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## HAZARDS AND COPING STRATEGIES A CASE STUDY FROM CHITRAL VALLEY PAKISTAN

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# Acronyms

ADB	Asian Development Bank
AKES	Aga Khan Educational Services
AKHSP	Aga Khan Health Service, Pakistan
AKRSP	Aga Khan Rural Support Programme
AWKUM	Abdul Wali Khan University Mardan
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
GDP	Gross Domestic Product
GoP	Government of Pakistan
KIB	Kunming Institute of Botany
KP	Khyber Pakhtunkhwa
LSO	Local Support Organization
SDC	Swiss Agency for Development and Cooperation
SPSS	Statistical Package for Social Sciences
UC	Union Council
VO	Village Organization
WASIP	Water and Sanitation Improvement Programme
WO	Women's Organization

## Abstract

This study documents hazards, impact of hazards and coping strategies in three villages of the Chitral District of Khyber Pakhtunkhwa Province Pakistan. Data for this study was collected through interviewing focus groups, key informants and representatives of households affected by hazards. The study documents hazard types, their frequency and the damages caused by them. Data collected for this study indicates that climate of the area has changed resulting in unpredictable and increased hydro-meteorological hazards. The data also indicates severe damages to assets, crops and crop land by hazards. Common hazards are flash floods and avalanches. Flash floods have increased since 1990s causing devastating damages. Coping strategies include temporary migration to other villages to take shelter, borrowing cash for repair of damaged infrastructure and land, and reliance on local village organizations and volunteers for help in emergencies. No sustainable coping strategies were noted.

Key words: Hazards, Flash flood, Avalanche



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# 1. Introduction

During the last decade Pakistan has witnessed a number of natural hazards – the devastating earthquake in 2005, floods in Baluchistan in 2007, devastating flood all over the country in 2010, in Sindh during 2011 and drought in Thar desert in 2014. There is now increasing evidence of climate change in Pakistan and increased temperature particularly in the northern mountain regions (Ali, Nizami, Ara and Salim, 2015; Hanif and Ali, 2015; Yu, Winston et. al., 2013; Hussain and Hanif, 2013). Pakistan is considered 16<sup>th</sup> most vulnerable country in the world to climate change related hazards (Maple Croft, 2011). The flood in 2010 was believed to have originated in the Hindukush, Himalaya and Karakoram mountains which caused devastation almost all over the country. The devastation was so big that the government and the affected people still have not been able to fully rebuild and rehabilitate broken roads, bridges and other infrastructure. The cost of recovery was estimated at USD 10.85 billion (ADB and GOP, 2010). The damages included loss of lives, total collapse of infrastructure in most parts of the country (including roads, bridges, grid stations and water supply systems) and loss of crops and other assets (ADB and GOP, 2010).

The 2011 flood in Sindh resulted in loss of crops scattered over 2.28 million acre of land (UNOCHA, 2011).

As a result of increasing hazards, Pakistan has taken a number of steps at policy level to prepare for climate change related issues in the future. The ministry of Environment was re-named as Ministry of Climate Change (GoP, 2012). The government has also adopted national climate change policy. The goal of the policy is “to ensure that climate change is mainstreamed in the economically and socially vulnerable sectors of the economy and to steer Pakistan towards climate resilient development” (GOP 2012). The policy further states that “the agriculture sector, as the single largest sector of Pakistan’s economy, is its lifeline. It accounts for 45% of the labour force, 21% of GDP and 70% of total export earnings. Agriculture in Pakistan is greatly affected by short-term climate variability and could be significantly impacted by long-term climate change. As the duration of crop growth cycles is related to temperature, an increase in temperature will speed up crop growth and shorten the time between sowing and harvesting. This shortening could have an adverse effect on productivity of crops and fodder for livestock. The hydrological cycle is similarly likely to be influenced by global warming, necessitating the agriculture and livestock sectors, particularly in rain-fed areas, to adapt to climate change”.

As elsewhere in Pakistan, changes in quantity and timing of precipitation are believed to have increased natural hazards in Chitral especially flash floods since the 1990s (Hope 2010). This study therefore was conducted to contribute to this discussion and to understand coping strategies by taking empirical data from 3 villages in Garam Chashma valley in Chitral.

This study is part of the “Building Effective Water Governance in the Asian Highland’s Research Project” being implemented in Pakistan, China and Nepal by Kunming Institute of Botany (KIB) China and funded by the International Development Research Centre (IDRC). This study is a preliminary investigation into climate change and impact of hazards. More than answering questions it is expected to pose specific questions for future investigations. Since the study was conducted in three villages, its scope is limited hence cannot be generalized to the whole of Chitral district.

