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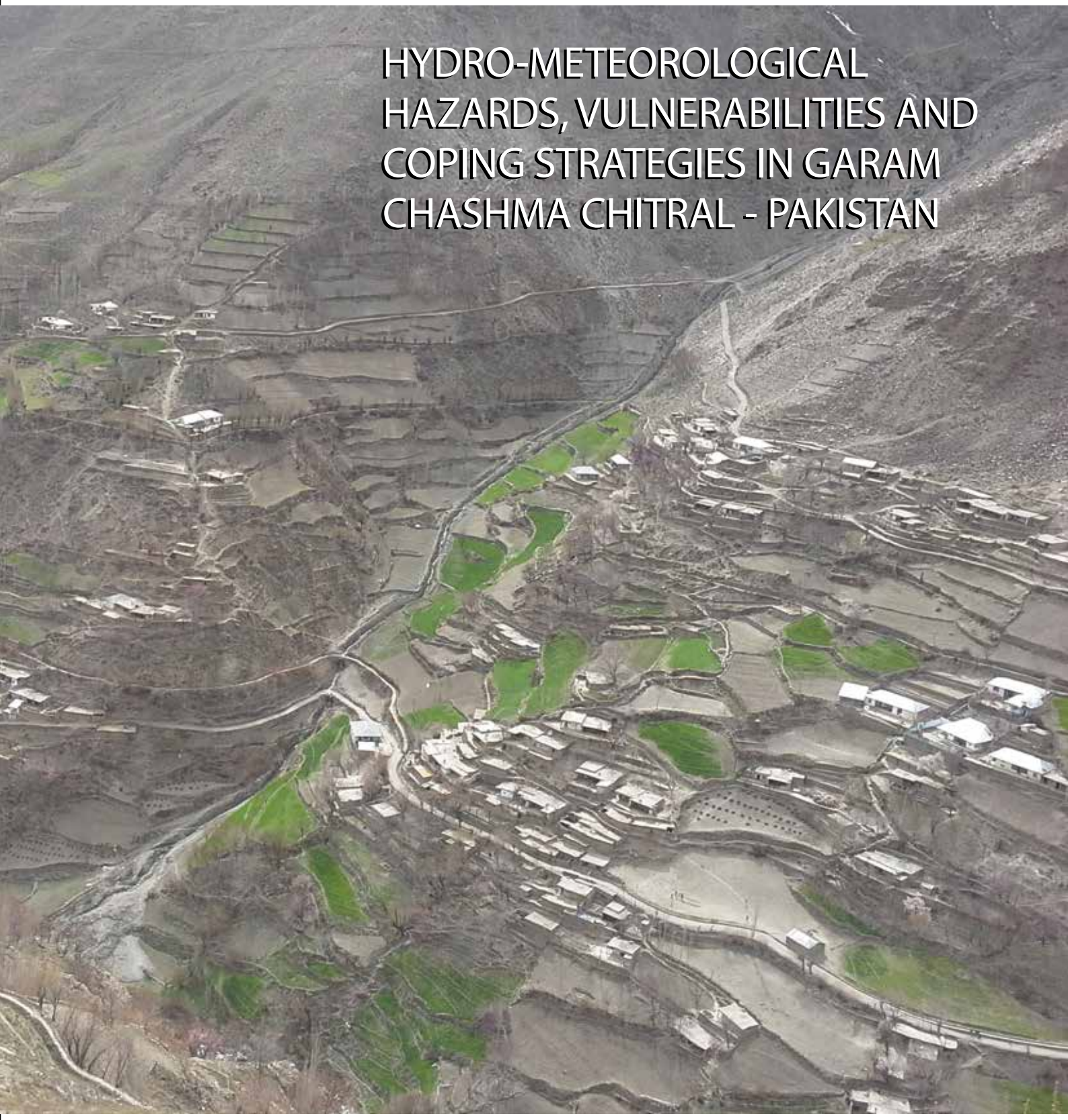
# HYDRO-METEOROLOGICAL HAZARDS, VULNERABILITIES AND COPING STRATEGIES IN GARAM CHASHMA CHITRAL - PAKISTAN



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# HYDRO-METEOROLOGICAL HAZARDS, VULNERABILITIES AND COPING STRATEGIES IN GARAM CHASHMA CHITRAL - PAKISTAN

This study is part of the Asian Highlands Research Project in Pakistan, China and Nepal funded by the International Development Research Centre (IDRC) and implemented by Kunming Institute of Forestry in China in collaboration with Intercooperation in Pakistan and Helvetas Swiss Intercooperation in Nepal.

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# Abstract

Using empirical data from eight clusters (41 villages) in Chitral district of Khyber Pakhtunkhwa province in Pakistan, this study contributes to the discussion and understanding of the occurrence, impacts of natural hydro-meteorological hazards on local livelihoods and importance of various livelihood assets for coping strategies. Data for this study were collected using the Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL) tool which helps in the mapping of key risks, vulnerabilities and coping strategies and their relationship with livelihoods assets at the community level. Results indicated that the three most severe disaster risks in the study area include flash floods, avalanches, landslides and landslips. These disasters take a heavy toll on community livelihood assets including water resources, agricultural crops, infrastructure, and houses. Communities spend limited resources especially cash income and reserves to overcome these losses using short-term coping strategies. These unsustainable strategies further exacerbate vulnerabilities. The case of Chitral indicates the importance of developing policies that encourage the government and development agencies to invest in understanding risks and long-term adaptive strategies so that local communities invest less of their scarce livelihood assets on short-term coping strategies.

Key words: Risk Assessment, CRiSTAL, Hazards, Coping Strategies, Livelihoods, Pakistan

# 1. Introduction

According to the IPCC's fifth Assessment Report (IPCC 2014), global surface temperature increases exceed 1.5°C and keep rising beyond 2100 in all scenarios except the lowest-emission scenario, in which actions are taken to nearly eliminate CO2 emissions in the second half of the 21st century. In scenarios with higher rates of emissions, warming is likely to exceed 2°C by 2100 and could even exceed 4°C. The increasing global temperature is believed to pose new challenges especially to countries more vulnerable to climate change. According to the Climate Change Vulnerability Index, Pakistan is among the 32 extreme risk countries when evaluated for sensitivity of the population to climate risks, the physical exposure of the country to climate related risks and the governmental capacity to adapt to climate change over the next 30 years (Maple Croft, 2015). Pakistan has witnessed a number of hazards since 2010. The cost of recovery in 2010 flood was estimated at USD 8.74 to 10.85 billion (ADB, WB, and GoP, 2010). The floods not only damaged standing crops, but also deprived rural dwellers of their livelihood assets. The floods in Sindh province in 2011 affected 5.2 million people and damaged 2.28 million acres of standing crops (UNOCHA, 2011).

The growing concerns about climate change and increased natural hazards in Pakistan have translated into the adoption of a national Climate Change Policy in 2012 and creation of Climate Change Division by abolishing the Ministry of Environment, under the direct leadership of the Prime Minister (GoP, 2012). An important objective of the national climate change policy is "to minimise the risks arising from the expected increase in frequency and intensity of extreme weather events such as floods, droughts and tropical storms" (GoP, 2012).

Recent studies conducted in Pakistan indicate that the country's climate is changing (Hanif and Ali, 2014, Akmal et al., 2014, Hussain and Hanif 2013). Climate change is expected to impact the availability of water by impacting the weather systems creating opportunities and threats to the livelihoods of the country's population particularly to those who depend on water for farming. Currently, about 50-80% of the total average river flows in the Indus system are fed by snow and glacier melt in the HinduKush-Karakoram (HKK) part of the Greater Himalayas, with the remainder coming from monsoon rain on the plains (Yu, Winston et al., 2013). Variability in the distribution and timing of snowfall and changes in snow and ice melt may be amplified by climate change, which has implications for Pakistan in general and the agriculture sector in particular. Agriculture contributes some 25% in Pakistan's Gross Domestic Product (GDP) and 46% of the labour force is employed in the agriculture sector (GoP, 2007; Pakistan Water Gateway 2008). Warmer temperatures increase the frequency, intensity, and duration of heat waves, which can affect crops and farming systems. While changes in the patterns and amount of rainfall, as well as changes in the timing and amount of stream flows, can affect the quantity and quality of water and therefore farm production. A recent study from Chitral region conducted by Intercooperation indicates that the annual maximum temperatures are increasing while annual minimum temperature is decreasing compared to the base period of 1971-2000 (Hussain and Hanif, 2013). Both maximum and minimum temperatures in spring are showing an increasing trend implying that days and nights are getting warmer during the spring season. This study also reported that the annual rainfall is increasing compared to the base period of 1971-2000. These findings indicate important implications for crop growth and yields. The rise in temperature will increase

Growing Degree Days (GDD) and shorten the Growing Season Length (GSL) leading to early crop maturity. Chitral may therefore expect yield increases in the existing wheat varieties. Another study indicates possibilities of expanding wheat production to mountainous areas above 1500m where wheat currently is not grown due to shorter and colder growing season (Hussain and Mudasser, 2007).

How to assess risks and vulnerabilities caused by climate change and other factors so that appropriate measures to enhance local resilience may be identified? Many studies are based on household surveys and narratives to capture the extent of recent disasters or perceived risks to various natural hazards. Most analysts remain quite subjective making it difficult to identify key conclusions. Mustafa et al., (2011) have argued that while narratives have enhanced our understanding of multiple drivers of vulnerability, these studies have had limited influence on hazard and climate adaptation policy. These authors argue for a theoretically driven and empirically tested quantitative vulnerability and capacities index (VCI) for use at the local scale to help connect vulnerability research and policy. There are many forms of risk and vulnerability assessment.

According to the United Nation's report on disaster risk reduction (Southgate et al., 2013), risk measurement is a methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend. According to this definition, risk assessments include a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. One important aspect of risk studies are data collected directly from the communities who live with risks and have learned to cope with them.

