unit), AJK Secretariat Chattar
- Government of AJK (2012) *AJK at a glance*. Planning and Development Department, Government of the State of Azad Jammu and Kashmir. <http://pndajk.gov.pk/Documents/Book%202012.pdf> (accessed 28 April 2014)
- Government of Gilgit-Baltistan (2007) *Northern areas agriculture statistics 2007*. Gilgit-Baltistan, Pakistan: Department of Agriculture, Government of Gilgit-Baltistan
- Government of Gilgit-Baltistan (2009). *Northern areas agriculture statistics 2009*. Gilgit-Baltistan, Pakistan: Department of Agriculture, Government of Gilgit-Baltistan
- Government of Gilgit-Baltistan (2013) *Major agro-ecological zones of Gilgit-Baltistan*. Gilgit-Baltistan, Pakistan: Department of Agriculture, Government of Gilgit-Baltistan
- Government of Pakistan and IUCN (2003) *Northern areas state of environment and development*. Karachi, Pakistan: IUCN Pakistan
- Huddleston, B; Ataman, E; d'Ostlanl, LF (2003) *Towards a GIS-based analysis of mountain environments and populations*. Rome, Italy: Food and Agricultural Organization. <http://www.fao.org/3/a-y4558e.pdf> (accessed 13 March 2014)
- Hussain, A (2010) *Achieving food security in Pakistan: Assessment of current situation and policy issues at national and regional levels*. Germany: Lambert Academic Publishing

- Hussain, A; Routry, JK (2012) 'Status and factors of food security in Pakistan.' *International Journal of Development* 11(2): 164–185
- Hagen-Zanker, J; Mallett, R; Ghimire, A; Shah, QA; Upreti, B; Abbas, H (2014) *Migration from the margins: Mobility, vulnerability and inevitability in mid-western Nepal and north-western Pakistan*. Secure Livelihoods Research Consortium. http://www.securelivelihoods.org/resources_download.aspx?resourceid=330&documentid=401 (accessed 19 October 2014)
- ICIMOD (2008) *Food security in the Hindu Kush Himalayan region: A position paper*. Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD)
- ICIMOD (2014) *Results of vulnerability and adaptive capacity assessment (VACA)*. Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD). (unpublished)
- Israr, M; Khan, H (2010) 'An analysis of livelihood sources in hilly areas of northern Pakistan.' *Sarhad Journal of Agriculture* 26: 4
- IUCN (2006) *Water requirements of major crops for different agro-climatic zones of Balochistan: Balochistan Programme*. Quetta, Pakistan: IUCN
- Kakar, AR (2012) *Livestock ecological zones in Balochistan*. Camel, Food Security and Climate Change. Society of Animals, Veterinary and Animal Scientists (SAVES). <http://camel4all.wordpress.com/2012/01/02/livestock-ecological-zones-in-balochistan/> (accessed 7 July 2014)
- Khan, AU (2011) *Mapping and measuring of multidimensional poverty in Pakistan: static and dynamic approach*. PhD thesis, Department of Economics and Agri. Economics, PMAS Arid Agriculture University, Rawalpindi, Pakistan
- KPK (2011) *Agriculture statistics*. Pakistan: Bureau of Statistics Government of Khyber Pakhtunkhwa
- MAFSO (2014) *Greening the mountain economy*. A study presented by Mountain Areas Farmer Support Organization, Gilgit-Baltistan, in a Provincial Conference on "Managing Mountain Ecosystems for Livelihoods in Pakistan" on 7-8 August in Gilgit-Baltistan
- MWP (2013) *Hydropower resources of Pakistan*. Pakistan Islamabad: Private Power and Infrastructure Board, Ministry of Water and Power, Government of Pakistan
- Mirza, SN; Ahmad, S; Islam, M (2006) 'The vagaries of drought in Balochistan and strategies to reduce economic losses.' *Bal. Journal of Agricultural Research* 3(1): 39–42
- Ojeda, G; Rueff, H; Rahim, I; Maselli, D (2012) *Sustaining mobile pastoralists in the mountains of northern Pakistan*. Central Asia, Research Evidence for Policy, Regional edition Central Asia, No 3. Bishkek, Kyrgyzstan: NCCR North-South
- PBOS (1996) *Pakistan livestock census 1996*. Islamabad, Pakistan: Pakistan Bureau of Statistics, Government of Pakistan
- PBOS (2006) *Pakistan livestock census 2006*. Islamabad, Pakistan: Pakistan Bureau of Statistics, Government of Pakistan
- PBOS (2010) *Population estimates for 2005 of administrative units*. Islamabad, Pakistan: Pakistan Bureau of Statistics, Government of Pakistan
- PBOS (2011) *Energy and mining (160–164)*. Pakistan Statistical Year Book 2011. Islamabad, Pakistan: Pakistan Bureau of Statistics, Government of Pakistan
- PFI (2012) Preliminary draft, Khyber Pakhtunkhwa rangeland policy. Pakistan Forest Institute Peshawar Government of Khyber Pakhtunkhwa. <http://www.pfi.gov.pk/Ranglandpolicy.html> (accessed 14 April 2014)
- PMD (2014) *Precipitation data*. Islamabad, Pakistan: Government of Pakistan, Pakistan Meteorological Department, National Drought Monitoring Centre
- PDDNA (2003) *Agriculture and food security, background paper (prepared by A. A. Hashmi and Shafiullah), Northern Areas (now Gilgit-Baltistan) strategy for sustainable development*. IUCN Pakistan Programme, and Planning and Development Department Northern Areas (PDDNA), Pakistan.
- Rahim, I; Maselli, D; Rueff, H; Wiesmann, U (2011) 'Indigenous fodder trees can increase grazing accessibility for landless and mobile pastoralists in Northern Pakistan.' *Pastoralism: Research, Policy and Practice* 1(2): pp20
- Rahim, I; Saleem, M; Rueff, H; Maselli, D (2013) *Conserving indigenous livestock breeds to benefit mountain smallholders*, Evidence for Policy Series. Regional edition Central Asia, No 6. Bishkek, Kyrgyzstan: NCCR North-South