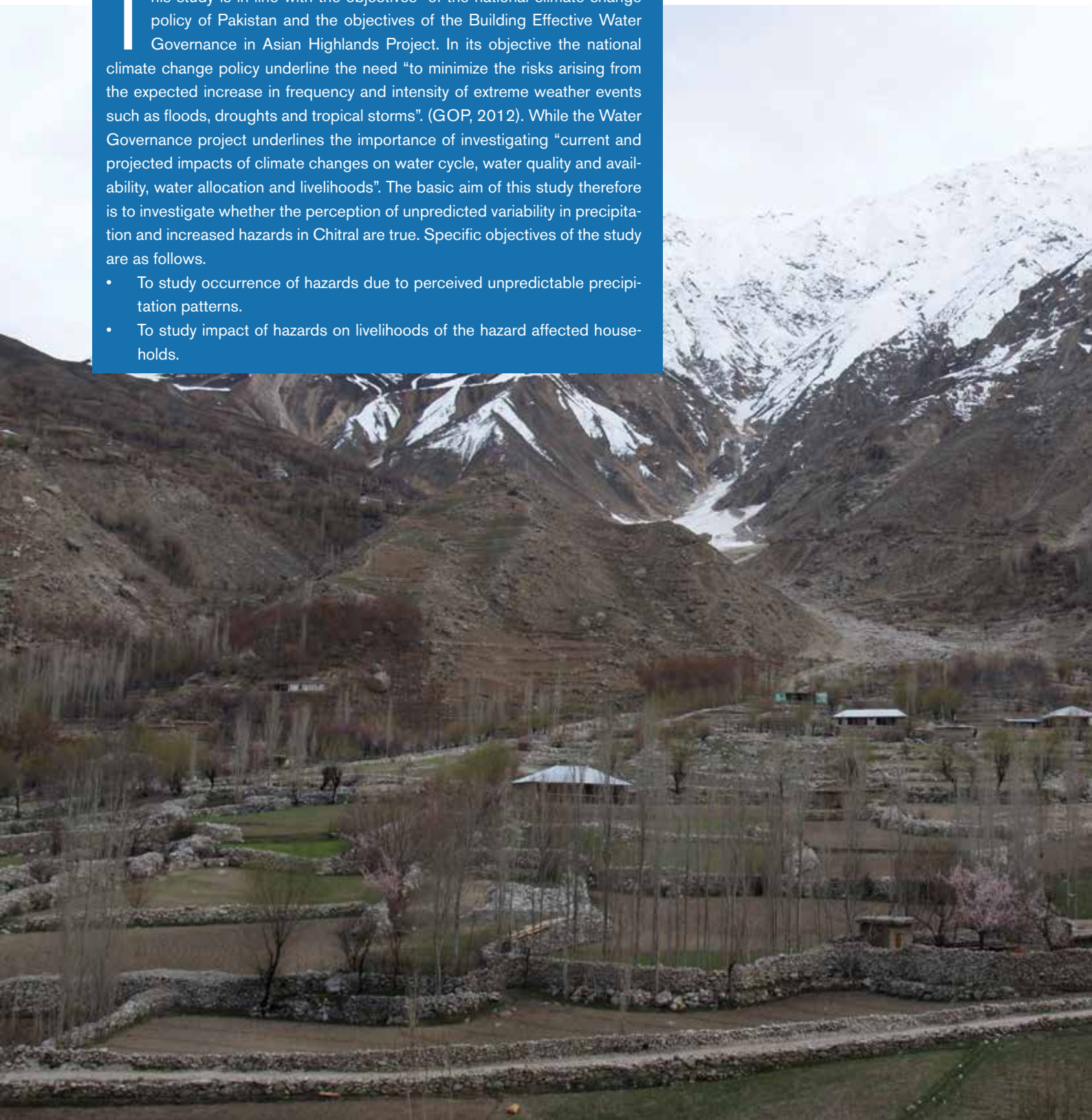




## 2. Objectives

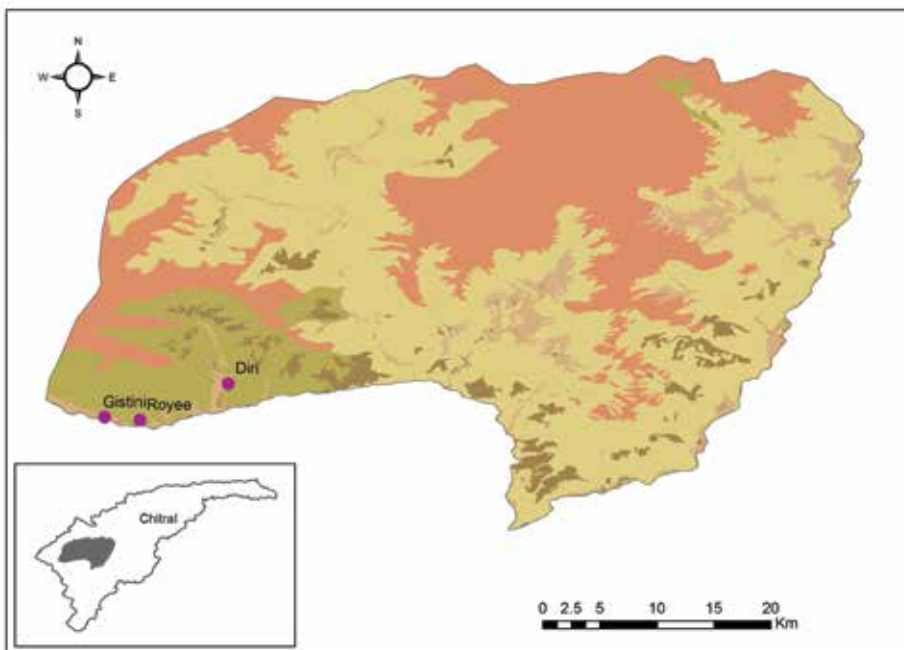
This study is in line with the objectives of the national climate change policy of Pakistan and the objectives of the Building Effective Water Governance in Asian Highlands Project. In its objective the national climate change policy underline the need “to minimize the risks arising from the expected increase in frequency and intensity of extreme weather events such as floods, droughts and tropical storms”. (GOP, 2012). While the Water Governance project underlines the importance of investigating “current and projected impacts of climate changes on water cycle, water quality and availability, water allocation and livelihoods”. The basic aim of this study therefore is to investigate whether the perception of unpredicted variability in precipitation and increased hazards in Chitral are true. Specific objectives of the study are as follows.

