

LAND POLICIES IN THE FACE OF CLIMATE CHANGE

**INTEGRATING LAND RELATED ISSUES INTO
CLIMATE CHANGE ADAPTATION POLICIES AT
COMMUNITY LEVEL WITH A FOCUS ON MOUNTAIN
REGIONS**

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Enschede, the Netherlands,
February, 2015

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DISCLAIMER

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ABSTRACT

Climate change is real and it has significant impacts on land and its resources. Mostly, the policy measures for adaptation to climate change has given attention only on its root causes like carbon stock and greenhouse gas emissions. This study has two major purposes: (1) to identify and integrate land related issues into climate change with land policies and (2) to demonstrate the role and responsibilities of local community for adaptation to climate change. This research is specifically concerned with improving adaptive capacity of communities belonged to Hindu Kush mountains region to help them against the expected risks and the adverse effects of climate change.

Study of literature determines that major cause of today's climate change are human activities. Abrupt changes in weather pattern and climate related extreme events such as flood, droughts, heat waves, glaciers melting and landslides have strong impact on our ecosystem. Secure access to land and its resources, safe places for human settlements, land degradation, tenure insecurity due to land losses etc. are the major land related issues that are needed to address while integrating climate change into land policies. Based on literature studies, a framework for integrating land related issues and policies into adaptation policies is proposed, however, participation of all land sector stakeholders including civil society can build strong foundation for developing such integrations.

This study was conducted in Chitral, Pakistan where focus groups and interviews were conducted to collect data. This study adopts deductive approach for data analysis in order to validate the assessment of key findings from literature. The analysis shows that the impacts of climate change are more severe in this region because of increasing stress on watershed due to melting of glaciers. Depletion in forest reserves is a major environmental problem and people living in the village areas are highly dependent on these forests for their livelihood. The results suggest that engaging both local authorities and community members together can be useful for enhancing adaptive capacity of communities. Although, governments are primarily responsible for managing climatic risks but people have also some responsibilities. Local communities and people must have enough awareness and access to information about anticipated climate risks for developing their strategies to manage these risks. Further, they should also know about the rules and restrictions about land use, land use change and building infrastructure.

This research study provides an insight about the environmental and social impacts of climate change and at the same time it contributes towards better understanding about land related issues into climate change and the implication of integrated land policies in the face of climate change. Further research is recommended to assess the integrated role of land administration with other land sector institutions in providing up to date spatial information in shape of thematic temporal climate as well as up to date cadastre information that can help the relevant institutions to assess the vulnerability of agriculture, water and people's livelihood. Thus, land administration department may need to recognize its new emerging role in the present climatic changes in the region.

Key words: Climate change impacts, land related issues, land polices, integrated land policies, community role, participatory role of stakeholders, climate change adaptation.

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1. INTRODUCTION

1.1. Background and significance

Coping with the issue of climate change is one of the main challenges on earth. Developing policies to address climate change issue is becoming a global priority (Ingram & Hong, 2011). At present, the policies, actions and measures for adaptation to climate change only focus on conservation of carbon stock and environmental protection. Therefore, it is an interesting topic to study and investigate about how land related policies can contribute to adaptation strategies for climate change. In relation to this challenge, although, scientists have not linked the issue of adaptation to climate change with land policies, however previous research study by Paul Vander Molen expose the role of land registry and cadastre in the field of climate change adaptation (Molen, 2009).

Land policy is about the arrangement of land in terms of ownerships, use rights and the shaping land use as a fundamental natural resource for livelihood. It includes a land registration system of country that authenticates not only individual property rights but also provides regulatory control over land use. Ownership and land use rights emanate the legal constraint in implementing climate change adaptation policies (Smith & Travis, 2010). Therefore there is a need to identify the possibility of any link between land parcels, ownership rights and climate change issue in order to accommodate both user interests about land as well as governmental implementation of plans related to climate change adaptation. Previous study also claims that land registers and cadastres can provide a basic source of information for implementing land management policies which means that by incorporating additional information about climate change into land related policies can help to make a strong linkage between land polices and climate change issues.

It appears that land related instruments such as land use planning, land management and administration can play a role in adapting and mitigating climate change. To support this argument, a report was published by FAO/IIED in 2008 about climate change and land tenure (Quan & Dyer, 2008a) which suggest the secure access to land use facing the risk of climate change and provision of settlements in safe areas to improve adapting capacity of local communities. This report also highlights the need of climate proofing land policies as a measure for adaptation. As an example case, a project by FAO analysing the contributing role of Mediterranean forests of North Africa to people livelihood and climate stresses. *“Adapting to Climate Change in China”* (ACCC, 2009) was a three year project by UNFCCC started in 2009 for the purpose of sharing China’s experience of land management and land use planning to reduce China’s and other Asian countries vulnerability to climate change.

Further research also demonstrates that land administration and above mentioned instruments can serve the society as a measure for climate change adaptation (Stig Enemark, 2010). A major constraint on adaptation is the existing land policies that do not control access to and use of land in relation to climate change. Local governments at community level need to incorporate climate change issues in setting their priorities for effective management of land. In this regard, land administration can extend its position from traditional role of land registry toward contributing for adaptation to climate change.

The current research concerns about understanding and analysing the gaps in scientific knowledge in land profession; how to incorporate climate change issues into land policies and to involve community for climate change adaptation at local level.

1.2. Research Problem

Developing policies to address climate change issue is becoming a global priority (Ingram & Hong, 2011) since recognizing its dangerous impact on our life. Abrupt changes in weather and temperature, changing

landscapes, reducing biodiversity, rising water level, increased risk of droughts are the main threats of climate change. Besides these environmental issues, it also includes risks to food security, health, livelihood and displacements of human settlements. The current research try to build up and bring added knowledge about understanding the role of land policies in identifying and addressing these climate change issues at community level specifically with a focus on mountains region of south Asia. The research problem concerns how the land related issues with climate change can be incorporated into land policies. Figure 1 symbolises the identified research gap in scientific research and main focus of this research study about understanding the link between land policies and climate change adaptation to address land related issues in an integrated framework of land policies with climate change adaptation policies. Aim of this study is to provide relevant source of information particularly for those countries that have not yet explicitly linked their land policies with planning and development for climate change adaptation.

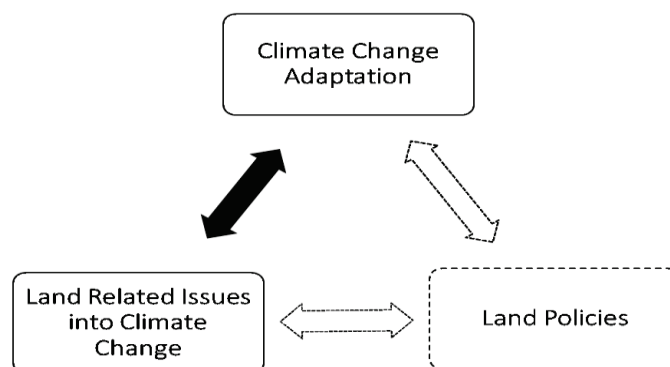


Figure 1 : Research Framework

Land Administration (LA) is an effective tool for sustainable living (Arko-Adjei, 2011). But the aspect of climate change adaptation and capacity building for responding against climate changes is not strongly interconnected with the current land sector policies. Therefore it is important to do a scientific research to address the issue of realigning land policies to strengthen adaptive capacity for climate change at community level to help people against the expected risk vulnerabilities and the adverse effects of climate change/variability. Due to this, the enhanced understanding role of land policies related to climate change can be the key for future success in dealing with all environmental as well as social problems under the umbrella of Land Administration. Further this research can also provide a new direction to public as well as private agencies and donors for developing strategies, programs and projects related to Climate change adaptation.

1.3. Conceptual Framework

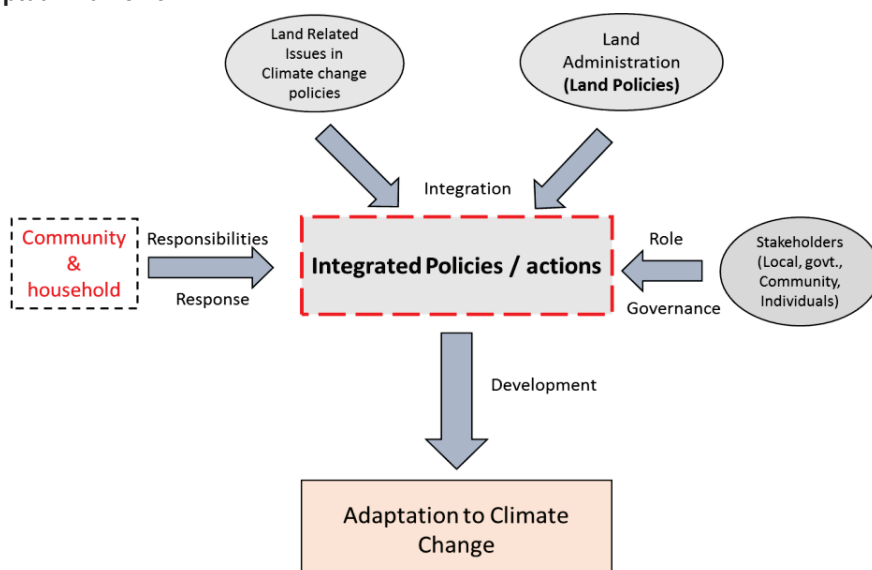


Figure 2: Conceptual Framework

The figure 2 shows the conceptual framework that describes the main concepts related to research problem. Under the umbrella of two basic concepts about climate change and land administration (LA), an integrated and multidimensional approach is needed to make a linkage between climate change adaptation policies and land policies. Furthermore, these integrated land policies can have a positive impact on adaptation to climate change only if local government as stakeholder as well as people both as individual and as a community involve in formulating these integrated policies. Good governance has an important role in incorporating the environmental issues like climate change into governmental policies and regulations but effective implementation of policies and actions is only possible with the participation of community. Thus, with inducing the role of community, these integrated policies can enhance the adaptive capacity of vulnerable people for better response to climate change adaptation.