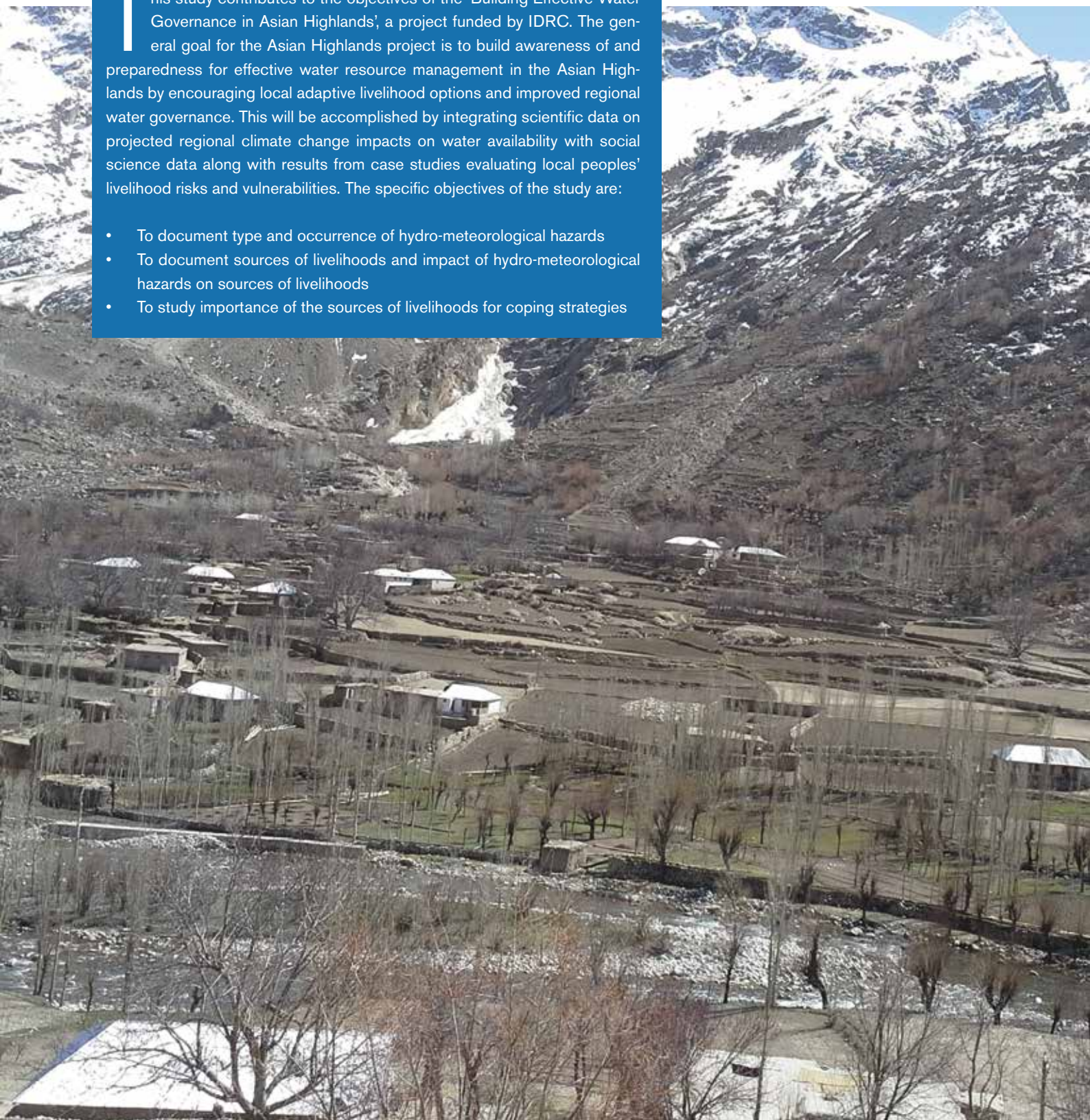
The methodology used for this study is in line with the (UNDSS) United Nations Office for Safety and Security (2013) guidelines for conducting risk and vulnerability assessment. This study uses CRISTAL, (Community-based Risk Screening Tool – Adaptation and Livelihoods) that maps key risks, vulnerabilities and coping strategies and their relationship with livelihood assets at the community level. Taking empirical data from Chitral district in the Khyber Pakhtunkhwa (KP) province this study documents hazards, coping strategies and livelihoods assets that are crucial to implement coping strategies. The study is conducted in 41 villages included in eight clusters. The data therefore are mainly collected for clusters of villages and not for individual villages. Findings of this study are expected to help the communities, government policy making, the implementing and development agencies in developing climate change related adaptation plans. The study elaborates on the sources of livelihoods in the study area, natural hazards, impact of natural hazards, coping strategies and importance of livelihood assets to implement coping strategies.

This study is part of a regional study, the Asian Highlands project: Living with Risks and Building Resilience in Water Governance. The Asian Highlands project is funded by the International Development Research Institute (IDRC) and is being implemented in China, Nepal and Pakistan by the Kunming Institute of Botany Chinese Academy of Sciences, Helvetas Swiss Intercooperation Nepal and Intercooperation Pakistan.

# 2. Objective of the study

This study contributes to the objectives of the 'Building Effective Water Governance in Asian Highlands', a project funded by IDRC. The general goal for the Asian Highlands project is to build awareness of and preparedness for effective water resource management in the Asian Highlands by encouraging local adaptive livelihood options and improved regional water governance. This will be accomplished by integrating scientific data on projected regional climate change impacts on water availability with social science data along with results from case studies evaluating local peoples' livelihood risks and vulnerabilities. The specific objectives of the study are:

- To document type and occurrence of hydro-meteorological hazards
- To document sources of livelihoods and impact of hydro-meteorological hazards on sources of livelihoods
- To study importance of the sources of livelihoods for coping strategies



# 3. The study area

## 3.1. District Chitral– Climate and livelihoods

This case study was conducted in eight clusters of villages in Garam Chashma valley of district Chitral in Khyber Pakhtunkhwa province of Pakistan (Figure 1). Chitral is the largest and the northern most district at an altitude of 1500 meters above sea level (in the valley bottom) with a latitude and longitude of approximately 35_ 51 $^{0}$N and 71_ 50 $^{0}$E, respectively. The word Chitral basically means field in the native language Khowar. The terrain of Chitral is quite mountainous and is prone to natural disasters such as flash floods from steep valleys and snow avalanches. Part of the Pamir Mountains is situated here. Chitral borders Afghanistan in the West and Wakhan Corridor in the North, Gilgit-Baltistan in the East and districts of Upper Dir and Swat in the south. Chitral was a princely state and was merged with Pakistan in 1969. The area is rich in natural resources, including forests, wildlife and minerals. The natural resources enhance the potential for tourism in the area contributing to the livelihoods of the local population.

**Climate:** The weather of Chitral is dry temperate and dominated by a winter weather pattern with rains caused by western disturbances that occur in the period of December–March. The valley remains cut off by snow from the rest of the country for nearly six months in a year, a problem expected to be relieved by the currently under construction Lowari Tunnel.

**Figure 1: Location of Chitral in Pakistan**

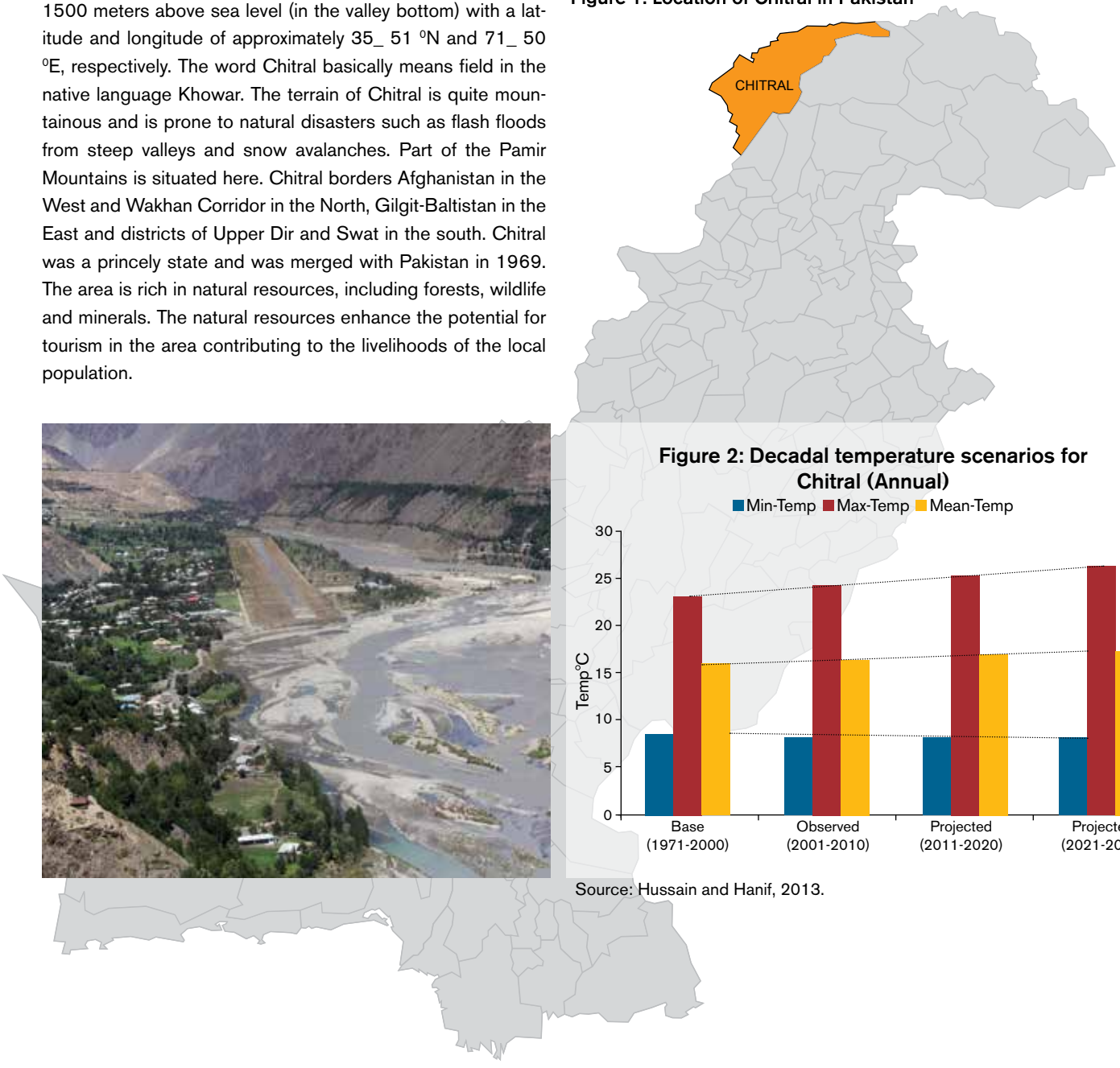





**Figure 2: Decadal temperature scenarios for Chitral (Annual)**




Source: Hussain and Hanif, 2013.