- To study occurrence of hazards due to perceived unpredictable precipitation patterns.
- To study impact of hazards on livelihoods of the hazard affected households.



## 3. The study area

This study was carried out in three villages in Garam Chashma valley District Chitral Pakistan. The three villages are: Gistini, Dir and Royee.



Source: World Agroforestry Centre – East and Central Asia

Chitral district is located in the north western part of Khyber Pakhtunkhwa (KP) province stretched over an area of 14,850 sq. kilometre (km<sup>2</sup>). Chitral town is the district headquarter. Chitral shares its boundaries with Afghanistan to the north and west, Gilgit-Baltistan region to the east and the Districts of Dir and Swat to the south. Administratively the district is divided into two tehsils, seven sub tehsils and 24 union councils (UCs). The population of Chitral is around 385,000 with 48,000 households having an average household size of 7.9 persons. More than 90% of the population lives in rural areas (GOP 1998).

Garam Chashma valley where the study villages are located is at a distance of 43 km from Chitral town in the North West, bounded by Afghanistan in the north and west, Akram Pass (Arkari) in the east and Chitral town in the south. Garam Chashma provides the shortest transit to the Central Asian Republics via Badakhshan province of Afghanistan through the Dorah Pass at 10,000 feet above sea level (asl). The

main features of the area are Darbar-e-Nasir Khusraw, Garam Chashma Fort, hot springs (Garam: hot: and Chashma: spring) and trout fish. Garam Chashma consist of three sub valleys: Khoh, Doaba and Gabor.

### 3.1 The study villages

**Gistini:** Gistini is 50 km away from the main Chitral town, 5 km away from main Garam Chashma town on the left bank of Garam Chashma river at an altitude of 8047 feet. It has 30 households and the population consists of 400 individuals. Ethnically the whole community belong to Haidari tribe. Their forefathers migrated from Badakhshan in Afghanistan. According to a village elder Faiz-ur-Rahman aged around 100; their forefathers were forced to migrate from Afghanistan due to unfavourable socio-religious conditions in their native Badakhshan. First they

migrated to Nagar in Drosh valley in the south of Chitral town, then to Danin near Chitral town and finally to Gistini.

Khowar and Yatga languages are spoken in Gistini. The average household consists of 13 members. Interestingly, majority households have 20 members while few have less than 5 members. Gistini has two organizations: Village Organization (VO for men) and Women's Organization (WO). Gistini has a basic health facility run by the Aga Khan Health Services. Potato is the main crop grown on 70 % of the available cultivable land while wheat is cultivated on 25 percent. The rest is under other uses, mainly vegetables.

**Diri:** Diri is 47 km away from Chitral town and 7 km from Garam Chashma town at an altitude of 8771 feet asl. Ethnically the people belong to Syed and Saghnea tribes and speak Khowar language. There are 13 households with a total population of 162 and household size around 12. Major crops in Diri are potato, wheat and barley. Irrigation water to the crops is provided by two irrigation channels. These are repaired annually and maintained communally.

There are two village organizations in Dirí, a VO and a WO. In Dirí two persons received post graduate level education, two graduates, four intermediate while 15 have secondary level education. There is no school in Dirí. Children go to schools in Shah Gram, a nearby village. No health facilities exist in Dirí. Basic health facilities run by AKHSP exist in village Droshp, 5 km away from Dirí. Due to lack of medical facilities in Droshp most patients are sent to health facilities in Chitral.

**Royee:** Royee is situated at 5800 feet asl and is 47 km away from the Chitral town and 4 km away from Garam Chashma at the right bank of Garam Chashma River. Royee has 78 households and the population is 940. Ethnically the residents belong to Dashmany, Monigy and Malpik tribes. Khowar and Yadgh languages are spoken. The livelihood is based on subsistence farming (crops and livestock). Wheat and potato are

major crops. There is no health facility in Royee. The residents travel to Garam Chashma to access basic health facilities run by the Aga Khan Health Services. Better health facilities are available in Chitral town.