1.4. Research Objectives

In the following, main sub objective of this research study is further divided into three sub objectives. To achieve objectives of this study, each sub objective is structured into a set of research questions to be answered.

1.4.1. Main Objective and sub objectives

To integrate climate change issues into land policies with a focus on mountain community.

Sub objectives:

- i. To identify land related issues in climate change adaptation policies
- ii. To integrate these land related issues into land policies
- iii. To analyse the obligations and responsibilities of stakeholders at community and household level for adaptation to climate change

1.4.2. Research Questions

To identify land related issues in climate change adaptation policies:

1. What are the land related issues in the face of climate change?
2. What is the present knowledge about climate change adaptation policies?
3. What are current initiatives related to climate change adaptation in the study area?

To integrate these land related issues into land policies:

4. How these land related issues in climate change adaptation policies can be incorporated into land policies?
5. How stakeholders particularly government, community and households can coordinate with each other to combat against climate change?

To analyse the obligations and responsibilities of stakeholders at community and household level for adaptation to climate change:

6. What are the present activities on forest biomass and carbon stock in study area?
7. How can temporal carbon maps be used for improving climate change adaptation?
8. How can local knowledge of households and community support them for a better adaptation to climate changes?
9. What are the responsibilities of households and community for adaptation to climate change?

1.5. Research design and methods

This section describes in detail the research framework to answer the research questions formulated to address the research problem. It includes the description of case study area for field work, data collection

tools and approaches to conduct this research. It also includes a work-flow that provide a sequential overview of whole research plan from initial research question to final result and conclusions. A detailed research matrix is included in the list of appendices as Annex-A.

The current research is a qualitative study design as it offers more flexible and openness to describe the research problem (Kumar, 2012). The study is descriptive in nature and tends to describe the new innovative role of land policies for addressing climate change issues.

1.5.1. Research methods and approach

As stated above, the study is a kind of qualitative research, so qualitative research methods are used for data collection. Deductive approach is used for data analysis and interpretation. As the assessment of key findings in integration of climate change policies and land policies needs a field work and desk study therefore, overall research approach can be stated as mixed mode concept of using two approaches i.e. deductive and case study methodology.

Study site selection

As district Chitral is selected for current research study so numbers of site are selected for data collection, assessment and observation. Three sites are selected for conducting the field work, one representing famous indigenous group (Calash) and the other two (Shogore and Booni) representing the government based governance system.

Data types

In addition to literature review concerning the policies related to climate change issues and land policies, other source data can be divided into primary and secondary. Source of primary data consist of data acquired during field work for assessment of key findings to answer the research questions done during pre-field work. In addition to scientific literature, secondary data also include the collection of documents possessed by the local authorities and reports published by national and international agencies.

Data collection tools (Primary and secondary data)

Focus group discussion is the most appropriate data collection tool for collecting primary data to gather information from communities. Community is directly involved in many other projects related to water management and energy resource management programs, therefore, in order to assess the proposed integrated framework of land policies, the participatory role of community is highly relevant. Participants for focus group discussions were selected from farmers, highly reputed people of community and local members of union councils. Three different study sites were selected and group discussions were arranged at each place with an average of 8-10 participants each. Further, in order to support the information collected through focus group discussions, some semi structured interviews and meetings were also conducted with officials of local public and private institutions. The detailed research matrix showing a summary of methods and approaches chosen for answering each research question is given in the lit of appendices as annex-A.

Secondary data is collected by desk research method which covers the thorough screening of already existing literature, published or unpublished policy documents available with public and government agencies. Secondary data also includes collection of carbon stock maps available with local forestry authorities, latest data published by ICIMOD on geo-portal and other sources if available.

Data processing and analysis

As qualitative data collecting techniques were used in this research, so the field data acquired is to be processed through coding, labelling and conceptualizing the text. For speedy processing of data, Atlas.TI is used to support the processing and categorising of focus group data and interviews.

As recommended by Webster & Watson, to organize the literature review, concept centric approach is used to drive relevant information for answering the research questions (Webster & Watson, 2002). Primary data

collected through focus groups, meetings and interviews are analysed by an interpretation process of coded data through constructing patterns and linking the whole data with each other.

1.5.2. Description of Study Area

The district of Chitral, located in eastern part of Hindu Kush consists of 800 km long mountain range along the northern part of Pakistan (KPK, 2014). This region is highly populated and majority of people living there are poor and dependent on agriculture. Mostly farmers are the owner of the land parcels of area less than one hectare. (Shahid et al., 2013). Agriculture in this area is dependent on surface irrigation water coming from river and streams. Local crop products i.e. fruits, beans, wheat and potato are major cash crops for farmer's prosperity (Hussain & Mudasser, 2007).

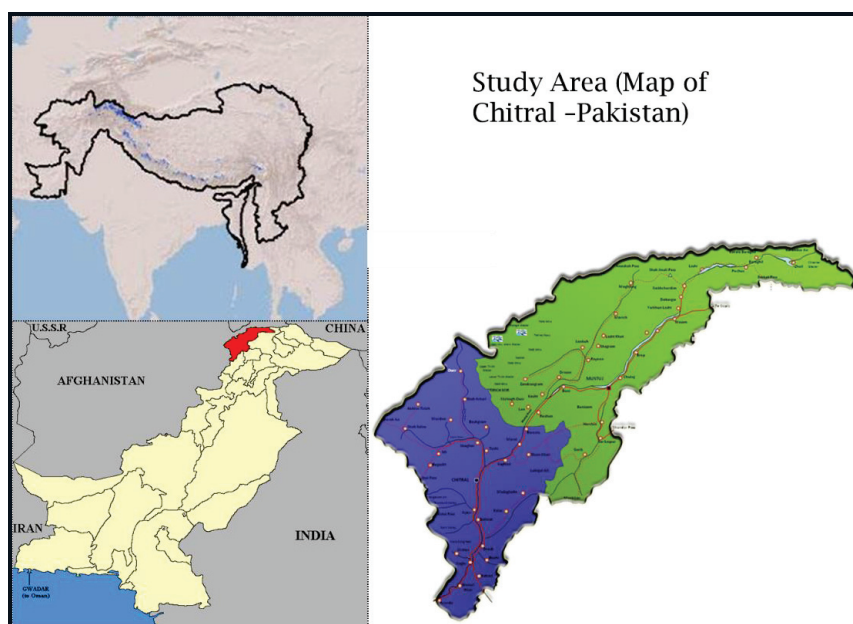


Figure 3: Map of Chitral –Pakistan Sources: (ICIMOD, 2014b) & (CIADP, 2014)

According to Intergovernmental panel to climate change (IPCC) which states that “*Glacier melt in the Himalayas and Hindu Kush region is expected to increase flooding within next two to three decades*”. The Glaciers are retreating very fast due to global warming and human mobility near the glaciers (IPCC, 2007b). Eventually it follows the reduced river flows as the glaciers retreat.

Further, the timing and length of the monsoon period is also changing day by day (Eklabya Sharma, 2009). This indicates that the dry season is becoming more drier and seasonal droughts and water-stress are more severe. The drainage area of Chitral River in Chitral is about 11,400 km² and its flow mainly depends on glacier, snow fed and the monsoon. Statistical results for the past 40 years shows that river flow is continuously declining (Shakir & Ehsan, 2010). These signs of river flow have profound effects on agricultural and natural ecosystems, as well as on the availability of water for household use, industry, and energy, thereby impacting considerably on people's livelihoods and wellbeing. Thus, people living in this area are highly vulnerable for potential impacts of climate changes.

In Chitral, governance structure is a mix of community-based system, indigenous informal system and government. However, due to intervention of a local NGO “Aga Khan Rural Support Programme (AKRSP)”, community based governance is more operational in Chitral (Shahid; Nadeem et al., 2013). Therefore, Chitral as case study for this research is appropriate for assessing the possible interventions in land policies for climate change to meet the challenge of climate change at community level.