The mean annual temperature in Chitral district is 16 $^0$C, minimum average temperature reaches to 8 $^0$C and maximum average temperature is 24 $^0$C. Temperatures in the winter season drops to freezing. The district receives an annual total rainfall of 451 mm with heavy snow fall in winter, more in the surrounding mountains. The main source of livelihood is subsistence agriculture and natural resources. A study conducted in 2010 by Intercooperation Pakistan indicates that the climate in Chitral is changing (Hussain and Hanif, 2013).This study indicates that the annual maximum temperatures are at an increasing trend and annual minimum temperatures are at a decreasing trend compared to the base period of 1971-2000 (Figure 2). This implies that days are getting hotter while nights are getting cooler. On average the increase in annual mean temperatures is about 0.6 $^0$C per decade. This pattern of increasing trend for maximum temperature (hotter days) and a decreasing trend of minimum temperature (cooler nights) has also been observed for all the seasons during the year except spring season. For the spring season both maximum and minimum temperatures are showing an increasing trend. Winter mean temperature is increasing with 0.45°C per decade, with day temperature increasing with 1.0°C per decade. Spring mean temperature is increasing with 0.7°C per decade. Summer mean temperature is increasing with 0.3°C per decade.

Hussain and Hanif (2013) also show that the annual rainfall is showing an increasing trend compared to the base (1971-2000) and projected to further increase by 2030. This is due to an increase in the winter season's rain and snow. For other seasons, rainfall is showing a declining trend. However, this analysis may be seen with caution because the existing simulation models do not provide consistent predictions for precipitation.

**Livelihoods:** Chitral's population is rural and depends on farming for their livelihoods. There is a high dependence on natural resources. Conifer forests exist in patches which offer livelihood opportunities to the local inhabitants. Generally landholding is small due to terrain and partly due to lack of availability of sufficient water for irrigation. Most of the agricultural production is at subsistence level on mountain terraces although commercial potato production is on the rise.

Along with crop production and horticulture, livestock farming is also a dominant occupation, particularly for women. Changes in precipitation and uncertain hydrological patterns are reported to have resulted in increased natural hazards especially flash floods and avalanches for the last 30 years affecting food security and access to irrigation and clean drinking water in addition to property and life losses (Hope, 2010).

Main crops are Wheat, Maize, Pulses, Potato, Rice and fodder. In addition, high value fruits such as Apple, Apricot, Pomegranate, Walnut, Grapes, Pear are grown and dried as well. Most of the area is cold with a shorter growing season and is single-cropped. The remaining area in lower elevations is usually double cropped. Agriculture is dependent on irrigation from snow melt water carried by irrigation channels, most of them constructed in steep slopes and managed communally.

## 3.2. Garam Chashma

Garam Chashma also known as Lotku and Injigan is one of the 7 sub-districts (Tehsils) of District Chitral. The literal meaning of Garam Chashma is hot spring (Garam: hot and Chashma: spring). Garam Chashma is located at a distance of approximately 2 hours' drive (45 km) northwest of Chitral town, near Pak-Afghan border. It lies between latitude of 35°59'42''N and a longitude of 71°33'32''E with an average elevation of 6100 feet (1859 meter) above the sea (Aftab, 2013). It borders on the east by tehsil Mastuj and by Chitral Gol on the south. On the west it borders with Nuristan (Afghanistan) and on the north with Trich Mir (highest mountain of Hindu Kush Range). The weather of Garam Chashma is mostly cold. Heavy snowfall is received in winters (December to February) which blocks the road and the valley becomes inaccessible. The summers (May to August) are mild and pleasant.

The estimated population of Garam Chasma valley is 25,835 with 2923 households spread across some 47 revenue villages . Khowar is the widely spoken language of the area. Major castes are shahzada (royals), darwish, dashmane, zondray, sheikhan and syeds. Agriculture, horticulture and domestic livestock and poultry rearing are the main sources of income of the majority along with seasonal labour and government jobs. Major crops of the area are wheat, maize and potato. The valley is rich with mulberries (Morus alba), apricots (Prunus armeniaca), apples (Pyrus malus), pears (Pyrus boissieriana), grapes (Vitis vinifera), pomegranates (punica granatum) and melons (Cucumis melo). Common trees include Chinar (Platinus orientalis), walnut (Juglans regia), several species of poplar (Populous nigra, alba and ciliata) and several medicinal and aromatic plants. Wildlife species include leopard (Panthera unica), ibex (Capra ibex), deer (Moschus sp), urial (Ovis orientalis V.), wolves (Canis lupus) and black bear (Ursus thibetanus). Bird species include Chakor (Alectoris chukar), Ram Chakor (Lerwa lerwa) and Murgh Zarreen (Lophophorus impejanus).The presence of hot springs in the valley attract tourists and patients of certain skin diseases from other parts of Chitral and the rest of the country. Other tourist attractions of the valley are minerals, trout fishing and the tomb of the spiritual leader Pir Nasir Khusrow, 1004-1088 (Aftab, 2013).

### 3.3. The clusters of villages

This study was conducted in eight clusters of villages in two sub-valleys of the Garam Chashma Valley namely Gobor and Karimabad (Figure 1). The clusters included Begusht, Doaba, Gobor, and Murdan in Gobor; and Hearth, Parsan, Shogor and Susume in Karimabad. Names and number of villages in each cluster is given in table 1.

Table 1: List of valley clusters and villages in study site

| Valleys | Karimabad | | | | Gobor | | | |
|---|---|---|---|---|---|---|---|---|
| Clusters | Herth | Parsan | Shoghor | Susume | Begusht | Doaba | Gobor | Murdan |
| Number of villages (41) | 7 | 3 | 3 | 5 | 4 | 7 | 8 | 4 |
| Names of the villages | Ajrandeh | Parsan | Hasanabad | Susume, | Begusht | Beshqer | Gistini | Diri |
| | Gri | Bilbil | Sewakht | Dardai | Munoor | Lower | Goborbakh | Droshp |
| | Lolligram | Telegram | Shoghor | Lasht | Ovirk | Doaba | Gufti | Murdan |
| | Madashel | | | Kiyar | Thonik | Izh | Postaki | Shahgram |
| | Orelagh | | | Pitragram | | Kandojal | Royee | |
| | Shah | | | | | Sanik | Spokht | |
| | Tashqar | | | | | Yourjogh | Wakht | |
| | | | | | | | Zhitoor | |

**Susume** lies in the foothills of the Trichmir Mountain . The highest point in the cluster is 3050 meters above sea level at Kiyar. Susume consists of 5 revenue villages. It is a single cropping zone and the major crops are wheat, potatoes and peas. Apple is the major fruit and is sold for cash income. Major hazard of the area is glacier melting which causes flash floods during July and August damaging farm land and standing crops. Another major environmental problem is gradual landslips caused by sewerage wells dug in the recent past.

**Parsan** is located in the north-east of Chitral town at a distance of 2.5 hour's drive. The road is very narrow, rugged and

difficult. Parsan consists of 3 revenue villages. It is a single cropping area. Major crops are wheat and potato. Major hazards of the area are landslips, landslides and erosion. The residents migrate seasonally and farm on leased land in other villages.

**Herth** is located in the north of Chitral town at a distance of 2 hours by jeep. Hearth has 7 revenue villages and is single

cropped. Wheat and potato are the major crops with Apple the major fruit, Livestock being the major source of subsistence. Alfalfa is grown on large scale for fodder, mainly in the apple orchards. Landslide is the major hazard.

**Shoghor** is located in the north-west of Chitral town at a distance of 1 hour's drive and has 3 revenue villages. This is a double cropping zone and has 3 major crops - Wheat, maize and red beans. Flash floods are the major hazard caused by tributaries of the valley's river Oxorogh. Flash floods have caused heavy damages to houses and agricultural land in 2007. Due to successive floods, the residents had to shift houses to the farmlands. Agriculture land therefore has reduced and the residents depend on income from unskilled labour and assistance by relief and development agencies for their livelihoods.

**Murdan** is located in the north-west of Chitral town at a distance of 3 hour's drive. It has 4 revenue villages. This is a double cropping zone with wheat, maize and potato as major crops. Major hazards in the valley are landslips, land erosion and flash floods. Sporadic springs and subsoil water leakage from water channels are reported as the main cause of landslips.

**Doaba** is located in the north-west of Chitral town at a distance of 3 hour's drive. It has 6 revenue villages. This is a double cropping zone with wheat, maize and potato as major crops. Doaba is situated at cross-roads of 3 rivers namely Gobor, Begusht and Ovirk and therefore is at high risk of heavy floods during July-August.

**Begusht** is located in the north-west of Chitral town at a distance of 5 hour's drive, part of which is uphill. It has 4 revenue villages. It is a single cropping zone with 2 major crops - wheat and potato. Major hazards of the area are avalanches and floods. Floods are caused by glacier melt.

**Gobor** is located in the north-west of Chitral town at a distance of 6 hours' drive, mostly uphill terrain. It has 8 revenue villages. This is also a single cropping zone with wheat and potato as major crops. Major climatic hazards of the area are flash floods caused by rains. Flash floods have severely damaged land and crops in this area forcing some families to discontinue education of boys in favour of offering unskilled daily labour to earn cash income for the families.