There are three village organizations in Royee - two VOs (Royee upper, and Royee lower) and one WO. Royee has three schools; Government primary school for boys and girls, the Aga Khan Education Services (AKES) primary school and a community based high school only for girls. After primary education male students commute to middle and high schools in village Parabeg 2 km from Royee. The high school for girls is also in Parabeg.



## 4. Methodology

**M**eetings for developing methodology for this study were held at the Bacha Khan Campus of Abdul Wali Khan University Mardan (AWKUM) in Chitral. Three students from AWKUM then collected data from the field using the following tools.

**Transact walks:** Transact walks were conducted in all three villages. The purpose of these walks was to personally observe hazard sites and damages by hazards to infrastructure, land and other property.

**Questionnaire:** A detailed questionnaire was used to collect data on demography, hazards and damages. The questionnaire had both closed and open ended questions. This questionnaire was then administered to key informants at the villages.

**Time line history:** A time line history was used to record occurrence and intensity of hazards. Data on these indicators was

collected from key informants using the time line history.

**Focus Group Discussions:** Focus group discussions were held in each village in order to document climate change perceptions, damages due to hazards and coping strategies.

**CRiSTAL:** Some data related to sources of livelihoods and types of hazards was collected using Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL: <https://www.iisd.org/cristaltool/>). CRiSTAL relies on information collected from desk-based review, community and other stakeholder consultations at the local level using participatory methods.

**Data analysis:** The data collected especially on occurrence and intensity of hazards, and damages was analysed using Microsoft excel.



## 5. Sources of livelihoods

Five sources of livelihoods are available in the study area: natural, human, physical, social and financial. In natural resource category; land, water, forest, springs and medicinal plants are available. In the human resources; teachers, un-skilled labour, people employed with security agencies and shop keepers are important resources. Schools, religious buildings, roads and water channels feature in the list of physical resources. Social resources include LSOs, VO, and WOs while financial resources include fruits (apple, apricot, and walnuts), woollen fabric (Patti) and livestock (sheep, goats, cattle).

### 5.1. Sources of Livelihoods in Gistini

Land, water and medicinal plants are the important natural resources in Gistini. Forest resources have severely depleted. Some ten years ago forest was available at a distance of 2 hours walk. The communities had also established plantations. With the passage of time and increased population, demand for wood increased while the natural forests decreased. Heavy floods and avalanches damaged bulk of the plantations. Now the people buy wood from the market in Chitral town, 50 km from Gistini.

Although unskilled labour is an important resource, laundry men seem to specialize in laundry. Ten laundry men are working in different parts of the country. Their average monthly income is Rs.10, 000. Another seven men are employed with law enforcing agencies, each earning around Rs.15000/month. Skilled labour and cooks are also contributing vital cash income to their household and village economy. Details of the livelihood sources is given in table 1.

Table 1. Income from various sources of livelihoods in Gistini

S. No.	Source	Numbers	Income (Rupees)
1.	Teachers	4	24000/month
2.	Law enforcing agencies	7	105000/month
3.	Laundry men	10	100000/month
4.	Shopkeepers	5	60000/month
5.	Potato crop (kg)	18000	4500000/year
6.	Chitrali Patti (meter)	308	100000/year
7.	Livestock		Both for domestic consumption and sale

Four irrigation channels, a link road, two school buildings and a mosque are important physical resources. Electricity is received from a micro-hydro power house located in Royee, a nearby village. In summer, electricity is available for 14 hours a day while in winter it reduces to 8 hours due to shortage of water.



In Gistini there are two private primary schools, one for each boys and girls while a Government school is under construction. For elementary (middle) level education, students go to a nearby village called Golugh around 1 km away from Gistini. For secondary level education students have to walk 5 km downhill to reach the high school in another village. At this point about 15% students drop out of the school due to distance and parents not able to finance their children education. Interestingly, however drop rate was reported more in males compared to the females indicating that distance to school is not a major cause for drop outs.

Piped drinking water in Gistini was provided few years ago by the Water and Sanitation Improvement Programme (WASIP) of the Aga Khan Foundation. Health facilities do not exist in the

village. Patients have to travel 5 km to access health care at a basic health faculty situated in Garam Chashma. Five medics are posted in this facility - a general practitioner and a dentist assisted by three technicians. Serious cases are referred to the hospitals in Chitral town (50 km), Peshawar and Islamabad

(around 13 hours' drive to both the destinations). Despite remoteness and scarce opportunities, the people of Gistini have found ways to earn cash income. Potato, livestock, fruits and woollen fabric are important products for marketing. Potato is produced on a large scale. Annual production in the village before the floods in 2013 was worth Rs.4.5 million. Fresh and dry fruits are another source of earning cash income. The village also produces handmade woollen fabric (Chitrali Patti) for sale which fetches around Rs.100, 000 annually. After potato, livestock is the most important source of income.

Village and women's organizations, and volunteers are important social resources of the village. Prayer gatherings and other religious events are also considered very important social resources.

**5.2. Sources of livelihoods in Dir**

Land, forest and water are important natural resources. Water channels (2) and link road are important physical resources. Teachers, people employed with security agencies (Chitral Scouts and Police), shopkeepers, labour and laundry men are important human resources. Livestock is considered important financial resource while women's organization and volunteers

are social resources. Details of the sources of livelihoods are given in table 2.