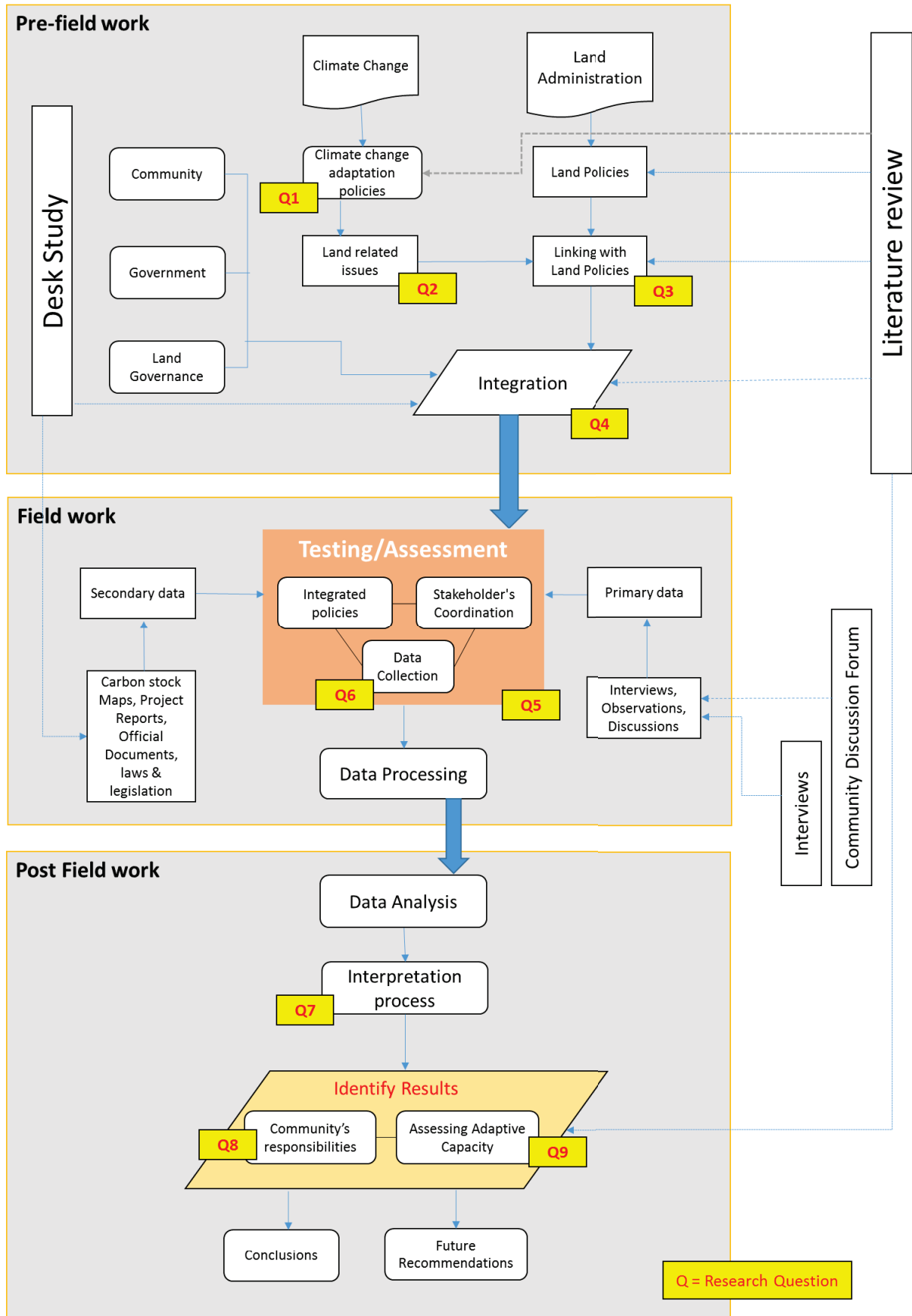


Figure 4: Research Design

1.5.3. Operational Plan

The operational plan for current research consists of three phases: pre field work, field work and post field work is shown in Figure 4 on previous page. The detail description of work to carry out in each phase is here under.

Pre field work

This phase covers two main parts of the study. In first part of this phase, all the preliminary work related to build knowledge about the current situation was done on the base of literature review. With the help of this knowledge, common indicators and factors were identified to establish a link between climate change and land policies. With the identification of land related issues linked to climate change policies, an integration is proposed on the basis of this identified linkage between the two concepts. In second part of this phase, all the necessary preparation is done for conducting field work, setting specific target group and selecting respondents and construction of guidelines for interviews, questionnaires, surveys and observations.

Field work plan

In this phase, actual field work was done in case study area. It also include preliminary work needed for establishing communication with target group for collecting primary data and with relevant organizations for collecting secondary data required for desktop research. This phase covers the assessment of the study findings concluded during pre-field work phase by data collection, structuring and its processing. The details about methods for data collection is followed under description of methodology and approaches given in next.

Post field work

In this phase, data analysis and interpretation is done on the primary and secondary data collected during the field work and final result are concluded. Also with the inclusion of literature review, certain conclusions and recommendations are also presented in the last.

1.6. An overview of thesis structure and chapters

The provisional structure of thesis report contains 7 chapters. A brief summary about each chapter is given in the table below. List of figures, tables and a list of Appendices is also included within table of content. Figure 5 given below shows an outlines of different part of thesis writing.

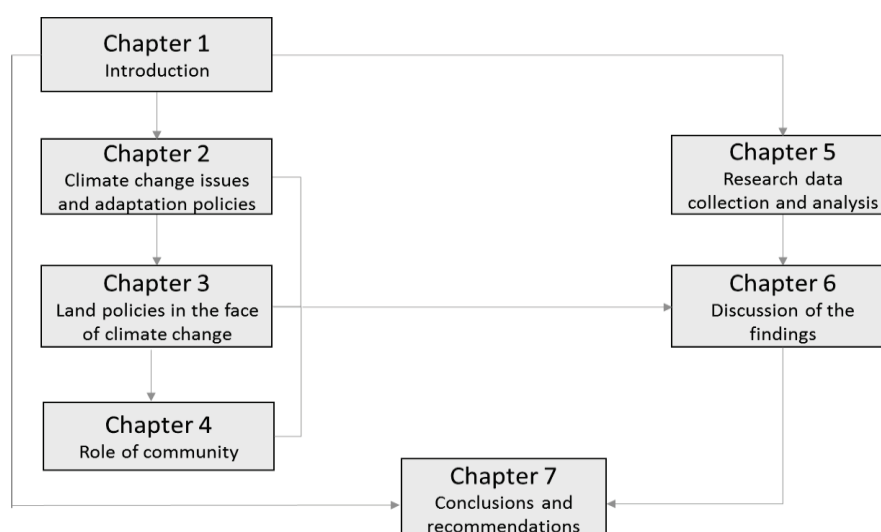


Figure 5: Layout Plan of Thesis Chapter

Table 1: Outline of Thesis Chapters

Sr. No.	Title of Chapter	Summary of contents
1	Introduction	This chapter contains background, justification of the research and defines the research problem with the help of research questions. A brief description of study area and research methodology to achieve the research objectives are included in this chapter. At the end, an outline of thesis structure and work plan to conduct the research is also included.
2	Climate change issue and adaptation policies	This chapter include the literature review about the understanding of climate changes issues related to land sector, adaptation policies and existing situation of about climate change in the study area.
3	Land policies in the face of climate change	This chapter cover the literature review about existing land policies and the governance aspect of land administration institutions for understanding the role of integrated land policies. At the end of this chapter, a framework of integrated policies in context of climate change adaptation is proposed based on the review of literature.
4	Identifying role of community and households in adaptation to climate change	This chapter reviews the literature about role of community in developing adaptation policies and their implementations at local level. At the end, some roles and responsibilities of community and household are identified and included in this chapter.
5	Research data collection and analysis	This chapter highlight the methodology for conducting field work, preparation of data collection and data analysis. At the end of this chapter, a summary of results from processing and analysis of data is included.
6	Discussion of key findings	This chapter include the discussion of key findings both from literature review and through analysis of field data whether the field data results support the answers from literature review or these results uncover more questions.
7	Conclusions and recommendations	The conclusions include a summary of overall understanding and body of knowledge about the research topic and recommendations about some future research finally make end of this thesis document.

In the next three chapters, literature review is covered in order to get understanding about the specific research objectives related to research problem from the previous studies. Next chapter i.e. chapter 2 is about to identify the causes and effects of climate change and impacts of climate change on land.

2. CLIMATE CHANGE ISSUES AND ADAPTATION POLICIES

2.1. Introduction

Today everyone have a clear idea about global warming and there is general consensus that earth's atmosphere is heating up. Whatever the reasons are for this global warming, either likely caused by industrial activities or over exploitation of natural resources, the main accountable factor causing this rise in temperature are emission of greenhouse gases (GHG) and declining carbon sink and sources on the earth (Crowley, 2000). This global warming have its effect on the weather patterns and nature of extreme events in all over the world and the major respondent on earth for these weather changes and climate related extreme events is the land and its resources. The purpose of literature research in this chapter is to understand the notion of climate change and its causes and effects on land and its resources. There is need to address the issues related to land sector such as agriculture, forestry, water supplies, and settlements because these sectors directly tremble the people and their livelihood.

The main objective of this of part of our literature review is to identify land related issues arising due to climate change and the role of policies in planning for local adaptation to climate change. In this chapter, main focus is to seek through scientific literature for enough understanding about the following questions following research questions.

- i. What are the land related issues in the face of climate change?
- ii. What is the present knowledge about climate change adaptation policies?
- iii. What are current initiatives related to climate change adaptation in the study area?

For in-depth understanding about the land related issues due to climatic changes and to answer the above questions, necessitates a systematic review of all available relevant scientific papers, scientific reports, peer reviews, policy documents, and other relevant grey literature. Thus, a broad search scientific database for searching relevant published literature (journal articles and book chapters) is included. To find out relevant material for exploring the past studies under the objectives highlighted above, relevant abstracts are searched on academic databases including ITC academic library, Web of Science, Google Scholar search database, and FAO, IPCC, UNHABITAT, and ICIMOD Publications. A review of Grey literature including conference proceedings, technical reports, working papers, project reports and policy documents available at official websites of ministries and online resources is also included wherever it became necessary to refer for this research part.

This chapter is divided into five sections. In section 2.2, this research study focus on highlighting about the causes and effects of climate change. This section also provide an overview of impacts of climate change in mountain areas. Section 2.3 highlights the impact of climate change on land due to climate change. Then section 2.4 provides an insight about climate change adaptation policies. This section also captures the present status of policies and initiatives in mountain systems of Hindu Kush-Himalayan (HKH) being case study area of this research study. Section 2.5 summarizes the findings and provides preliminary answers to the questions raised at above.