# 4. Methodology

CRiSTAL was used as main investigating tool for data collection for this study. CRiSTAL is a risk assessment and project-planning tool that helps users design activities that support climate adaptation at the community level. CRiSTAL relies on two major sources of information. One, information collected from desk-based review of livelihoods, ecological and climate contexts available from secondary sources in order to establish a broad context within which CRiSTAL discussions are being launched. The second and major part of CRiSTAL constitutes discussion at local level with a defined group using participatory methods. CRiSTAL helps users to understand vulnerability context of the local population. The discussions revolve around how current and potential future climate hazards affect or may affect a community and their livelihoods, which livelihood assets are most affected by current climate hazards and which ones are most important for planning response strategies.

CRiSTAL demands good listening and probing abilities of the facilitators. It is also very important to give voice to women and marginalised ethnicities that are often passive in expressing themselves due to other dominant views. It is also to ensure that knowledge of each social segment is valued and further probed during discussion. The facilitators must also be good at taking notes of interesting topics which may not have receive well deserved probing during CRiSTAL analysis but will be taken up later with specific focus groups.

The representatives from individual villages within each cluster were invited for a daylong session and to provide information on the cluster. The representatives included village activists, cluster activists, and activists of local NGOs belonging to the villages. These people move frequently within the villages and in the entire Chitral valley. Therefore they are expected to know the area well and represent the views of the rest of the people from their villages accurately. Also, the representatives interviewed knew each other's villages, therefore it is expected that views and claims were contested and corrected. Each cluster was interviewed in their cluster on a pre-decided day. In some clusters the exercise took two to three days as the discussion on impact of various types of hazards and ranking of livelihood assets for coping strategies generated lengthy discussions. Each topic was thoroughly discussed by the facilitators and communities among themselves before recording in the CRiSTAL database (CRiSTAL IV). Livelihood assets were thoughtfully recorded in the order of importance. This provision is originally not available in the methodology, however the facilitators were careful in noting down livelihood resources / assets in a manner that later we could analyse these resources in the order of importance for the villagers. The data collected in the field was then analysed and conclusions were drawn. Table 2 provides a very brief chronological order of the exercises.

Preparation for conducting exercises entailed two major tracks. One, secondary information about the villages was collected from local NGOs namely Gobor Area Development Organization (GADO) and Karimabad Area Development Organization (KADO). Village profiles provided by GADO and KADO were important secondary base for building mutual relationship between the facilitators and villagers and this also helped facilitators to quickly contextualise the discussion. The preparation entailed facilitators' first visiting villages and introducing the purpose and methodology of CRiSTAL to selected respondents. The entire meeting was held in local language and notes were taken directly on CRiSTAL database. The discussion was led by a Junior Researcher who was supported by local students. Local NGOs also helped on a need-base for communication within the villages.

Table 2: Simplified Chronology of CRiSTAL Exercises

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| EXERCISES | Enlisting major livelihood assets (natural, physical, financial, human and social) and suggest their significance | Enlisting key hazards based on historical evidences , what losses do they cause and what are the coping strategies to prevent such | Impact of hazards on livelihood assets / resources (on a scale 1-5) | How do resources help in implementing coping strategies (each hazard and coping strategy separately for each set of resources on a scale 1-5) |
| | The results are documented in an automated table with all these notes and their relationship. | | | |

# 5. Livelihood assets in the area and their significance

We asked communities in the clusters to list their three most important livelihood assets in order of priority in five major categories of livelihood assets namely natural, physical, financial, human and social. In each category they enlisted resources ranked in the order of significance for their livelihoods (scale 1-3). The attached graph takes most of the assets on the list except for those which were mentioned only once or twice with lower significance. The picture is a little skewed since not all clusters have access to every resource equally. Figure 3 shows a higher inclination towards Natural and social assets whereas physical and financial assets are the second most prioritized resources. The most important natural resource indicated is water since this is the main asset on which people's livelihoods depend. During the exercise we have noted that interestingly water channels were often not ranked among physical assets at a higher level since these channels were built during princely times or by NGOs. What if these channels will not exist in this area - there is no consciousness among people at the moment around this question since things generally go well at the moment. Other physical assets such as schools, health centres and power house were ranked at higher levels also because of the employment opportunities generated for local people.

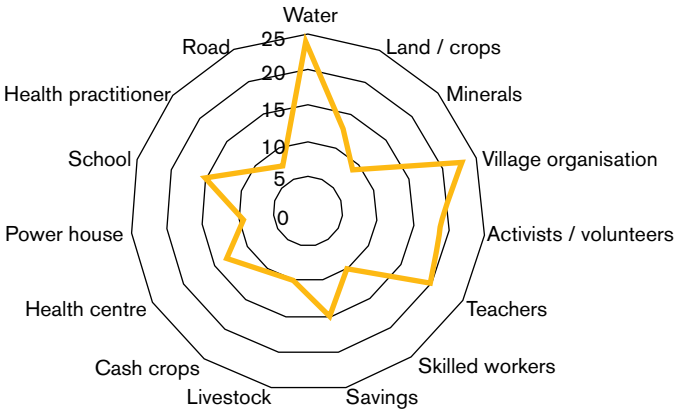
Under each category of assets, there are one or two leading resources that offer the main contribution for people's livelihoods. These include water and minerals, school building and health centre, cash crops, livestock and savings, social organizations and volunteers.

The details of five major categories of assets and ranking within each category are as follows:

### 5.1. Natural Resources

Water, land, gemstones, forest and hot water springs were ranked as the most important natural resource in the study area (Table 3).Water was considered the most important natural resource for livelihoods followed by land (farming). Out of eight clusters, seven ranked water as the most important resource. The eighth cluster Murdan, ranked land for farming as the most important resource for livelihoods. Hot water spring was ranked as the second most important resource in Murdan. Murdan has hot water springs which attract tourist attention to the Garam Chasm valley. Tourism is an important source of cash income in this area.

**Figure 3: Most important livelihood assets**




Farming land (cultivable and grazing wastelands) was ranked as the second most important natural resource by four clusters while two clusters ranked it the third most important resource. These two clusters which placed land as number three, ranked minerals as number two resource. Since irrigation water was ranked as number one resource, apparently land remains the most important natural resource even in these clusters. Gem stones (mostly marble), although their harvesting has been ini-

tiated in the recent years, is another important natural resource. One cluster (Shoghor) ranked gemstones the most important livelihood resource; two clusters (Parsan and Doaba) ranked it at the second important position while two clusters (Gabor and Hearth) ranked it at the third.

Forest (and forest products), once an important livelihood resource, is no more among the top three important resources although it features among the top five. Two clusters ranked forest the second most important resource, three clusters ranked in third while the remaining three did not even mention forests. In these three clusters gemstones have taken over the forests as an important resource in the subsistence rural economy. Even in clusters where farming (irrigated) is the most important resource, commercial potato is grown on large scale instead of subsistence crops.

Table 3. Importance of natural resources of the area (on a1-3 ranking where 1 is most crucial)

| Natural resources | Clusters and ranking of resources | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Begusht | Doaba | Gobor | Hearth | Murdan | Parsan | Shoghor | Susume |
| Water | 1 | 1 | 1 | 1 | | 1 | 3 | 1 |
| Farming (Land/crops, fruit plans/ Wastelands) | 2 | 3 | 2 | 2 | 1 | 3 | | 2 |
| Minerals (gemstones, marble) | | 2 | 3 | 3 | | 2 | 1 | |
| Forest and products (cumin, ibex) | 3 | | | | 3 | 2 | 2 | 3 |
| Hot Springs | | | | | 2 | | | |

### 5.2. Physical Resources

Eight types of important physical resources were identified by the respondents on a 1-3 ranking (Table 4). These included schools, health centres, power houses, roads, water channels, religious centres, medical stores and water mills. Schools, health care centres and power houses are the top physical resources. Out of the eight clusters, four ranked schools as the most important resource. One cluster ranked it as the second most important resource while another cluster ranked it as the third most important resources. Presence of health centres was ranked as the most important resource by one cluster, as the second most important resource by four clusters while the third most important resource by one cluster. The remaining two clusters ranked power houses as most important resource instead of education and health facilities. Road was ranked as the most important resource by only one cluster.

Table 4. Importance (on 1-3 ranking) of physical resources of the areas

| Physical resources | Villages and ranking of resources | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Begusht | Doaba | Gobor | Hearth | Murdan | Parsan | Shoghor | Susume |
| Schools | 1 | 1 | 1 | | 3 | 1 | 2 | |
| Health centres | 2 | 2 | 2 | 2 | 1 | | 3 | |
| Power houses | | | | 1 | | | 1 | 3 |
| Roads | | | | | 2 | 3 | | 1 |
| Water channels | | | | | | 2 | | 2 |
| Religious centres | 3 | | | | | | | |
| Medical stores | | 3 | | | | | | |
| Water mills | | | 3 | | | | | |
| Water supply pipes | | | | 3 | | | | |

### 5.3. Financial Resources

A total of eight financial resources were identified by the respondents namely savings, cash crops, livestock, shops, Micro-finance banks and other sources (Table 5). Savings are considered to be the most important resource followed by livestock and cash crops. Four clusters ranked saving the most important resource, one cluster ranked it second most while for the remaining three saving is not important. Cash saving as opposed to food storage is a new trend in the area. Although, only one cluster considered livestock as the most important resource, it remains among the three most important resources for seven clusters out of eight. Cash crops, mainly commercial potato are another important financial resource for four clusters. Potato traditionally has been an important food. Cultivation of potato for commercial purposes during the last 30 years has fast spread. This shift fetches crucial cash, it has promoted monoculture. Apart from soil fertility problems,

this could result in food security issues in the event of major hazards leading to road blocks as food for longer periods are not stored. In conclusion savings are important in double cropping clusters with relatively easy access and low altitude while livestock and cash crops (potato) are more important in single cropped high altitude areas (Gabor, Begusht). Gabor rated patti making (woollen fabric) as the most important cash generating resource. This indicates importance of farming sheep for wool.