Table 2. Income from various sources of livelihoods in Dir

S. No.	Source	Numbers	Income (Rupees)
1.	Teachers (Government school)	1	17000/month
2.	Teacher (Community school)	1	8000/month
3.	Labourers	25	150000/month
4.	Shopkeepers	3	45000/month
5.	Potato crop (kg)	9500	2375980/year
6.	Chitrali Patti (meter)	1500	487500/year
7.	Livestock		Both for domestic consumption and sale

The main source of light is electricity received from a hydro power plant in a nearby village, Shah Gram. A decade ago, wood for heating and cooking was collected from the natu-



ral forests. This resource has now diminished and wood is no more available except in remote inaccessible areas. Wood is now harvested from private farm plantations. Wood harvested from farms is not sufficient to meet domestic demands. Fire-wood and timber is purchased and transported from Chitral town. Animal dung is also used for heating and cooking.

### 5.3. Sources of livelihoods in Royee

In Royee, land, water and forest are important natural resources while irrigation channels, road, and schools are important physical resources. Teachers, laundry men, employment with law enforcement agencies and shopkeepers and shopkeepers are human resources. Laundry men add to important human resources in Royee. They mainly work out of Chitral. Currently 18 are working in Quetta and 6 in Rawalpindi. Six water channels are maintained on self-help basis for irrigation. Farming especially potato cultivation is crucial for livelihoods. Potato crop is cultivated for sale while wheat and barley are grown for subsistence. Livestock, marketing of fruit and woollen fabric

(Chitrali patti) are other important sources of income. Details of livelihood resources are given in table 3.

The main source of energy in Royee is electricity from a local hydro power plant. During summer electricity is provided for 14 hours, in winter it reduces to 9 hours due to shortage of water. In the past, the residents used raisin rich wood from natural forest for lighting. Also, wood for heating and cooking was fetched from natural forests. Wood is no more readily available in the natural forest. The forest has drastically decreased due to over cutting to fulfil increased population needs. Nowadays wood collected from farm forest and animal dung is used for heating and cooking. Wood is also purchased from market in Garam Chashma and Chitral town. Realizing the fast depletion of natural forest the residents have established irrigated plantation with the help of the Aga Khan Rural Support Programme (AKRSP). These plantations are now an important source of wood. These plantations were severely damaged by the floods in 2013.

Table 3. Income from various sources of livelihoods in Royee

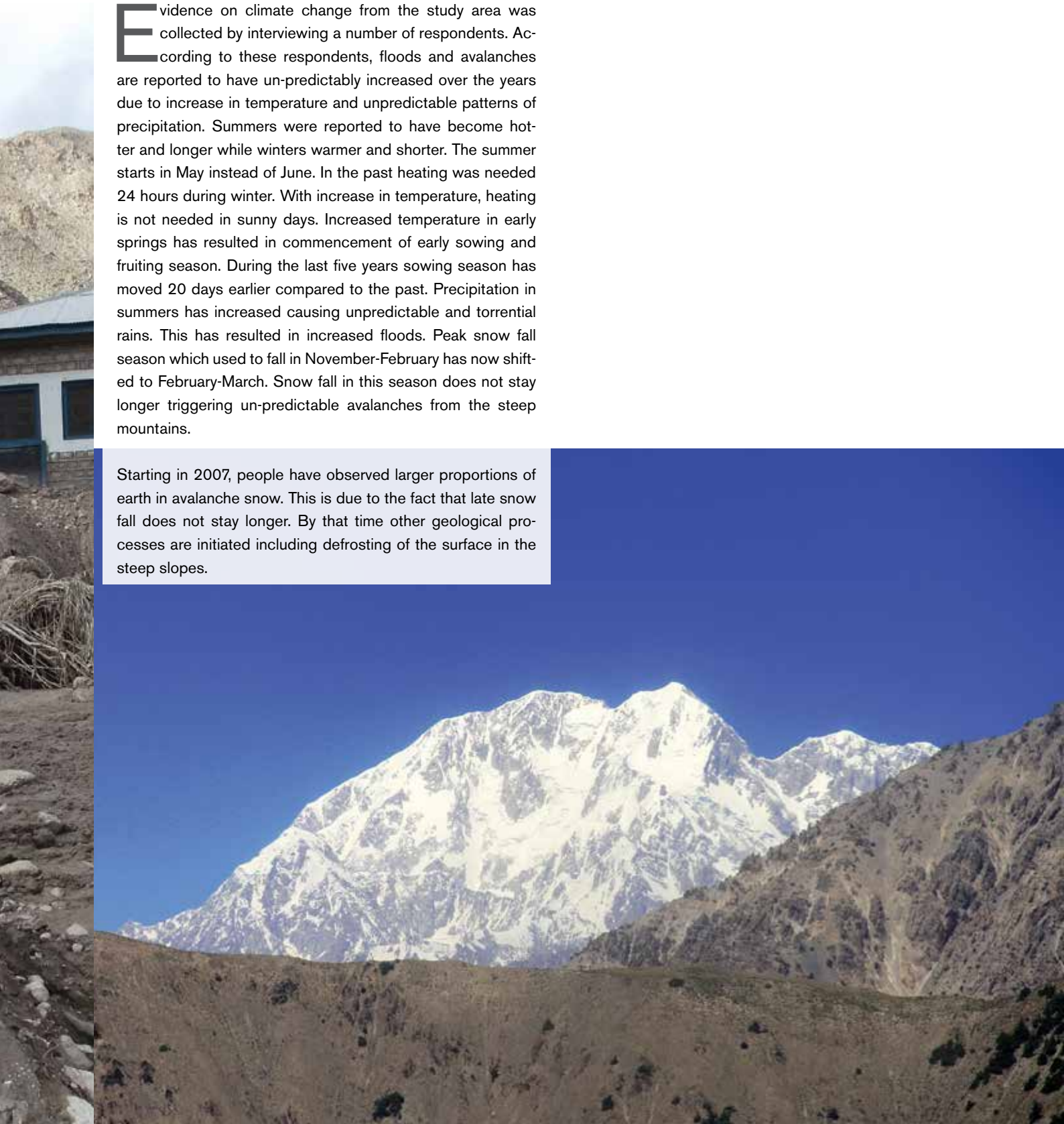
S. No	Human Resource	Numbers	Income (Rupees)
1.	Laundry	24	192000/month
2.	Teacher (Government)	1	25000/month
3.	Teachers (AKES)	4	72000/month
4.	Teachers (CBS)	5	40000/month
5.	Teachers (Private)	4	40000/month
6.	Government Doctor	1	25000/month
7.	Lady health worker	1	6000/month
8.	Carpenters	4	15000/month
9.	Plumbers	3	12000/month
10.	Electricians	5	12000/month
11.	Shopkeepers	15	50000/month
12.	Tailors	7	10000/month
13.	Potato (village income in 2014)		875000
14.	Fruits/Dry Fruits (village income in 2014)		212500
15.	Chitrali Patti (income)		1000000 (approximately) per year
16.	Livestock		Both for domestic purposes and sale