2.2. Climate change issues

2.2.1. Causes of climate change

Climate change refers to a change in the state of typical weather that can be identified by changes in the mean (e.g. using statistical test) and/or the variability of its properties persistent for many decades (IPCC, 2007b). Basically, it is a change in weather pattern over the periodical time ranging from decades to millions of years. It is not just a change in weather but it refers to a significant change in natural ecosystem, the human economies, culture and livelihoods (Global Climate Change Alliance (GCCA), 2014).

Now a days, the scientists of all over the world agree on the statement that apart from natural changes, human interventions are one of the main cause of today's climate change situation. The term anthropogenic

climate change (ACC) refers to the production of greenhouse gases (GHG) emitted by human activity. Major contributions towards CO₂ emissions are: (i) burning of fuel (wood and coal). (ii) Use of petroleum for transportation. (iii) Deforestation (iv) and land use conversion mainly agricultural to urban. The figure below shows clearly the impact of human influence on the climate system. Mostly changes in extreme weather and climate events observed since 1950 have been linked to human influence. Figure 6 briefly summarise the percentage contribution of different sectors in GHG emissions. Energy related CO₂ emission is at the highest level of about 35% which is due to the reason that majority of the energy supplies is based on burning of fossil fuels. Second highest contribution is from agriculture, forest and other land use which is about 24%. Certain challenges like degradation, land conversion and climatic effects on productivity in agriculture and forests sector have significant impacts on carbon stock. Further industrial boost of last century is also contributing up to 21% and with this industrialization and increasing demand of mobility, transport sector which mainly use fossil fuels is also contributing up to 14% of total GHG emission.

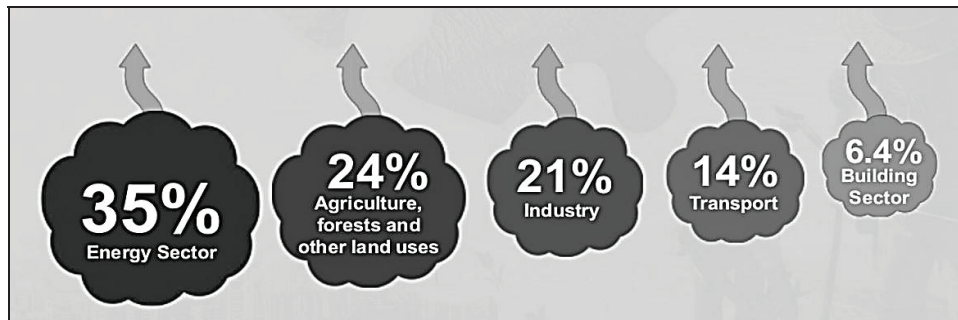


Figure 6: Contribution of different human activities in percentage on GHG emission. Source: (IPCC, 2014a)

The IPCC, Fourth Report states that the emission of these GHG is at the highest levels for over 800,000 years (IPCC, 2007b). The latest IPCC Report 2014 confirms that between 1750 and 2011, carbon dioxide concentration in the atmosphere were 2040 ± 310 GtCO₂ which is a big alarm for causing climate change (IPCC, 2014a). This report claims that in previous decade from 2000 to 2010, carbon emissions continued to increase although in presence of large number of interactive climate change mitigation policies. The most important drivers of increases in CO₂ emissions were from fossil fuel combustion (IEA, 2013). With the boost in global economic growth, trend of coal use for production of energy has increased which have reversed the efforts of reducing GHG emission. These figures confirm that increased rate of GHG emission due to human activities mentioned in above is the major cause of climate change.

Continuing increase in GHG emission contribute to global rise in land and ocean temperature, in shrinking of Arctic ice cover and global glacier, and also rising the level of sea (Lashof & Ahuja, 1990). The following graph in figure II shows highest level of increase in average global surface temperatures by 0.5 [0.4 to 0.6] °C in previous decade 2000 to 2010.

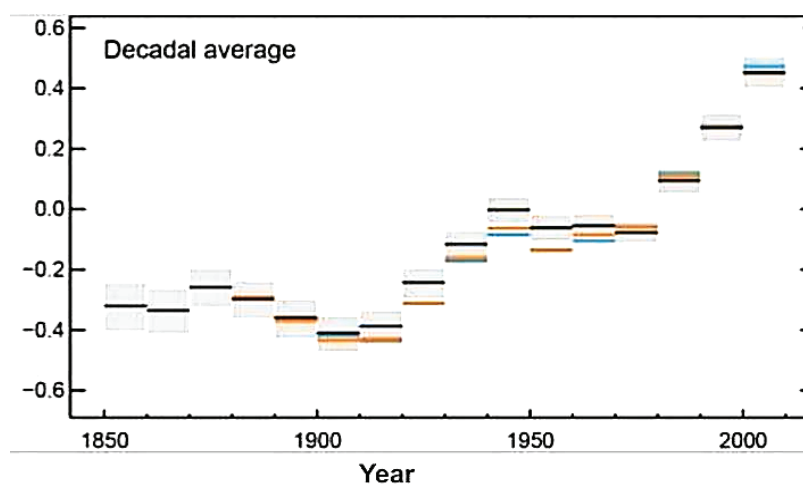


Figure 7: Globally averaged combined land and ocean surface temperatures (Source; www.ipcc-data.org)

In addition to rise in temperature, changes in climate have potential impacts on our ecosystem. One evidence of these impacts are the extreme weathers over the past 50 years. Changing precipitation level and glacial reduction systems due to change in temperature effects the water resources in terms of quantity and quality thus impacting on hydrological system and its associated species. The climate related extremes such as droughts, landslides, floods, glacier bursts and heat waves have direct impact on human life make it significant vulnerable to climate change (Lohani, 2007). Thus, limiting climate change by extensive and sustained reductions in GHG emissions together with adaptation is needed for building our prosperous and sustainable future.

2.2.2. Effects of climate change

Extreme weather conditions and natural disasters are mainly induced from climate change. The direct consequences of this climate variability is on the environment, human life and socioeconomic activities. Other areas affected by climate change include terrestrial animals, and forests, water sources and related ecologies, and so on. Assessment of all these risks related to climate change needs to quantify for devising strategies and action plans for responding to these challenges.

The extreme weather events responsible for Natural disasters

As stated earlier, climate change impacts a rise in average temperatures, but it also effect extreme temperatures that result in increasing intensity of weather-related natural disasters. According to a study by Anderson & Bausch, the extreme weather events include heat waves, storms (windstorms and hurricanes), high precipitation changes causing flooding, declining precipitation causing droughts (Anderson & Bausch, 2006). Further this study considers the extreme events like avalanches, debris flow, landslides, and wild fires as secondary effects of the natural disasters.

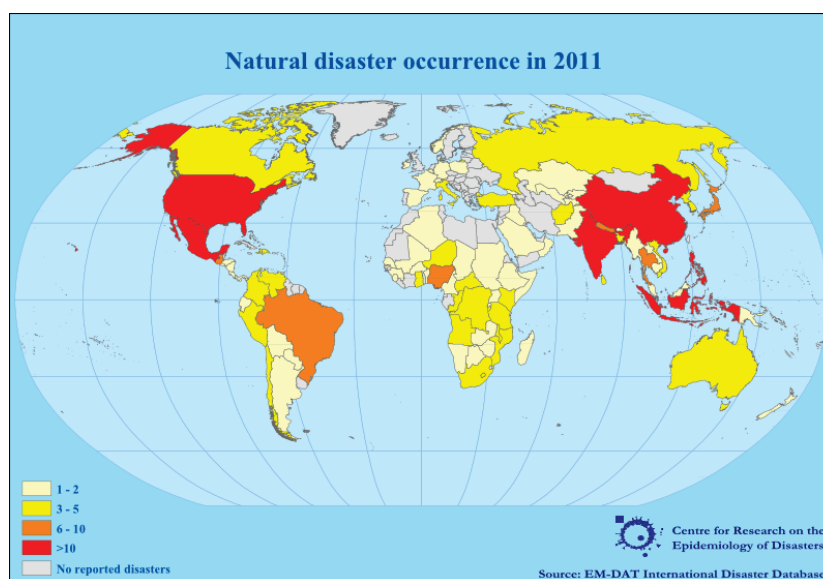


Figure 8: Frequency of climate related natural disasters in 2011 (Source: EM-DAT online database)

According to IPCC report, an increase in global temperatures also include an increased risk of drought, storms, cyclones, heavy monsoon and rainfalls (IPCC, 2001). Further, this report confirms that glaciers and snow melting effect the sea level rises and become motive for severe coastal flooding. Scientists argue in a study that the heat waves will become common while heavy rains, flooding and drought will be severe and frequent (van Aalst, 2006). The data from International disasters database (EM-DAT) shown in Figure 8 indicates the increasing frequency of natural disasters all over the world. These potential increases in climate change related extreme events increase vulnerability of environment as well as mankind. Figure 4 highlight the data about number of persons effected from these extreme events. Figure shows that South Asia being highly populated area is among the highest effected areas where billions of people are directly affected with the increasing frequencies of climate related disasters. These statistics also refers to a high rise in economic

damage due to these events. Therefore, in assessing climate change for limiting their impacts, demands broad efforts to reduce the risk of natural disasters.