Table 5. Important (on a 1-3 ranking) financial resources of the area

| Financial resources | Villages and ranking of resources | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Begusht | Doaba | Gobor | Hearth | Murdan | Parsan | Shoghor | Susume |
| Savings | | 2 | | | 1 | 1 | 1 | 1 |
| Livestock | 2 | 3 | 3 | 1 | 3 | 3 | 3 | |
| Cash crops (mainly Potato) | 1 | | 2 | | 2 | | | 3 |
| Shops | | 1 | | 2 | | | | |
| Microfinance bank | | | | | | | 2 | 2 |
| Patti making | | | 1 | | | | | |
| Land leasing | 3 | | | | | | | |
| Transport | | | | 3 | | | | |

### 5.4. Human Resources

A total of nine types of human resources were considered important by the eight clusters (Table 6). Teachers are most important human resource followed by medics (doctors, nurses and LHVs) and skilled workers. Teachers were rated as important by seven clusters. Of these, six clusters ranked teachers as the most important resource. This resource is considered important for two reasons:-education and employment-more schools more employment for the educated members of the community. Similarly, where high rating for health facilities could mean awareness about health issue, the health department is another important employer in the area. Skilled workers were also ranked an important human resource by five clusters. These include carpenters, masons and plumbers. The skilled workers provide services in the valley during the summer and go to the urban centres in the south during winter to earn cash income. Interestingly, one cluster rated musicians as most important resource. Music is an integral part of culture in Chitral. This was fading due to an increased religious extremism in the province during the last 30 years.

Table 6. Importance (on a 1-3 ranking) of human resources of the areas

| Human resources | Villages and ranking of resources | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Begusht | Doaba | Gobor | Hearth | Murdan | Parsan | Shoghor | Susume |
| Teachers (educated people in 2 places) | 1 | 1 | 1 | 1 | | 2 | 1 | 1 |
| Doctors (LHVs, nurses) | 2 | 2 | 2 | | 2 | | 3 | |
| Skilled workers | | | 3 | 2 | 3 | 1 | | 2 |
| Local knowledge | | | | 3 | | | | 3 |
| Musicians (Drummer) | | | | | 1 | | | |
| Police/ Chitral Scouts | | | | | | | 2 | |
| Agriculturists | 3 | | | | | | | |
| Lawyers | | 3 | | | | | | |
| Labourers | | | | | | 3 | | |

### 5.5. Social Resources

The Aga Khan Rural Support Program (AKRSP) is implementing a rural development programme in Chitral since mid-1980s. An important component of the programme is formation of village based community organisations - Village Organisations (VOs) and Women's Organisation (WOs). All the eight clusters have these organisations and were ranked the most important social resource (Table 7). Five clusters ranked the VOs most important social resources and the remaining three clusters rated them second. The VO formation and engagement process resulted in emergence of village and valley activists. The elected representatives were rated as third, only by two clusters. This indicates effectiveness of the community based organisations and in-effectiveness of the formal elected members and their institutions. The village activists help communities in a number of occasions including rescue, relief and repair activities in the aftermath of floods, avalanches and road block. They also assist communities in organising ceremonies and holding meetings of the members of VO.

Table 7. Important (on a 1-3 ranking) social resources of the areas

| Social resources | Villages and ranking of resources | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Begusht | Doaba | Gobor | Hearth | Murdan | Parsan | Shoghor | Susume |
| Village organizations | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 |
| Activists/volunteers | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 2 |
| Councillor | | | 3 | | 3 | | | |
| LSO | 2 | | | | | | | |
| Culture | | | | | | 3 | | |
| Yard (collective effort) | | | | | | | 3 | |

# 6. Major hazard in the area

With maximum three options available to each cluster from the list of eight hazard risks in Chitral, a total of 7 types of natural hazards were identified by the representatives of eight clusters (Table 8). Some hazards are common in most villages whereas others are specific to clusters (Figure 4). The ranking of hazards by perceived severity has been given in Figure 5.

Avalanches in the mountainous areas with winter snow are common. Avalanches are the most frequent hazard in the study area. Settlements are generally built in safer locations.

Flash Floods cause greater damage than other hazards. The main damage to land, crops and property during the last 30 years was by floods. People have experienced increased and unexpected floods due to unpredictable rains. Historically, monsoon rains were rarely received and in less quantity. In recent years however, unprecedented splashes of intense and short duration showers are reported to have increased, triggering flash floods and then landslides. On an average however rains may not have significantly increased in quantity, but the sudden intensity received causes problems. Severity of hazards varies from cluster to cluster. For example, landslide has been placed at the third most severe hazard however it is reported by only three clusters. Landslips as a hazard was reported by two clusters, Murdan and Parsan. But in both the cases the severity of this phenomenon is high, 3 on a 1-3 scale. River over-flooding and melting of glaciers has been reported by three clusters close to the river. This phenomenon increases with accelerated glacier melting. River overflows have severely damaged a number of villages situated along the streams. Stone rolling has also been reported by three clusters however its severity is not high.

The respondents reported that landslip is a new and serious hazard (3 on a 1-3 scale in two clusters). The entire villages were reported to be sliding down along creeping land. Causes of landslips need to be explored through a thorough investigation. However water seepage due to mismanagement of newly constructed irrigation channels funded by development agencies is considered to be the main cause. It is pertinent to mention that post-construction management of these channels is the sole responsibility of the beneficiary villages.

Table 8. Ranking of hazards on 1-3 scale (3 being most severe in impact)

| | Begusht | Doaba | Gobor | Hearth | Murdan | Parsan | Shoghor | Susume | Frequency | Severity of hazard |
|---|---|---|---|---|---|---|---|---|---|---|
| Flash Floods | 2 | 3 | 3 | | 2 | 2 | 3 | | 6 | 15 |
| Avalanches | 3 | 2 | 2 | 2 | 1 | | 2 | 1 | 7 | 13 |
| Landslides | 1 | | | 3 | | | | 3 | 3 | 7 |
| Landslips | | | | | 3 | 3 | | | 2 | 6 |
| River over-flooding | | 1 | 1 | | | | | 2 | 3 | 4 |
| Stone rolling | | | | 1 | | 1 | 1 | | 3 | 3 |

**Figure 4: Most frequently mentioned hazards**

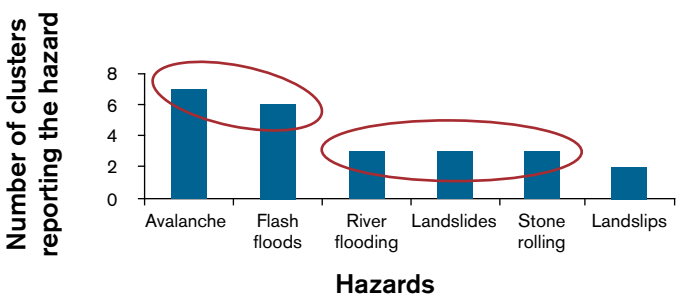
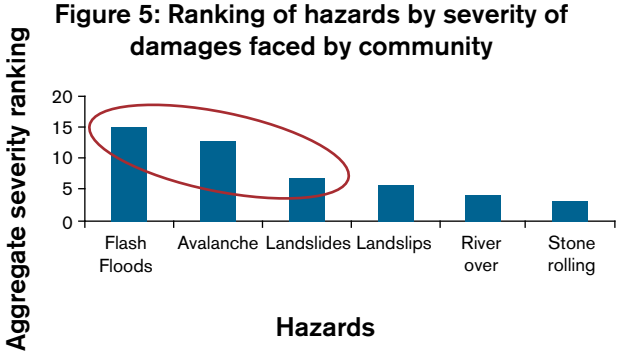



**Figure 5: Ranking of hazards by severity of damages faced by community**

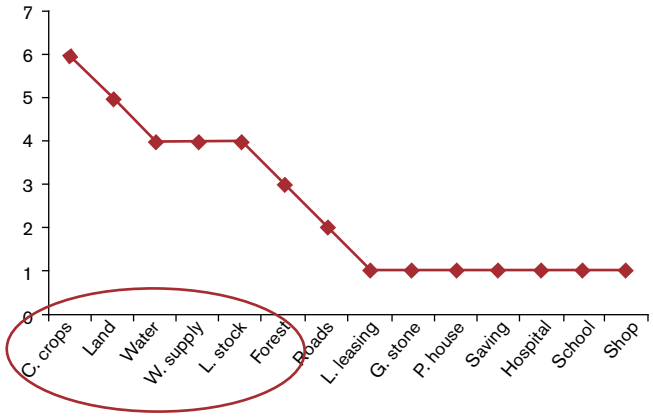



# 7. Impact of the hazards on various livelihood assets

The severity of the impact of hazards on livelihood assets was ranked on 1-5 scale (1 being minimum and 5 maximum impacts).

Figure 6 illustrates the frequency of responses from the cluster suggesting a livelihood asset that is most devastated due to hazard. This graph shows that most of the respondents report that cash crops are most affected livelihood resource by hazards followed by land, water and livestock. Damages to cash crops on scale 5 were recorded by six clusters. Damages to cultivable land were recorded by 5 clusters. Likewise, damages to water and livestock were recorded on a scale of 4. One reason for cash crops being so high on damages is due to the fact that potato is cultivated on large scale which fetches crucial cash to buy food and pay for social services including education and health. Forest plantations and roads are also severally damaged by the hazards. Excavation, collection and marketing of gemstones are important cash earning activities which are impacted in various ways by hazards including danger of collection in areas prone to stone rolling and landslides and damages to the actual gemstone collection sites. Road blocks due to floods and landslides also impact transportation and marketing of gemstones and agriculture produce. Saving is another resource seriously impacted by hazards especially in villages prone to landslips. The affected population drastically lose savings in repairing properties that may slip again.

**Figure 6: Assets most mentioned as affected by hazards**




Damages due to hazards depend on type of hazard that hits a particular village or area. Avalanche, flash floods and river over-flooding cause damages of various magnitudes to the livelihood assets. Landslide results in damages to water supply infrastructure, roads, and public infrastructure (power houses and schools). River over-flooding specifically damages land and water supply infrastructure. Landslip damages crops, land and any kind of construction. As a result land for leasing decreases and saving diminishes as land repairs are highly costly. Stone rolling and avalanches hamper excavation and collection of gemstones. Therefore any interventions directed at reducing hazards risks depend on hazard types in a given area and type of damages the hazards inflict. For example, landslip is specific to Murdan and Parsan cluster of villages. Damages due to flash floods are high in Murdan. River over-flooding is a problem in Gabor, Doaba, and Susume. While stone rolling is reported from Parsan which reduces their income due to difficulties in collecting gemstones. Avalanches and Landslides are reported from most of the areas due to slopes and mountainous nature of terrain. Table 9 illustrates the spread of impact across clusters whereas Figure 7 presents an aggregated severity of impact of these hazards as reported by communities.