## 6. Climate change in the study area

Evidence on climate change from the study area was collected by interviewing a number of respondents. According to these respondents, floods and avalanches are reported to have un-predictably increased over the years due to increase in temperature and unpredictable patterns of precipitation. Summers were reported to have become hotter and longer while winters warmer and shorter. The summer starts in May instead of June. In the past heating was needed 24 hours during winter. With increase in temperature, heating is not needed in sunny days. Increased temperature in early springs has resulted in commencement of early sowing and fruiting season. During the last five years sowing season has moved 20 days earlier compared to the past. Precipitation in summers has increased causing unpredictable and torrential rains. This has resulted in increased floods. Peak snow fall season which used to fall in November-February has now shifted to February-March. Snow fall in this season does not stay longer triggering un-predictable avalanches from the steep mountains.

Starting in 2007, people have observed larger proportions of earth in avalanche snow. This is due to the fact that late snow fall does not stay longer. By that time other geological processes are initiated including defrosting of the surface in the steep slopes.





## 7. Hazards, damages and coping strategies

### 7.1 Hazards, damages and coping strategies in Gistini

#### 7.1.1 Natural hazards

**Floods:** The intensity of floods has increased over time. First major flood was reported in 1991 but no serious damage was reported then. In 1996 another flood inflicted heavy damages. The 2010 flood was also severe. Most of the assets were damaged. People fled the village to save their lives. Another flood in July 2013 also caused severe damages.

**Avalanches:** Avalanches were reported in 1993 and 1998. The intensity was medium. Presence of forest on the slopes above the villages at that time reduced intensity of avalanches. Now since the forest has severely depleted with the remaining further damaged by the flood in 2013, future avalanches could be devastating.

#### 7.1.2 Damages by hazards

The area is single cropped. Wheat is cultivated in March while potatoes in May. Harvesting is done in August-September when the risk of flood is very high. The flood in 1991 did not cause many damages while the flood in 1996 damaged infrastructure worth Rs.450, 000. The 2013 flood was of high intensity. It came in the middle of the night devastating the village. The people fled to save their lives. The economic and social impact of flood was so severe that many children had to discontinue education because the parents had no resources to pay for their education. People lost most of their livelihood assets including livestock, agricultural land and crops and most importantly seed potato. Four houses were completely demolished while eighteen were partially damaged. Farmers had to take credit from the First Microfinance Bank to buy seeds. Paying back the loan and interest has severely affected purchasing power and spending on food, education and health.

The four irrigation channels were severely damaged. Two channels have been partially repaired with the financial support from the Aga Khan Rural Support Programme. The other two channels are non-functional. It is estimated that land worth approximately Rs.55, 000,000 (an area equal to 100 Chakurams (Chakuram = 0.5 hectares) whereas cash crops worth Rs.6, 070,000 was lost to the flood. One farmer named Dustiar lost his land and potato crop expected to yield 15,000 kg potato worth Rs.450, 000. This farmer is left with hardly any resources to repair the damaged land and grow crops to



the full potential. Many other farmers lost wheat crop ready for harvesting. Snakes, lizards and other insects are reported to have increased. The remaining fruits and crops are attacked by pests.