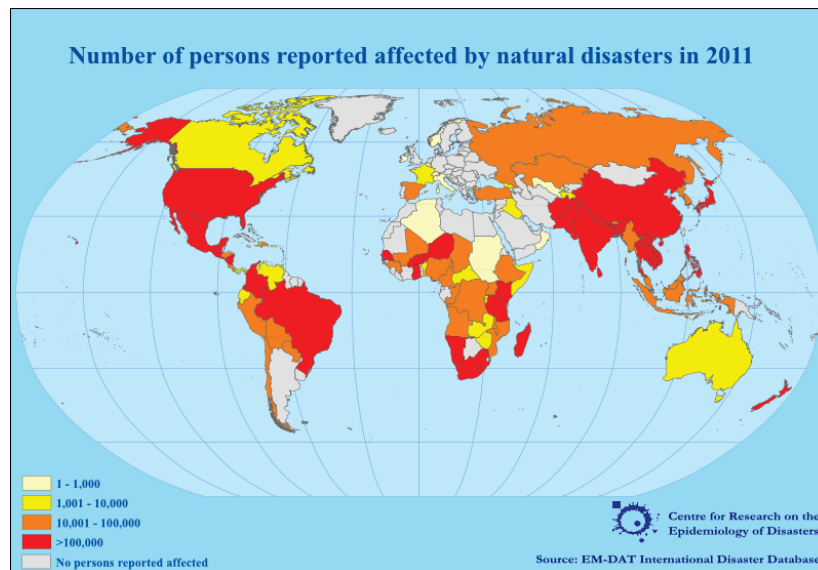


Figure 9: No of persons effected from natural disasters in 2011 (Source: EM-DAT online database)

Land as a source of carbon stock

As stated above, climate change effects our ecosystem, and it is important to study about the land as being one of the main part of ecosystem. Scientists have already quantified the impacts of land-use change on regional and global climate through the surface-energy budget, as well as through the carbon cycle (Pielke et al., 2002). Virginia H. Dale analyses the relationship between climate change and land in terms of land use change and land-cover patterns change (Dale, 1997). Literature review shows that effects of climate change are also expressed as a land-use change. Land use change influences the conversion cycles of carbon stock and energy while land-cover patterns alter these cycles. Although human use of land also effects land-cover pattern but projected climate changes in the recent century override these effects at a variety of temporal and spatial scales. Therefore, to understand the climatic causes of land use change in terms of land degradation, desertification and deforestation is necessary because these changes conversely effects the carbon stock boosting more climate changes.

Zachle et al. studied the impact of changes in land use both in context of climate change as well as under socio-economic factors like greenhouse gas emissions, agricultural policies and other factors (Zachle et al., 2007). The authors studied the future impacts of land use changes on the European terrestrial carbon balance and estimated an uptake of carbon 17–38 Tg C/year between 1990 and 2100. The main reasons account for this uptake were decrease in agricultural areas and afforestation which clearly indicate the positive effect of land-cover patterns. Soil carbon stock also losses due to global warming and increasing concentration of atmospheric CO₂. Thus the issues associated with the land like land-use change, afforestation and deforestation, land degradation and desertification has a strong link with climate change and needs to be addressed in land use decisions for monitoring environmental changes.

Increasing risk of loss of biodiversity

Scientists have already established a strong link between climate change and biodiversity. “Global Biodiversity Information Facility” provides an evidence for indications that rapid global warming affect a natural ecosystem in terms of destruction of its biodiversity (Secretariat of the Convention on Biological Diversity, 2010). Besides effect of temperatures rise, other consequent effects of climate change such as frequent extreme weather events like changing patterns of rainfall and drought also influence on biodiversity (Gitay, Suarez, Dokken, & Watson, 2002). Data from Global Biodiversity Information Facility reveals that significant changes in ecosystem of Arctic are already observed. Inability of marine species to adapt the abrupt climate changes causes an increase in ocean biodiversity loss (GBIF, 2014).

Destruction of biodiversity results not only in habitat loss for wildlife, flora and fauna but also effects food security for human (Díaz, Fargione, Chapin, & Tilman, 2006). As human population rely on plants, animals, aquatic and marine life as a source of its food chain, so the increasing risk of biodiversity loss have also direct impact on human food security.

Agriculture productivity

The climate is one of the most important factors influencing agriculture (Maharjan & Joshi, 2013), hence it is important to study relationship between climate change, agriculture and crop production. Only a 2°C rise in temperature can dramatically change agriculture productivity by the end of the 21st century (IPCC, 2007b). Rise in temperature and abrupt rainfalls in different seasons have already caused a significant regression in crop productions all over the world in semi-arid, tropical and sub-tropical regions (Zougmore, Jalloh, & Tioro, 2014).

Agriculture is not just a victim of climate change but it is also a major cause of climate change (Pye-Smith, 2011). About 10–12% of GHG emissions is due to agricultural activities (IEA, 2013). Further, agriculture is also responsible for reduction of carbon stock through clearance of forest land for agriculture purpose (Page, S.E., Morrison, R., Malins, C., Hooijer, A., Rieley, J.O. Jaujainen, 2011).

As reported by Kelly Millward, deforestation in sub-Saharan Africa for food crops and conversion of peat lands in Southeast Asia for oil palm production, contributes 20% of global land-use change emissions (Millward, 2014). In next ten years, rain fed agriculture in some African countries are projected to reduce up to 50 % due to climate change thus increasing food insecurity and hunger (Behnassi, Muteng'e, Ramachandran, & Shelat, 2014). Further, this report claims that cash crops are another factor for large scale destruction of forest lands besides urbanization. Thus, agricultural clearance is responsible for deforestation as well as main contributing factor to climate change. Figure 10 shows the country wise expected future changes in agricultural productivity by 2080 due to climate change including its positive and negative impact on carbon stock

Although almost every country recognize the importance of agriculture as a major cause of deforestation, however a recent analysis from REDD+ revealed that the actions taken in this regard are not so strong enough to meet the challenge. There is an urgent need for introducing more active and solid measures. Society need to take care about forests for maintaining carbon stock one side and at the same time we need to meet our food demands. Therefore, there is also a dire need to introduce adaptation practices that can improve the agriculture's climate perception positively.

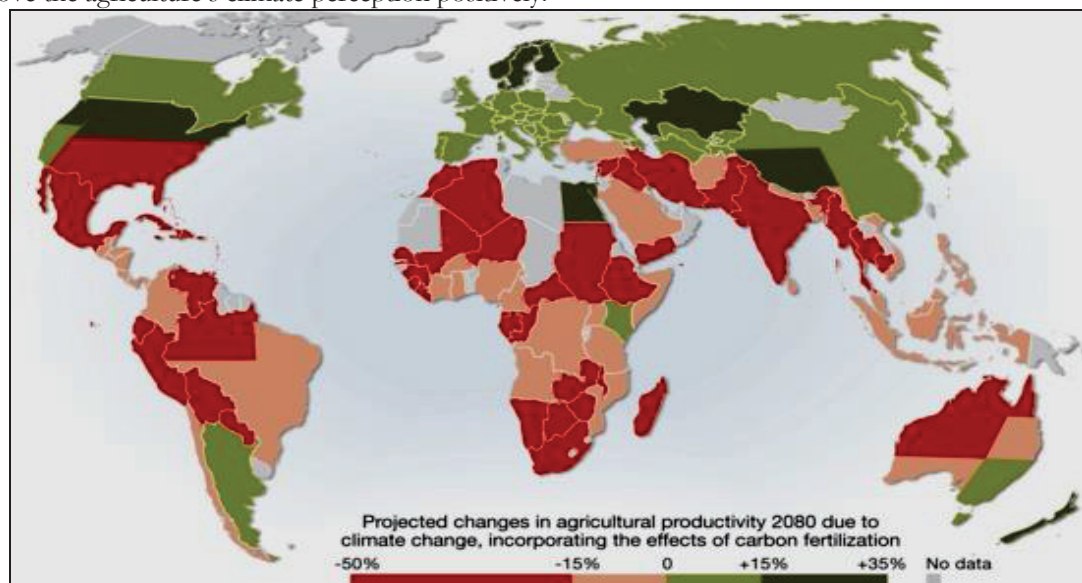


Figure 10: Global Warming and Agriculture: Impact Estimates by Country (Source(s): Adapted from Cline, W. R. 2007. Global Warming and Agriculture: Impact Estimates by Country. Washington D.C., USA: Peterson Institute).

Food security

Due to present population pressure, food production must increase by 70% to meet the demands for next 50 years (Pye-Smith, 2011). For example, according to the policy pointer, estimated projections about population growth in Africa suggest that yields of all food crops would have to increase by 230% by 2050 in the continent to meet the daily food consumption demand (Pye-Smith, 2011) where one third of the population is already suffering from hunger. Researchers in a research study claim that there is a significant decline in crop yield of cereal in South Asia and Africa in past four decades (Burke & Lobell, 2010) as shown in figure 11. Another recent study from Asia region predicts that more than half of the plains in South Asia will be under heat stress in future which can badly effect wheat production.

Thus, in the light of above, this rising demand for food availability without increase in GHG emissions from agricultural activities makes a big challenge for countries having big population. At the same time, farmers will also need to modify their farming in the face of climate change and due to changes in weather patterns.