Summarising this, graphically it shows that water resources (including piped drinking water, land, cash crops, roads, forests, livestock and minerals receive the maximum damage when hazards occur. Savings are ranked at lower end however the loss of cash crops as well as other resources collectively impact on people's income and cash reserves.

**Figure 7: Aggregate impact of hazards on key livelihoods assets**

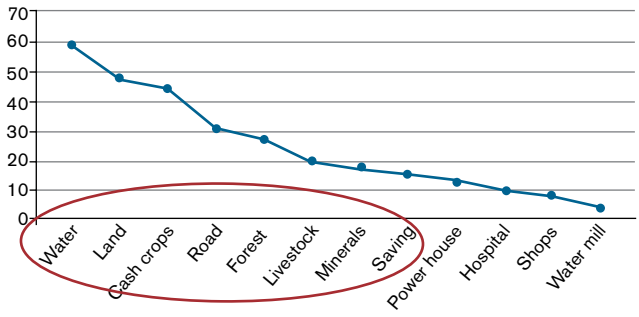



Table 9. Hazard and Vulnerability Matrix: Impact (on 1-5 scale) on crucial livelihoods resources / strategies (5 and 4 are extreme and high impact respectively and are indicated by red highlights. 3 indicates medium impact. 2 and 1 are low and not much impact respectively).

| Hazard | Hazards and Vulnerability Matrix | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cash crops | Land | Water | Water structures | L. stock | Forest | Roads | Land leasing | Gem stone | Power house | Saving | Hospital | School | Shop | |
| Avalanches | B4+G4 +M5* | B4+ G5 | B4+ D3 | H5 | G5+ M5 | B4+ M5 | H3 | B4 | H5 | H4 | M3 | | | | 72 |
| Flash Floods | B5+G4 +P5+M5 | B5+ M5 | B5+P5 +S4 | P5 | S5+ M5 | B5+ M5 | M5 | | S4 | S4 | G3+ S4 | S4+ M5 | D3+S5 +M3 | | 108 |
| Landslides | B4 | | B4+ H3 | H3+ $5 | | B4+ G4 | H3+M4 +$5 | B4 | | H5 | | | H3 | H3+ $5 | 59 |
| Landslips | M5+P5 | M5+ P5 | | P4 | | M4 | M4+ P4 | M5 | | | M5 | | M3 | | 49 |
| River over-flooding | | G4 | D5+ $5 | $5 | | | | | | | | | | | 19 |
| Stone rolling | | | | | | | P4 | P4 | P4+ S4 | | | | | | 16 |
| Cumulative Impact | 46 | 33 | 38 | 27 | 20 | 31 | 32 | 17 | 17 | 13 | 15 | 9 | 17 | 8 | |

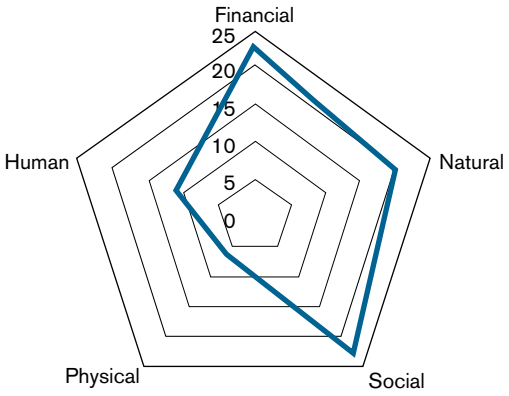
*B-Begusht, G-Gabor, M-Murdan, P-Parsan, D-Doaba, H-Hearth, S-Shoghor, $-Susume. B4+G4+M5 means the effect of avalanche on cash crops for Begusht and Gabor ranked as 4 and for Murdan 5.

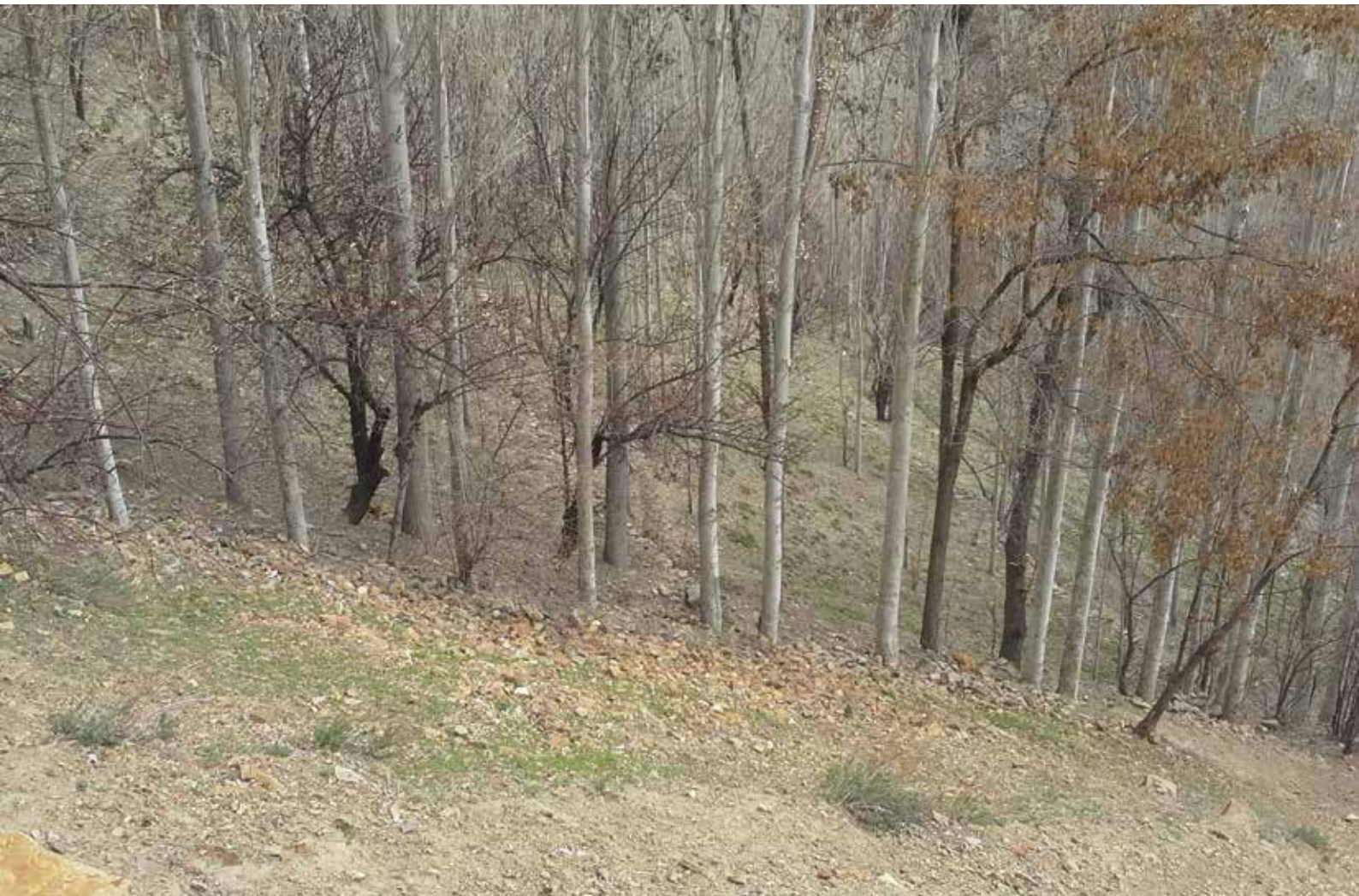
# 8. Important resources for realising coping strategies

Coping strategies are decided according to the hazard, its magnitude in terms of its impact on various livelihood assets. Coping strategies are affected by availability of certain resources. This section describes various coping strategies and their dependence on available resources or livelihood assets. It is important to note that the livelihoods assets identified for coping strategies are those available with the communities. However some options for improved coping from hazards may not be available, for example, special skills to cope with hazards and disasters such as search and rescue skills for people trapped under avalanches and debris, first aid and so on.

Figure 8 gives an aggregate picture of most frequently deployed resources to get out of a situation in case of a disaster. In short how people cope with a situation is depicted in the graph and it shows that most important resources in the event of disasters are financial, social and natural. There is little support sought from human resources (defined as indi-

**Figure 8: Livelihood assets deployed to cope with hazards**



vidual skilled, educated persons in the villages) and physical resources (buildings, roads). When we compare this with Figure 2 (livelihood resources), there are several complimentaries but also differences. One major difference is that the physical and human resources people have enlisted as very important, are of not much use in the event of disaster. Personal savings (either in the form of cash, cash crop reserves or livestock) are deployed first in parallel to the support extended by social network of village organizations and volunteers.

In the following sections we will unpack this for each type of hazard and major coping strategies deployed by the communities with few cluster specific examples.

### 8.1. Coping strategies and resources for damages due to Avalanches

The impacts of avalanches include damages to cultivable land, crops, human lives, houses, and power stations (Table 10). Annex 2 (Appendices 2-6) presents detailed data sets for each cluster, type of hazard, coping strategies and resources deployed.