Most of the trees from the private plantation were damaged and washed away by the flood which may take 20 years to re-grow. The road was severely damaged and remained blocked for 3 days. It took two days for twenty five community members with support from Chitral scouts to partially repair the road. Four houses were completely lost along with assets and land, six were partially damaged and eight households only lost agricultural land and crops. In total 18 households out of 30 are effected while the remaining are away from the hazard zone. However they are also affected as a result of loss to infrastructure in the village and power house situated in a nearby village. The village grain store was also damaged. The families who lost houses completely have moved to safer places within the village.

As most of the land area where fodder was grown has been damaged by the flood. Livestock numbers have decreased as people sold them to earn cash needed to repair the damaged land. Production of milk products (e.g. butter and cheese) for domestic consumption and commercial purposes drastically decreased. Production of Chitrali Patti also decreased with decreased number of sheep. As women were the in-charge of Patti making, they lost crucial income they generated from this activity.

Gistini is famous for trout fish. Fish was used both for domestic and commercial purposes. Most of the fish died due to heavy siltation in the river in the aftermath of the flood. This resource will take years to rehabilitate to its full potential.

After the flood, male members of the families had to go to the cities in search of jobs to earn and support families while the females were left home with no assets to work with.

### 7.1.3 Coping strategies

The residents are aware of the climate change and its impact on livelihoods but they don't have the required knowledge and resources to adapt to these changes. The government is not investing in mitigation and adaptation measures due to remoteness of the area, limited access and the area being less politically important to the policy makers. Majority of the families are repairing damaged houses and agricultural land on self-help basis. Local volunteers from nearby villages however have helped the affected in every way they can.

One coping strategy is to reduce intensity of hazards by increasing vegetation. Planting on barren slopes that once had vegetation is being considered to reduce intensity of floods and avalanches. In order to increase plantations in the irrigated areas, the village has put a ban on free grazing. Number of livestock has any way decreased - some of livestock were lost to the flood and some were sold to earn income after the flood damaged crops and assets. The residents are contemplating to shift to a safer place (Gumpesh) situated a kilometre above the village.

An alternate coping strategy being considered is to decrease dependence on farming and focus on higher education for jobs. Some households took out their children from schools and colleges to work in the cities as daily labour to earn income for the family. Dustiar was a grade 12 student who had to leave the college and work in Rawalpindi as a waiter. Sherwali was a grade 11 student now working in a laundry in Quetta. Himad-ud-din, Amir, Ibrahim also left the school and are currently working in Peshawar as daily wagers. Those working in cities before the flood for shorter periods are now working for longer. Before the flood they returned home during the crop season for 7 months (May-November). Now they go back early in September.

## 7.2 Natural Hazards, damages and coping strategies in Dir

### 7.2.1 Natural Hazards

The main hazards recorded in Dir are Landslips, flash floods and avalanches. According to the respondents snowfall during winter has decrease and has shifted from December – Janu-

ary to February – March. The area also now receives summer monsoon rain starting in May. Monsoon rain did not reach this area in the past. These changes in addition to reduced forest and degraded pastures in the steep mountain have resulted in unpredictable hazards including flash floods. Due to these reasons frequency and intensity of the hazards has increased during the last 20 years.

**Landslips and landslides:** Landslips and landslides are frequent and the main natural hazards in Dir. The intensity of landslides has increased over time. For example, landslides in 1993 and 1994 were considered mild and their intensity was thought to be 1 on a 1-10 scale. While intensity of landslides increased over time. The intensities of landslides in 2006 and 2007 were thought to be 6 and 7 respectively. Another severe landslide was recorded in 2013 with 7 intensity. Both cultivable as well as non-cultivable land was lost to the land slides. The respondents claim that number and intensity of landslides has increased due to increased surface water. Landslides are a new phenomenon which were triggered due to late winter snow and increased rain in summer. Late snow fall melts quickly and triggers erosion, landslips and landslides.

**Avalanches:** Avalanches in winter are common in Dir. Avalanches were received in 1993, 1999, 2007, and 2011. The intensity of avalanches has also increased over time. For example, the intensity of avalanches on a 1-10 scale in 1993 and 1999 were thought to be 2 and 1, respectively. While the intensity of avalanches received in 2007 and 2011 were 10 and 5 respectively.

**Floods:** Low intensity floods occur in Dir occasionally causing minor damages. Devastating flood in 1999 caused severe damages to infrastructure and other property. The respondents estimated losses equal to Rs.2 million.

### 7.2.2 Damages by hazards

Reliable estimates for damages due to various hazards are not available for this study. The respondents estimated that around 12 chakuram land worth Rs.4.2 million was damaged due to various hazards. Crops (wheat, potato) worth Rs.2.3 million were lost. Some animal sheds were damaged, few large animals were killed and other assets were also lost. Damages to assets include loss of fruit and forest plants and houses.