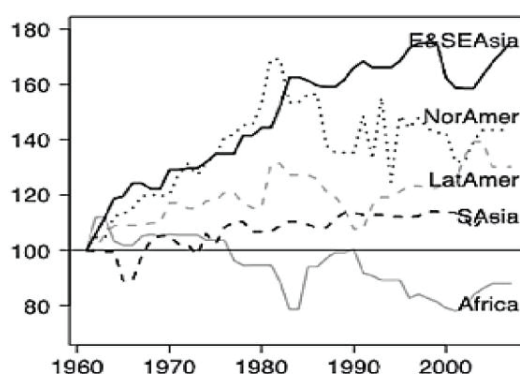


Figure 11: Changes in per capita production. Source FAO (Burke & Lobell, 2010)

Water accessibility

IPCC technical paper VI on climate change and water provide clear evidences that climate change have significant impact on freshwater resources (B. Bates, Kundzewicz, Wu, & Palutikof, 2008). Hence climate change make fresh water resources vulnerable by limiting its availability and accessibility for human society as well as for animals and agriculture. Floods and droughts are the main factors effecting water availability. Besides this, climate change also effects the quality of surface water of rivers and lakes (Delpla, Jung, Baures, Clement, & Thomas, 2009) by increasing dilution and concentration of substances in water.

Water is essential for agriculture whether cultivation is arid, semi-arid or water-fed. In addition to direct impact of climate change on crop production as explained in above, there is concern about future agricultural water demands. A review about vulnerability of global water resources from climate change, climate change alone have both positive and negative impact and is highly region specific (Vörösmarty, Green, Salisbury, & Lammers, 2000). Results of a study by Fischer and co-authors indicate that climate change is likely to increase water scarcity around the globe, mostly in the southern Mediterranean, the Middle East and Sub-Saharan Africa (Fischer, Tubiello, van Velthuisen, & Wiberg, 2007).

As an example case, China's climate is getting warmer day by day with an increased frequency of heat waves and glaciers are in retreat (Piao et al., 2010). Although, extreme rainfall and glaciers melt have a positive impact on river run off whereas have increased flooding. But variability in water resources is very large such as very severe droughts hit in the past decades in some other parts of China. The Yellow river and Yangtze River are two major rivers in China. Figure 12 shows that Yellow river is sensitive to drying trends while Yangtze River, on the other hand, is frequently flooded by monsoon rains (Piao et al., 2010). The third main river, Tarim River is runoff due to glacier retreat. All these statistics suggest that water scarcity and abundance in different areas of country require a good management approach for future prosperity.

In the light of above, a sustainable water supplies for both agriculture purpose as well as for supply of clean water for drinking purpose to avoid health risks is a key challenge. Further, projected impacts of climate

change confirm the problem of water scarcity in future (Mukheibir, 2010), thus a requirement of an adaptive water management approach in connection with climate change is essential for sustainable accessibility of water for both agriculture and drinking purpose.

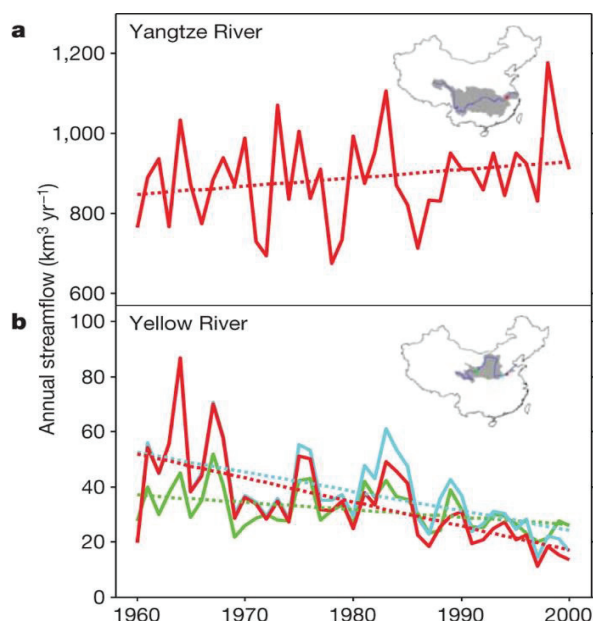


Figure 12: Observed inter-annual variation in annual runoff in two major Chinese rivers, Source FAO (Burke & Lobell, 2010)

Safety of Human settlements

Climate change related events like floods and sea level rise in coastal areas effect human settlements in three ways (i) through economic losses, (ii) service infrastructure, buildings, and transport system and third most important (iii) population through changes in people health status and life losses etc. (Mosha, 2011). Further, migration of people due to climate changes increase the population pressure on cities and may change the size and characteristics of settlement populations, which demand for an integrated local resilience planning for urban services with extension of projected climate changes.

The vulnerability of populations is one of the major concern in 'climate hotspots'. According to data managed by EM-DAT, majority of people killed or effected from natural disasters are from heavily populated Asian region, islands and coastal urban areas as shown in figure 8. Intensity and frequency of these events is so large due to impact of climate change that human settlement in safe areas become a serious challenge for developing countries (McBean & Ajibade, 2009). According to the Centre for Research on the Epidemiology of Disasters (CRED, 2012), out of total 552 disasters events worldwide, 364 events (65% of total) were categorized as climate related hazards. Thus, climatic changes act as a trigger for most of the natural disasters and contribute towards more vulnerability to human settlements.

As in urban areas, informal settlements are exposed more for frequent floods and mostly poor people live there thus poor people becomes more vulnerable for their life stress and safe settlements. For example, in Dhaka, city of Bangladesh, most of the informal settlements are located in highly flood-prone areas (Jabeen & Johnson, 2013), hence the urban poor community experience relatively more damages to their lives, livestock and houses as compared to other urban areas.

Storms and flooding are prime cause of life losses and physical damage to infrastructure (Manton, 2010) which confirms that all kinds of human settlements both in rural and urban areas are vulnerable to the climate related extremes. Therefore effective management and monitoring will be needed to minimize the impacts of climate extremes.

Livelihood

Climatic changes can affect livelihood in both positive as well as negative way but its impact is more intensely on poor people as well as this experience is region specific (Chandrappa, Kulshrestha, & Gupta, 2011). Rural households are more vulnerable to climate change than the urban (Paavola, 2008). A recent research conducted in mountain areas of Nepal also confirms that sensitivity to climate hazards varies with different well-being status and poor households are more vulnerable than medium and well-off households (Gentle, Thwaites, Race, & Kim, 2014). The research indicates that the effective management plans in response to climate change require to estimate the impacts of vulnerability based on well-being status of households. Further, IPCC in its recent analyses of adaptation and vulnerability to climate change recommends the assessment of social consequences of climate change for ensuring sustainable individual livelihood and well-being (IPCC, 2014b).

Livelihood of people in rural community is affected by climate change in many ways. (i) Reduction in crop yield due to changes in temperature and soil degradation effects people who depend on agriculture. (ii) Increasing droughts and limiting water availability also effects agriculture production which can decrease income of farmers. (iii) Increase in epidemic diseases resulting from climate hazards in domestic animals and wildlife will affect not only livestock but also people who depend on them. Thus, there is a need to develop a sustainable livelihoods framework for strengthening poor communities in context of climate change who are already vulnerable under the economic stresses.

2.2.3. Mountains, the most fragile to climate change

Literature review reveals that mountains are among the most fragile environments on Earth regarding climate change (Sharma, 2009). Rise in temperature and warming is more dominant in hilly areas as compared plain lands (E Sharma, Chettri, Tse-ring, Shrestha, ABMool, & Eriksson, 2009). Further mountain areas, particularly Eastern Himalayas are more sensitive to climate change due to rise in average temperature (Aryal, Cockfield, & Maraseni, 2014). One important example case in the mountain region having land use conversion because of deforestation, and land degradation which are slowly creeping into mountains (Pandit and, Brook, 2006). Further, indigenous people living in mountain areas are most vulnerable due to climatic impacts in context of frequent disasters like floods, droughts and landslides (Williams & Hardison, 2013).

The literature review reveals that the decline in glaciers and snow packs, changes in the hydrological cycle, and the changes in vegetation response due to changing weather patterns are the major threats of in Mediterranean mountains (Nogués Bravo, Araújo, Lasanta, & López Moreno, 2008). While on Hindu Kush Mountains, the main risk parameters accountable for climate change in this area are natural (hydrological cycle, temperature, precipitation and glacier storage) changes as well as human activities like forest degradation. Further, there are indications of abrupt changes in timing and length of the monsoon period (Eklabya Sharma, 2009).

As mountains serve as a repository of other ecosystem services like water which also meet the water needs of lying down plain areas, so the impact of climate change upon mountains further execrates its influence beyond their geographical limits. These changes have profound effects on land and water accessibility for agriculture so having considerable impact on people's livelihoods and wellbeing.

Many international organizations like IPCC, FAO and UNFCCC have programs aimed to address the issue of climate change adaptation in societal prospective. In Hindu Kush and Himalayas region, the report from Intergovernmental panel to climate change (IPCC) warn for an expected increase in melting of glacier (IPCC, 2007b). Glacier retreat is the main cause of increased flooding, land degradation and extreme weather conditions in the area. Another report from ICIMOD (2011) regarding climate change in the Hindu Kush and Himalayas provides an up-to-date knowledge on scientific research about analysis of climate change and strategies to address this problem. As, the timing and length of the monsoon period are changing (Eklabya Sharma, 2009) the study shows the indications for seasonal droughts and more water stress. Thus, climate change has profound effects not only on agricultural and natural ecosystems but also having a considerable impact on people's livelihoods. Therefore, policy interventions are needed for helping the mountain communities in relation to improve their adaptation capacity to climate change.

2.3. Impacts of climate change on land

Land contributes towards major part of GHG emissions but on the other hand it is also a main source of carbon stock and has a potential to reduce GHG emissions. As stated in section 2.1 of this chapter, human activities have strong influence on changing the earth's environment, therefore, apart from other emission sectors like burning of fossil fuel (energy and transport), land sector being habitat of mankind, itself has a leading role in both causes and effects of present climatic changes. As already discussed in section 2.2 about climate change impacts on agriculture, water, food security and livelihood of people, in this section, three main land issues namely land tenure, land value and land use are being discussed.