Each cluster has strategies depending on severity of losses and resources available. Cash earned from cash crop (mainly potato, livestock and in some cases minerals) is crucial in realising coping strategies especially for land reclamations and re-cultivation of crops (Begusht and Murdan). Livestock is banked on hoofs, liquidated in need to arrange cash and spent on coping strategies. Minerals, saving and indigenous knowledge are important in land reclamation and re-cultivation. In case of permanent re-location, savings in addition to skills and local knowledge play crucial role. Whereas in case of life losses when search and rescue are needed, community organisations (VO) and volunteers are important social resources. Savings are important too, as these are quickly lost in rehabilitation of the families when an earning member of family is lost. In summary, cash is the only resource that is used for getting rid of an emergency – which is very short term thinking when there are no choices around. In case of acute emergencies with life losses, social assets are important and are in action. However search and rescue skills are lacking in the areas except in a few villages where development agencies have provided basic skills. No refresher training and follow up were conducted however, which are badly needed.

Table 10: Resources deployed for realising coping strategies against damages due to avalanches

| Impact | Strategy | Resources deployed |
|---|---|---|
| Damage to land and crops | Land reclamation<br>Relocation<br>Migration for earning<br>Permanent shifting | Finances from cash crops, livestock, minerals<br>Volunteers<br>Local knowledge<br>Relatives (to search jobs)<br>Own skills |
| Loss of livestock | Purchase new livestock | Savings from shop and cash crops<br>Microfinance bank |
| Displacement / damage to houses | Temporary relocation<br>Constructing traditional houses | Savings from various sources<br>Stones, minerals<br>Transport<br>Local knowledge<br>Volunteers |
| Life Loss | Search and rescue | Volunteers<br>Village organizations |
| Damage to power house | Clearing debris | Road for machinery<br>Volunteers<br>Village organizations |
| Damage to roads | Lobby for opening roads | Stones, minerals<br>Linkages<br>Skilled labour<br>Local knowledge<br>Volunteers |

### 8.2. Coping strategies and resources for damages due to Flash Flood

Floods cause damages to land, crops, livestock, forest plantations, houses and other property. A number of coping strategies were identified by the respondents that need vital livelihoods resources for success. To avoid floods, the coping strategy suggested was to construct protection walls so that flood from the streams do not encroach the settlements. In this case, the role of the village organisation (VOs), at apex level Local Support Organisation (LSOs) and volunteers were considered crucial for realizing such a strategy (Table 11). Income diversification and food storage was also recommended so that all is not put in one basket as the case with large scales potato cultivation.

In Gabor, the flood is so severe that relocation to safe places was suggested as a coping strategy. In coping strategies the significance of volunteers, VOs and cash was highlighted. Although cultivation of potato as cash crop has resulted in monoculture, it generates crucial cash income to be used both in normal situations and emergencies. On the other hand cultivation of potato on large scale has resulted in creating insufficiency of food at local level. Traditionally, a number of crops ripening at different stages in the season were grown and stored. Potato on the other is mostly sold for cash income.

Table 11: Resources deployed for realizing coping strategies against damages due to floods

| Impact | Strategy | Resources deployed |
|---|---|---|
| Damage to land and crops | Protection wall<br>Income diversification (including migration for jobs)<br>Food storage | Finances from savings, cash crops, livestock, minerals<br>Bullock<br>Water<br>Volunteers<br>Village organizations / LSO<br>Local knowledge<br>Skilled labour<br>Relatives (to search jobs) |
| Damage to houses and property | Temporary relocation<br>Save food<br>Have houses in safe areas | Savings from various means<br>Saved food stock<br>Microfinance bank<br>Volunteers<br>Village organizations |
| Loss of livestock | Shit to safer location | Land<br>Forest |
| Life Losses | Permanent relocation (but not implemented) | |
| Damage to forests | New plantation | Forest land<br>Volunteers |

### 8.3. Coping strategies and resources for damages due to landslides

Landslides are also common in mountainous Chitral. Three clusters reported damages due to landslides (Table 12).This includes damage to crops and land (Begusht and Hearth), damage to roads (Hearth and Susume), damage to drinking water systems (Begusht) and damage to stored food (Susume). For damage to land and crops digging drainage and plantations were suggested. Role of VOs, LSOs, volunteers, was highlighted to implement these strategies.

Table 12: Resources deployed for realizing coping strategies against damages due to landslides

| Impact | Strategy | Resources deployed |
|---|---|---|
| Damage to land and crops | Digging drainage<br>Improve land<br>Plantation | Volunteers<br>Village organizations / LSO<br>Skills<br>Bullock |
| Damage to roads | Repair / remove debris<br>Lobby for opening if heavy damages | Volunteers<br>Saving from various sources to contribute<br>Minerals, stones<br>Tools<br>Skilled labour<br>Local knowledge<br>Linkages |
| Damage to drinking water | Repair water supply | Savings<br>Volunteers<br>Village organizations<br>Roads |
| Damage to food stock | Collective storage<br>Buy food | Crop reserves<br>Savings<br>Microfinance bank |

### 8.4. Coping strategies and resources for damages due to River over-flooding

River over-flooding has reported to have increased in recent years due to signs of climate change in Chitral (Table 13). Since settlements in some clusters are along the streams, river over-flooding during the glacier melting season damages land, crops, roads, water infrastructure, houses and other properties. Doaba and Gabor are vulnerable to this hazard. Linkages with NGOs and Government departments for support for construction of protection walls were highlighted. In Gobor the situation is severe and a permanent relocation was suggested as a coping strategy. For linkages to support relocation, the role of VOs, LSOs and volunteers was considered crucial. Potato crops were considered as very important because these generate enough cash to implement those strategies.

Table 13: Resources deployed for realising coping strategies against river over-flooding

| Impact | Strategy | Resources deployed |
|---|---|---|
| Damage to land and crops | Raise protection wall | Savings from shop, livestock<br>Wasteland<br>Tools<br>Volunteers<br>Village organizations / LSO |
| Damage to roads<br>Damage to water infrastructure | Lobby for opening road<br>Repair | Volunteers<br>Savings from various sources for contribution<br>Skilled labour<br>Linkages |
| Damage to houses and property | Repair houses<br>Construction in safe places (seldom implemented) | Savings from shop, livestock<br>Land<br>Skilled labour<br>Volunteers<br>Village organizations / LSO |

### 8.5. Coping strategies and resources for damages due to Rolling stones

Rolling stones is a hazard in three clusters (Table 14).Unlike avalanches, floods, landslides and river overflows where main damage is to land and crops, rolling stones damage roads, kill livestock and also damages houses. In case of damage to road, the strategy is to develop linkages with NGOs and GOs to rebuild roads and erect retaining walls. In case of damages to houses and livestock, cash from business, transport and savings play an important role. Loans from Microfinance banks were also mentions as a resource for implementing coping strategies.

Table 14: Resources deployed for realising coping strategies against damages due to stone rolling

| Impact | Strategy | Resources deployed |
|---|---|---|
| Damage to road | Repair road on self-help basis<br>Paving alternate paths | Savings for contribution<br>Minerals, stones<br>Tools<br>Volunteers |
| Loss of livestock | New purchases | Savings from shop |
| Life Loss | Nothing | |
| Damage to trees | New plantation | Land<br>Water<br>Plants<br>Skilled labour<br>Local knowledge<br>Volunteers<br>Village organizations / LSO |
| Damage to houses and property | Repair houses | Savings from shops, livestock<br>Roads and transport<br>Water<br>Minerals, stones<br>Trees<br>Skilled labour<br>Local knowledge<br>Volunteers |

### 8.6. Coping strategies and resources for damages due to Landslips

Landslips a new and serious phenomenon in two clusters Parsan and Murdan (Table 15). Landslip was triggered due to mismanagement of newly constructed irrigation channels. Mismanaged irrigation water from villages' situated on higher elevations seeps down to lower villages gradually causing landslips. Since landslips involve the entire village at times, it causes widespread damages to a number of livelihood assets including land, crops, irrigation systems, roads, and houses. Linkages for research and drainage were highlight as essential required resources. Shifting settlement including livestock was identified as another strategy. The role of VOs, volunteers and teachers was highlighted in creating linkages. Alternate land is another resource required for re-settlement. Savings as a crucial resource was specifically mentioned for implementing strategies.

Table 15: Resources deployed for realising coping strategies against damages due to landslips

| Impact | Strategy | Resources deployed |
|---|---|---|
| Damage to land and crops | Research and drainage<br>Protection wall | Savings from various sources<br>Volunteers<br>Village organization<br>Skilled labour<br>Road<br>Wasteland<br>Linkages (to get the protected wall for free) |
| Disturbance to livestock | Shift livestock to other places | Forest |
| Damage to irrigation system | Repair the channel | Savings from various sources<br>Volunteers<br>Village organization<br>Cash from selling livestock |
| Damage to road | Lobby with other organizations<br>Self help | Savings from various sources (mainly livestock)<br>Volunteers<br>Minerals, stones<br>Skilled labour<br>Tools<br>Linkages |
| Damage to houses and property | Move to relatives or neighbours<br>Repair houses | Culture: Tradition to shelter affected families<br>Savings from livestock, cash crops<br>Minerals, stones<br>Forest (timber)<br>Skilled labour<br>Volunteers |

# 9. Conclusions

Contextual analysis of Chitral's climate and people's feedback suggest that there is a felt trend in temperature increase which has important implications for crop growth, yields and water regime. Increase in temperature will enhance growing degree days for the crop. At the same time increased temperature has led to relatively early maturity in cereals which needs to be scientifically studied. Warming temperatures may also be beneficial for diversifying the cropping systems. However at the same time there are changes in precipitation patterns which have implications on daily and periodical risks people face in these valleys. With changing climate flash floods are reported to have increased. People live with risks in these areas for very long time and for generations. The risks have however increased and nature of risks have changed and therefore local knowledge has a limit to find effective long term solutions. This exercise revealed that people opt of various short term and long term strategies to cope with risks and adapt themselves to various risks and likely hazards.

**Major livelihood resources:**

Water is the most important natural resource for livelihoods in the study area while land for farming is the second most important resource. This means farming remains the most important livelihood resource in the area. Social assets have also been ranked at a higher level. Village organisation and volunteers were highlighted by all the clusters for their important role in implementing coping strategies especially in creating linkages and fostering self-help coping strategies. Role of any government institution including the elected representative were hardly mentioned as a resource in the area although the government line departments are important sources of employment for the local population. Skills for search and rescue in the event of avalanches and flood generally do not exist in the areas. Training and provision of search and rescue equipment was highlighted by almost all clusters. Communities living in villages where facilities like power houses, schools and health centres run by the government exist, people see more opportunity to get employment. Roads were ranked higher by clusters situated far from the main valley road. These assets were rated at a higher level by the communities. The dead end dirt link roads are the only access roads to these villages. Timely transportation of agricultural products especially potato to the market and food and non-food items from the market is dependent on these single access roads. These roads get frequently blocked by landslides, avalanches and floods. The repair of these roads gets less attention of the authorities and often the communities have to repair these on self-help basis.