### 7.2.3 Coping strategy in Dir

The main and sustainable strategy proposed by the respondents is to drain underground water. The community has no skills and expertise to do it. They are waiting for external support. Alternate strategy is to migrate from this village and settle

somewhere else; something that requires enormous resources which the residents cannot afford. One family who faced severe losses has migrated to Karachi.

As an alternate and short term strategy the affected households have borrowed money from relatives and have sold livestock to buy food and assets. Food and tents were also provided by NGOs and local government. Relatives and neighbours provided shelter to some families. Support by local volunteers was also provided to repair damaged roads and channels. The affected households have reclaimed some of the damaged land for cultivation. The rest remains damaged and barren.

### 7.3 Hazards, impact of hazards and coping strategies in Royee

#### 7.3.1 Natural Hazards

The main hazards in Royee are rock falling, avalanches and flash floods. According to the respondents, snow fall pattern has changed and its quantity has decreased. Snow fall has shifted to March from December. Summer rain is received earlier in the season during May-July instead of June-August. The respondents believe that natural hazards have increased due to increased temperature, over grazing of pastures and diminishing vegetation, particularly the forest.

**Flood:** Starting in 1990, flash floods were recorded in 1990, 1993, 1996 and 2013. The flash floods in August 2013 were devastating and changed the shape of the village and its surroundings. The floods in the past were not so severe and not much damage to property and land was reported.

**Rock falling:** Rock falling is another hazard causing damage to properties. Severe rock falling occurred in 1993 and 2007.

#### 7.3.2 Damages by hazards

Reliable figures for damages due to floods, avalanches and rock falling and cost of damages is not available. The flood in 2013 was reported to have fully damaged 12 houses while 3 houses were partially damaged. Total cost of damages to the houses was estimated to be Rs.3.4 million. Thirteen cattle Sheds were also damaged costing Rs.3.9 million. Around 65 chakuram land worth Rs.35.75 million was damaged, damage to crops was estimated around Rs.0.87 million.

#### 7.3.3 Copping strategies

When the flood came in August 2013 all the residents of Royee ran away to save lives. After the flood subsided, women and children were sent to neighbouring houses in the village and to the relatives in other villages and men initiated collecting what was left undamaged and to clean debris.

For rebuilding and rehabilitation, the affected families borrowed money from relatives in addition to selling livestock to buy food and other needs. In the aftermath of the flood, NGOs and local government provided food items and tents to families who lost houses. The affected families with help from volunteers from neighbouring villages repaired damaged channels and roads. Some have managed to reclaim damaged agricultural land for cultivation especially potato which fetches cash income. Some land still remains damaged and barren. Many have not been able to rebuild their damaged houses as they do not have safe places to build their houses.



## 8. Conclusions

**Important sources of livelihoods:** Important livelihood resources in the study area are water, land, employment with the education department and security agencies. Local Support Organizations play an important role in emergency situations.

Potato, livestock, fruits and woollen fabric are important financial resources. Natural forests are severely depleted and people depend on irrigated plantation for firewood while timber is purchased from other areas of the district. In two villages (Royee and Gistini) laundry men have developed their skills and are providing services in a number of places in the country.

**Changing climate and hazards:** Temperature in the areas is reported to have increased. Summers have become hotter and longer. These changes have resulted in setting of early springs and early commencement of sowing and fruiting seasons. Annual precipitation has become unpredictable and summer rains have increased resulting in increased and unpredictable floods and avalanches. Snow fall season has moved from November – February to February – March. Snow in this season does not stick to the ground and trigger un-predictable avalanches.

**Damages by hazards:** Both avalanches and floods cause damages. Flood however is more damaging. The study area is single cropped. The cropping season is March – September. Flash floods are received in July – August causing severe damages to the standing crops especially potato and wheat, as well as to the crop land, houses and animal sheds. Floods have increased in recent years – 1996, 2010 and 2013.

Apart from economic losses, the floods have also caused promotion of child labour. Young students are forced to discontinue education and go for daily wage labour to earn cash income for the families. In addition the affected families are forced to take credit from Banks for rehabilitation and purchase of seed for the next year.

The floods also damage roads, vital links to purchase agricultural inputs and to market farm production. These roads do not get repaired in time making it difficult to market farm produce especially commercial potato resulting further losses to the already affected families and villages.



**Coping strategies:** most of the coping strategies are short term. Coping strategies are limited to finding alternate land for building houses and finding resources to feed the families in the aftermath of the hazards. The government has not yet taken steps towards investing in sustainable coping strategies including adaptation. Reasons are remoteness of the area and lack of awareness on changing climate.

There however seems some awareness on how to reduce intensity of hazards. This is indicated by proposed ban on free grazing to increase vegetation on slopes with the awareness that plantation reduce chances of avalanches and floods. An alternate and more sustainable coping strategy was to decrease dependence on farming in the mountains and go for higher education so that people can rely more on off farm income.

In some areas landslips is a problem. Here the residents proposed to drain underground water. The local population lack resources and skills to drain underground water. They need external support. An alternate strategy for the population is to permanently migrate which will cause social issues.

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