- Rahman, A; Duncan, AJ; Miller, DW; Clemens, J; Frutos, P; Gordon, IJ; Rehman, A-u; Baig, A; Ali, F; Wright, IA (2008). 'Livestock feed resources, production and management in the agro-pastoral system of the Hindu Kush – Karakoram – Himalayan region of Pakistan: The effect of accessibility.' *Agricultural Systems* 96(1–3): 26–36
- Rasul, G (2011) 'The role of the Himalayan Mountain System in food security and agricultural sustainability in South Asia.' *International Journal of Rural Management* 6(1): 95–116
- Raziq, A; Younas, M; Rehman, Z (2010) 'Prospects of livestock production in Balochistan.' *Pakistan Veterinary Journal* 30(3): 181–186
- Saleem, M; Rahim, I; Jalali, S; Rueff, H; Khan, M; Maselli, D; Wiesmann, U; Muhammad, S (2013) 'Morphological characterization of Achai cattle in sedentary and transhumant systems in Pakistan.' *Animal Genetic Resources* 52: 83–90
- SDPI (2009) *Food insecurity in Pakistan*. Islamabad, Pakistan: Joint project of Sustainable Development Policy Institute (SDPI), SDC and WFP
- Shafiq, M; Inayatullah & Muhammad, F (2005) 'The effect of livestock on economic development of Pakistan with special reference to Balochistan.' *Balochistan Res. J.U.O.B.* 3 (1): 01–07
- Shafiq, M; Kakar, MA (2006) 'Effects of drought on livestock sector in Balochistan Province of Pakistan.' *International Journal of Agriculture and Biology* 8(6):
- Shahbaz, B; Shah, Q; Suleri, A (2012) Livelihoods, basic services and social protection in north-western Pakistan. <http://www.odis.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/7782.pdf> (retrieved on March 13, 2014).
- Shahbaz, B; Shah, QA; Suleri, A; Kazmi, MA; Commins, S (2014) *Surveying livelihoods, service delivery and governance: Baseline evidence from Pakistan*, Working Paper 14. London, UK: SDPI; Secure Livelihoods Research Consortium (SLRC)
- SLRC (2012) Secure Livelihoods Research Consortium's Baseline Data of Pakistan on 'People's livelihoods, access to and experience of basic services, and people's perceptions of governance'. http://www.securelivelihoods.org/publications_details.asp?resourceid=305&CategoryID=2255 (accessed 20 October 2014)
- Tiwari P (2000) 'Land-use changes in Himalaya and their impact on the plains ecosystem: need for sustainable land use.' *Land Use Policy* 17(2): 101–111
- Tiwari, PC; Joshi, B (2012) 'Natural and socio-economic factors affecting food security in the Himalayas.' *Food Security* 4(2): 195–207
- Ward, FA; Amer, SA; Ziaeef, F (2012) 'Water allocation rules in Afghanistan for improved food security.' *Food Security* 5(1): 35–53
- WAPDA (2009) *WAPDA's Development Plans*. Lahore: Pakistan Water & Power Development Authority, Government of Pakistan. <http://www.wapda.gov.pk/pdf/WAPDAsDevelopmentalPlan.pdf> (accessed 22 October 2014)
- WAPDA (2013) *Hydro potential in Pakistan*. Lahore: Pakistan water & power development authority, Government of Pakistan. <http://www.wapda.gov.pk/pdf/potentialPakistan.pdf> (accessed 22 October 2014)
- WFP (2010) *Pakistan Flood Impact Assessment*. Rome, Italy: World Food Programme

About ICIMOD

The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush-Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal.

Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.



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Pakistan Agricultural Research Council (PARC) is the apex national organization working in close collaboration with other federal and provincial institutions in the country to provide science based solutions to agriculture of Pakistan through its statutory functions. The overall decision-making body of PARC is its Board of Governors (BOG), responsible for the control, direction and superintendence of the affairs of PARC. The Board is assisted in its operation by a number of Committees. The Federal Minister for National Food Security & Research is the President of the Board. At present, PARC has five divisions; four technical divisions: Plant Sciences, Animal Sciences, Social Sciences, Natural Resources, and one services division: Finance. PARC has also ten Research Establishments throughout the country where research is conducted according to the agro-ecological needs of various regions. The Research Establishments include National Agricultural Research Centre (NARC) in Islamabad, Southern-Zone Agricultural Research Centre (SZARC) in Karachi, Balochistan Agricultural Research Centre (BARC) in Quetta, National Tea and High Value Crops Research Institute (NTHRI) in Mansehra, National Sugarcane Research Institute (NSCRI) in Thatta, Summer Agricultural Research Station (SARS) in Kaghan, Mountain Agricultural Research Centre (MARC) in Gilgit, and Arid Zone Research Institutes in Umerkot, Bahawalpur and D. I. Khan.

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ICIMOD gratefully acknowledges the support of its core donors:

The Governments of Afghanistan, Australia, Austria, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Switzerland, and the United Kingdom.



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ISBN 978 92 9115 329 9