2.3.1. Issues related to land use and land value

Keeping in view of most widespread effects of climatic changes on our environment, in fact most of the impact of climate change can be viewed as impact on land (Mendelsohn, 2011). The reason is; Agriculture, forestry, water and households are sensitive to climate change related hazards and all these sectors involve land. The role of land use, land use change and forestry in adapting climate change is obvious and cannot be ignored (Molen & David, 2014). This requires the management of land in both prospective, for land use change for improving carbon storage as well as protecting land from extreme events related to climate change.

Natural grasslands, rangelands and forests are big reservoir of above and below ground carbon mass, thus protecting them by effective land management plans can maintain the carbon stock. Forest management itself is a big issue related to land management. Degradation of the rangelands not only reduce carbon stock but also effects livelihood of local people who feed their livestock through these rangelands. Further man made conversion of forest into agriculture accounts for loss of carbon stock as well as affect the climate system, including its impact on local and regional hydrology (Tinker, Ingram, & Struwe, 1996).

Urbanization highly contributes in changing land cover given that 60% of the world's population will be urban by 2025 ("WHO," 2014), thus a rural–urban linkage on "climate change footprint" is critical to land use change assessments. The two urbanization pathways, Large-scale urban accumulations and extended peri-urban settlements lead to different impacts on rural landscapes. One by urban-led demands for conservation and recreational land uses and the other by reducing prime croplands (Lambin et al., 2001) & (Veldkamp & Lambin, 2001). Protection of land from flood risks, requirement of improved drainage and other utility service in context of climate change are the main concerns to deal with while land use planning in both urban and rural areas.

2.3.2. Issues related to land tenure and its security

2.4. Climate change adaptation and policies

After identification and clear description of land related issues linked with climate change in previous sections, below we discuss about the climate change adaptation and key policies that reflect adaptation particularly at community level. This research study investigate about the present knowledge about climate change adaptation policies. Further, present status of current initiatives related to climate change adaptation is also highlighted. The literature review aims at identifying the role of land policies to cope with land related issues linked with climate change.

2.4.1. Climate change adaptation

Refer to section 2.2, as stated that the direct consequences of climate variability is on the environment, human life and socioeconomic activities. Thus, we need to take measures to reduce the adverse influence of this variability on our life and environment. IPCC defines adaptation as adjustments in human system in response to actual or expected climate impacts in order to either avoid them or moderate (IPCC, 2007a). Thus, adaptation is a process of preparedness and making adjustment accordingly to combat or for better

response against changes in natural system due to climate change including variability. Today, climatic changes and disasters resulting due to climate change have disturbed the whole society by effecting both developing countries and developed countries. However, coping with the issue of climate change has become the most serious problem for developing countries because of lack of having enough resources to cope with climate changes and climate related hazards. Another reason for making this issue more severe for these countries is their dependence on climate-sensitive sectors, such as land, agriculture, fishery and water. Therefore, a sustainable policy agenda for climate change adaptation for these countries is desired to bring at the front foot of all their national developmental plans and strategies.

2.4.2. Adaptation policies

Vulnerability to climate change is higher in developing countries as compared to developed countries (I Burton, Diringer, & Smith, 2006) because of the two reasons. First, most of the developing countries by virtue are facing with increased rate of climate related disasters such as heat waves, droughts and floods. Second, as described in above section 2.4.1. Larger portion of their income comes from climate-sensitive sectors such as agriculture, fishing, water (as an energy resource) and tourism. Hence, developing countries generally have weaker adaptive capacity and climate change impacts will effect badly agriculture, water supplies, food production, people's livelihood and their health and social wellbeing.

Literature review reveals that currently there are three approaches that are being made as policy options for adaptation. One is adaptation under UN Framework Convention on Climate Change (UNFCCC) which is mainly about to facilitate national adaptation strategies. The other is an integrated approach which is about integrating adaptation with development projects through climate change risk assessment for the projects. Third one is a proactive type of approach which mainly focus on covering damages though climate related hazards.

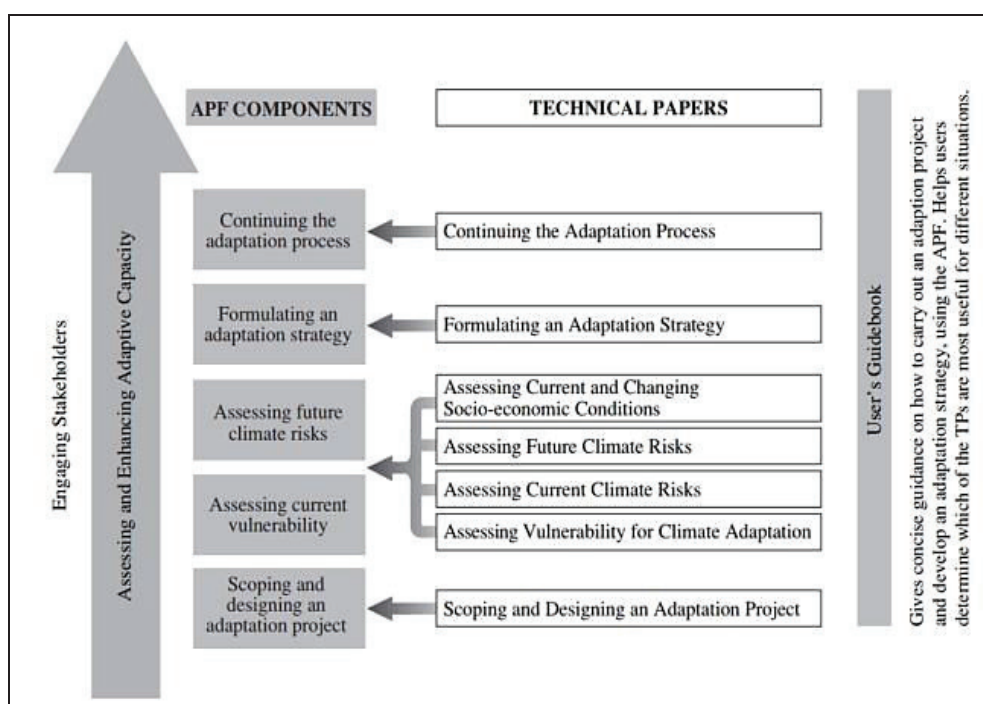


Figure 13: The Adaptation Policy Framework (APF) developed by UNDP-GEF

Although, all the creatures on earth including mankind has natural ability to adapt and adjust against the natural changes in climate conditions, but the idea of incorporating future climate risks into policy making is very new and need guidelines and a framework for developing them. The United Nations Development Programme – Global Environment Facility (UNDP-GEF), with the support from the Swiss, Canadian and Dutch governments (Ian Burton, Malone, & Huq, 2004) developed such a framework called the Adaptation

Policy Framework (APF). Key components of this framework are shown in figure 13. The objective of this APF is to provide a guideline to those countries who intended for integrating adaptation concerns into their national development action plans for protecting people and enhancing their adaptive capacity in the face of climate change.

The above mentioned all the three approaches have one common phenomenon that is, for effective adaptation, these countries need to make such institutional policies for setting priorities within the available resources i.e. integrated with their economic and developmental plans that can benefit to effectively address the adaptation concerns. All adaptation policies definitely should have more potential benefits than their costs.

2.4.3. Adaptation policies at local community level

In section 2.4.2, we discussed generally about different adaptation approaches and we see that all these approaches emphasize the framing of policies at national and global level. However, according to Robert Mendelsohn (2011), effects of climate change are highly region specific, so locally determined adaptation responses are necessary. His argument points out the importance of day-to-day practice of adaptation to climate change at local level. Thus, inclusion of local experience and knowledge in decision making processes and bringing bottom-up approach for making adaptation policies may produce better results for reducing vulnerabilities of communities to climate change.

Local communities are already responding at their own for climate changes and adjusting themselves locally according to their own knowledge. Therefore, it is essential to involve local communities in policy decision-making processes related to the impacts of climate change (Rojas Blanco, 2006). Further, access to information about the consequences of climate change, and creating awareness is also necessary to make them capable of generating solutions likely to work at their level (Chandrappa et al., 2011).

A recent study about implementing adaptation to climate change at local level argue that as vulnerabilities mainly unfold at local level and adaptation actually takes place at this level so local governance for adaptation has a central role in adaptation measures (Dannevig, Rauken, & Hovelsrud, 2012). Now it is generally accepted phenomenon that all climate related preparedness and interventions must be applied at local level called “communities. Therefore, in order to support communities in building their capacity to change their situation at their own, it is important to empower the people in the community (van Aalst, Cannon, & Burton, 2008). Further, integration of local adaptation strategies within policy will not only overcome the overlap between top-down and bottom-up approaches of policy driven but also can help to reduce vulnerability of both socio-economic and environmental systems (Stringer et al., 2009).

2.4.4. Current initiatives related to climate change adaptation in study area

Climate change has a severe impact on livelihoods of more than one billion people living in the territory of river basins of the Hindu Kush and Himalayas because of dependence on agriculture as major source of income. Furthermore, these mountain communities consist of diverse population groups with diverse cultural backgrounds and different level of adaptive capacities. In support to this argument, ICIMOD (2011) also emphasize on livelihood diversification while conducting several studies on community-based adaptation to climate change in these mountain areas. ICIMOD also recommends that the vulnerabilities of each group needs assessment in a specific context, to enhance community resilience and adaptive capacity for sustainable development.