**Changing livelihoods strategies:**

Interestingly forest, wildlife, medicinal plants and other resources that are collected from wild were not ranked at the highest level resources. Reliance on these resources is replaced by other resources collected from the environment such as gemstones or cash crops. In addition, there is increasing trend of raising forest plantations while natural forests are reported to have drastically decreased with remaining patches in areas difficult to access. The farming system is changing from subsistence to commercial. Livelihood activities that generate cash income are preferred over activities for subsistence. Cash saving as opposed to traditional food storage is a new trend. Cultivation of potato for commercial purposes during the last 30 years has spread fast in the area. This shift which fetches badly needed cash, has resulted in monoculture and a number of traditional local crops are no more grown. Cash income from sale of commercial potato and gemstones clearly is becoming an important livelihood resource. How much cash is important is also indicated by the fact that infrastructure that generates employment is ranked higher than vital physical resource like roads. Roads do not provide employment opportunities whereas schools, health centres and power houses do. Therefore these physical resources are rated higher than the link roads vital for transportation of farm produce to the market and food from the market to the villages.

**Hazards:**

Flash flood followed by avalanches, landslides and landslips are the major hazards in the area. Flash floods have caused major damages to land and property. Therefore floods need much more attention than avalanches since avalanches are localized and occur in specific periods when people can almost predict the disaster. Floods are unpredictable and are devastating especially to settlements and farmland. Landslip is localised in some areas caused by water seepage due to

mismanagement of newly constructed irrigation channels. The causes of the landslip however needs thorough investigation.

**Damages due to hazards:**

Cash crop (potato) followed by land, water, water supply infrastructure and livestock are the livelihood resources most impacted by the hazards. Saving has been indicated as a subject of impact by hazards which is explained by damages to resources that bring cash income. The main impact of hazards was reported on potato crop. One reason for potato being so high on damages is due to the fact that potato is cultivated on large scale which fetches crucial cash to buy food and pay for social services including education and health. Excavation, collection and marketing of gemstones is another important cash earning activity which is impacted in various ways by hazards – Road blocks and danger of collection in areas prone to stone rolling and landslides.

**Coping strategies:**

People opt for different coping strategies to deal with the risks arising from natural hazards and deploy their resources for realising them. Important coping strategies include permanent relocation, repair of land and damaged infrastructure, seasonal migration of male members including school going boys from hazard affected families to earn cash income, leasing land of other people for cultivation and shifting temporarily to relatives' in case of damages to houses.

**Resources for coping strategies:**

Cash earning (saving) from commercial potato, transport, gemstones and shops are crucial for implementing coping strategies. Livestock is also liquidated to arrange cash for coping strategies. Coping strategies depend on hazard type and impact on various resources. And resources required for coping strategies depend on what kind of resources are available. In case of permanent re-location, savings in addition to skills and local support play crucial role. Relatives, community organisations (VO) and volunteers play a crucial role in case of emergencies for rescue and rehabilitation operations.

In some places damages due to flood (Gabor) and damages due to river over-flooding (Doaba) is so severe that total relocation to safe places was suggested as a coping strategy. An alternate strategy is to construct protection walls which need heavy investment and support from the government and development agencies. In this case cash income for relocation and the role of volunteers and VOs was highlighted for linkages with the government and NGOs. Importance of cash for coping strategies encourages monoculture (cultivation of potato) as it generates crucial cash income to be used both in normal situations and emergencies. Large scale cultivation of potato has resulted in creating food insecurity as other crops grown traditionally for storage are no more cultivated.

It is important to note that communities have developed strategies for some hazards that are persistent. For example by building houses in safer places to avoid losses from avalanches. People can also predict avalanches therefore they avoid visiting avalanche areas in seasons when avalanches are expected. However some resources are not available in the event of any emergency, for example, skills for search in case people are under avalanches or flood debris. Increased floods are new to the area, their spread cannot be predicted. Coping strategies for such hazards therefore depend on the resources available with that particular cluster before the event. There seems no long-term coping strategy for this hazard.

**What does this reflect – summary for planners**

**It is clear from CRiSTAL exercise in forty-one villages that the top hazards and risks in Garam Chashma are hydro-metrological in nature.**

These hazards often damage natural assets such as land, crops, livestock, water resources as well as minerals which are the lifeline for local families living in Garam Chashma. In terms of coping strategies, none by definition have a long term outlook. Mostly local people's behaviour is to act in emergency deploying all their savings in order to get out of disastrous situation as early as possible. These situations may include damage to crops, land and houses, breakdown of channels or other infrastructure. The coping strategies are to build temporary shelters or temporary migration including male members leaving in search of earning livelihoods for their families. This is not sustainable at all since disasters consume all the savings people have made with hardship all the years. Investments of savings could be more productive to learn, plan and implement longer term protection from hazards. Frequency of hazards is essential to study in relation to climate change / variability. There is a need to understand causes of these hazards / disasters and predict them as much as possible. This will help in improved capacity for preparedness and minimizing losses in case of disasters.

There is a high need for replacing short term coping strategies with climate change adaptation measures. The findings of this study indicate that losses due to increasing natural hazards in the study area have increased and it is high time that the communities are supported in taking long term adaptation measures!!

The findings of this study correlate with certain changes in Chitral (Annex 1 and 2) including the increase in average temperatures, warmer days and cooler nights, warmer springs with early snow melting and early summers, shorter winters and longer summers and so on. These changes necessitate cross-sectional adaptive research to reassess the suitability of crops cultivars and cropping patterns under changing temperature since crops, especially commercial crops, are important coping strategies for the people to deal with the risk and yet it is vulnerability of agriculture which makes people vulnerable at the same time. Adaptation strategies and better governance may also be needed for irrigation water management. This includes better management of irrigation channels and introduction of efficient on-farm water management techniques. Warming temperatures may accelerate evapo-transpiration and thereby increase water demand for crops in the mountain areas. The early warming in spring causes accelerated snow melting and hence endangers sustainability of irrigation sources and settlements situated close to water.

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# Annex 1

Chitral: Decadal Temperature Scenarios (°C)

| Temperature | Base | Observed | % change from | Projected | % change from | Projected | % change from |
|---|---|---|---|---|---|---|---|
| | 1971-2000 | 2001-2010 | Base | 2011-2020 | 2001-2010 | 2021-2030 | 2011-2020 |
| Annual | | | | | | | |
| Average | 15.9 | 16.3 | 2.52 | 16.9 | 3.53 | 17.3 | 2.52 |
| Minimum | 8.6 | 8.3 | -3.49 | 8.2 | -1.20 | 8.1 | -1.22 |
| Maximum | 23.2 | 24.3 | 4.74 | 25.3 | 4.12 | 26.4 | 4.35 |
| Winter | | | | | | | |
| Average | 7.1 | 7.5 | 5.63 | 7.7 | 2.67 | 8.5 | 10.39 |
| Minimum | 0.7 | 0.7 | -5.07 | 0.6 | -16.48 | 0.5 | -12.28 |
| Maximum | 13.4 | 14.3 | 6.10 | 15.0 | 5.16 | 16.5 | 10.00 |
| Spring | | | | | | | |
| Average | 10.1 | 11.4 | 12.87 | 11.9 | 4.36 | 12.7 | 6.75 |
| Minimum | 4.2 | 4.7 | 12.11 | 5.2 | 9.48 | 5.7 | 9.23 |
| Maximum | 16.0 | 18.0 | 12.90 | 18.6 | 3.37 | 19.8 | 6.22 |
| Summer | | | | | | | |
| Average | 24.6 | 24.7 | 0.41 | 24.9 | 0.81 | 25.5 | 2.47 |
| Minimum | 16.5 | 15.7 | -4.86 | 14.8 | -5.47 | 14.7 | -0.81 |
| Maximum | 32.8 | 33.8 | 3.17 | 35.0 | 3.48 | 36.2 | 3.43 |
| Fall | | | | | | | |
| Average | 21.7 | 21.6 | -0.46 | 21.5 | -0.46 | 21.5 | 0.00 |
| Minimum | 12.9 | 12.3 | -5.09 | 11.8 | -3.87 | 11.3 | -4.24 |
| Maximum | 30.4 | 30.9 | 1.67 | 31.3 | 1.14 | 31.8 | 1.60 |

# Annex 2

Summary of climate change scenarios for Chitral and its implications

| Season | Chitral | | |
|---|---|---|---|
| | Av | Max | Min |
| Annual | + | + | - |
| Winter | + | + | - |
| Spring | + | + | + |
| Summer | + | + | - |
| Fall | + | + | - |
| IMPLICATIONS | ■ Overall temperatures are increasing<br>■ Days are getting hotter and nights are getting cooler<br>■ Hotter springs bring early snow melting and early summers.<br>■ Shorter winters and springs/ longer summers | | |
| IMPACTS ON AGRICULTURE &WATER | ■ Increase in crops and fodder yeilds<br>■ Shift in cropping zone further north with a possibility of double cropping and area expansion at higher altitudes.<br>■ Warming temperatures provide suitable conditions for diversifying cropping patterns to fruits and vegetables.<br>■ More water will be available becuase of early snow melting. The less snow accumulation will imply lesser water in summers and the increase in melting glaciers, will compensate.<br>■ Increased snow and melting glaciers may increase snow avalanches and GLOFs | | |
| ADAPTATION NEEDS | 1. Varieities of the sub-mountain areas (e.g. Swat) may be tested in the high altitude mountain areas.<br>2. Methods for conserving water from early/ increased snow/glaciers melting<br>3. Mulching techniques to reduce the impacts of cooler nights on crops | | |

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