ICIMOD (2012) in a study report about the role of policy and institutions in local adaptation to climate change highlights some key points for developing adaptation policy environment to support local responses. These key points include the development of an effective institutional arrangement; establishing and designating the role of focal institutions; public participation in order to respond for local needs and drawing local knowledge about climate change; supporting community level responses and their indigenous practices in policies; dissemination of climate information to service delivering institutions; and disbursement of resources to local governments and at the community level.

Currently, NGO's and Government organizations are focusing on effective management of water and its equitable access, improving agriculture productivity, improving safety walls along river sides and providing basic utility services like health, education and electricity. Although, all these initiatives are linked with livelihoods and are also supportive for improving adaptive capacity against hazards, but they still don't reflect or take into account the future climate risks.

In Chitral, Pakistan, NGOs have are engaged effectively in developing community-based water governance and have improved water accessibility for agriculture and household's use in many communities in the area. ICIMOD with the collaboration of national institutions like NARSP, PARSP, NDMA and PMD is focusing on monitoring and assessing impacts of climate change on natural resources and human in Hindu Kush and Himalayas (HHK) region. ICIMOD geo-portal provides comprehensive information on glaciers, water resources and land cover changes pattern in terms of story maps.

2.4.5. Present status of policies related to climate change in study area

According to a report published by UNFCCC (UNFCCC, 2009), *"The National, economic, environment and development study for climate change"* NEEDS (NEEDS, 2010) established by UNFCCC recommends agriculture, water, energy, land-use change and forestry as priority sectors for adaptation strategies including Pakistan among the seven participant countries. Under the umbrella of UNFCCC, Ministry of Environment, Pakistan published a report which emphasize on the need for drafting of climate change policy to address implementation measures regarding adaptation and mitigation (Malik, Amir, Ramay, & Ahmad, 2011). This report claims to formulate and adopt a national climate change policy in line with the international organizations.

With the partnership of UNFCCC, in 2010, Nepal has also already prepared its National Adaptation Programme of Action (NAPA) for addressing and adapting climate related extreme events. NAPA is one of the best example of integrating climate change into planning that also brings the public and private stakeholders including civil society altogether at one platform (Alam & Regmi, 2004). In proceeding further, Nepal has also prepared a National Framework for Local Adaptation Plan for Action (LAPA) with the objective of integrating climate change into local development planning as well as implementation of adaptation actions at local level (Regmi & Karki, 2010).

National institutions and policies strongly affect the adaptive capacity of people at individual and community level. However, in Pakistan, currently, there is no such policy which can address bottom up approach to take initiatives for adaptation measures at community and local level. In order to reduce huge financial burden on implementing these adaptation measures at national level, climate policies needs to be framed in a way to address private-public partnership as well as local community participation. Thus, under this kind of policy framework, the active participation of local community with an incentive approach can help to address issues related to climate change locally as well as can help to for strengthening adaptation capacity of people at local community level.

2.5. Summary

Now a days, the scientists agreed that major cause of today's climate change are activities of man on earth but at the same time mankind is the victim of these changes. Before answering to research question (i) about land related issues in the face of climate change, in section 2.2, this research study focused on highlighting about causes and effects of climate change. Climate change has strong impact on biodiversity, hydrological system and on ecosystem. The extreme events such as droughts, landslides, floods, glacier bursts and heat waves, all of them are now strongly linked with climatic changes. Society would have to take care about forests for maintaining carbon stock and at the same time it would need to meet food demands. Sustainable water supplies for both agriculture and drinking (clean drinking water to avoid health risks) are extremely necessary.

Land serves as both causes and effects of present climate changes, and as human being, man have the leading role for all activities related to land such as land use and land use change, so in section 2.3 of this chapter highlights some issues about land use, land use changes and the importance of land rights and their security in relation to adaptation for climate change. The vulnerability of populations is one of the major concern in

‘climate hotspots’. It effects not only the settlements but also effects people’s livelihood. This section also captured the present situation of mountain systems Hindu Kush-Himalayan (HKH) which are most sensitive to changing climatic conditions in the world. The basin of these mountains is not only the hub of water resources and diverse landscapes but also sources of income for a big population settlements living there. In summary, secure access to land and its resources, safe places for settlements, protection of land losses, climate threats for land use change and land value due to land degradation, tenure insecurity due to land losses etc. are the major land related issues that are needed to address while integrating climate change into policies.

While answering to questions about climate change adaptation policies and current initiatives about adaptation in study area, section 2.4 reviews the present situation of policies at national level in Pakistan and its implementation at local level in Chitral. The consequences of climate change in HKH region are more severe due to lack of adaptation planning at national and local level. The present framework and policy guidelines at national, provincial and local level in Pakistan are not so impressive followed by a limited role of policies in adaptation to climate change specifically at local community level. Although, communities are active in adaptation at their own and NGO’s and GO’s are investing in mediating adaptive capacity, but role of policies and institutions in adaptation to climate change is manifest. Thus it is clear that community adaptation strategies should be integrated in making policies in the face of climate change. However, National Adaptation policies in Nepal (NAPA) is appeared to be great effort for integrating climate change into policies as well as its implementation in adaptation at local level.

This chapter provides an insight about the environmental and social impacts of climate change. The finding of this part of literature review contributes towards better understanding about land related issues into climate change. In fact most of the impacts of climate change are on agriculture, water and human which no doubt are land intensive. In next chapter, this research study focuses on policies related to all these sectors including land policies and an integrated framework of policies that can play a better role in development and implementation of adaptation at local level.

3. LAND POLICIES IN THE FACE OF CLIMATE CHANGE

3.1. Introduction

In context of this research study, focus on land policy development and institutional strengthening is much desirable and there is a dire need for a comprehensive but region specific land policy for efficient land use planning and land management for the sake of poverty reduction, good management of land scarce natural resources. Reviewing existing land policies requires a strong knowledge that clearly defines and indicates the role of land tenure and land administration in the context of climate change. This chapter concerns a literature review to explore about land policies from both legal and institutional prospective. Main objective of this study is to know about the concept, role and development of land policies and to understand how land policy and management can support adaptation measures and community responses to climate changes. In this chapter, main goal is to learn and understand from literature about the following research questions.

- i. How these land related issues in climate change adaptation policies can be incorporated into land policies? and
- ii. How stakeholders particularly government, community and households can coordinate with each other to combat against climate change?

Similar research approach is adapted as in previous chapter. A systematic review of all available relevant research material is made including scientific papers, scientific reports, peer reviews, policy documents, and other relevant grey literature. Resources for this research material includes search from academic databases including ITC academic library, Web of Science, Google Scholar search database, and FAO, IPCC, UNHABITAT, and ICIMOD Publications.

This chapter is divided into six sections. In section 3.2, this research explore about present status of different forms of land policies in general and also in particular context of case study area. Section 3.3 provides the description of ingratiation of climate related land issues into adaptation. Section 3.4 covers the effectiveness of governance aspect for coordination between all key stakeholders including civil society and community. In section 3.5, a framework for integrating land related issues and policies into adaptation policies is presented. In the last, section 3.6 contains the summary of chapter.

3.2. Land policies in the face of climate change

From previous chapter while discussing about land related issues of climate change, a clear insight can be drawn that climate change effects the land in general and have an impact on land use in particular. Thus policies regarding land sectors such as agriculture, forests, water and other land use including human settlements need to be improved and demand for introducing an integrated approach to deal with climate change adaptation. Further, it is important to look on climate change predictions at the individual land parcel level for better adaptation in a local context, thus land administration policies can play a leading role in improving land policies and governance in the face of climate change.

In the light of above, we can therefore think of linkages between different land sector policies including land policy and climate change adaptation measures at institutional level and unifying all of them into an integrated framework. Therefore, in order to incorporate climate change adaptation related concerns into land policies, the conceptual domain of the land policies is necessarily it to be widen.

3.2.1. Land policies

There is no standard definition of land policy, but the most accepted one is the definition provided by United Nations/Economic Commission for Europe in its land administration guidelines (ECE, 1996). It states that *'Land Policy consists of the whole complex of legal and socio economic prescriptions that dictate how the land and the benefits from the land are to be allocated'*. The primary objective of a land policy is sustainable development (ECE, 2005).

Thus a land policy consists of a set of action plans for an effective management of land and its resources such as water, forests and soils for both urban and rural communities.

The above definition of land policy clearly recognizes its scope for addressing the land issue involving both socio economic and legal such as secure access to land as well as access to land related benefits. According to USAID, land policy is a tool to make a framework for meeting land related objectives such as administration of land use, management of land tenure, property rights and administrative structures (USAID, 2013). Thus in context of land use, the land policy is linked to agricultural production policy as well as to sustainable management of land, agriculture, water and other natural resources like forests.

The land management paradigm is present in figure 14 which illustrates the central role of land administration functions towards sustainable development to deal with socio economic as well as environmental issues like climate change and disasters. Good care of the environment, especially land and water depends on land management (Molen, Silayo, & Tuladhar, 2008). Apart from this land management paradigm, a triangle showing three key concepts at the vertices namely climate change, land policies and cadastral system for administration of three main areas of land, thus showing linkage between each other (S Enemark, Williamson, & Wallace, 2005).

Thus a clear cut land policy must provide a framework to deal with the land related environmental issues like climate change and for smooth implementation of adaptation measures. A land policy is not just a document that provides a legal cover for land management but it is expected to improve environmental sustainability, effective land use and economic growth (Molen et al., 2008). A brief review about nature of land policy illustrates the existence of a close link between land policy, economic growth, poverty reduction and sustainable development (Deininger, 2003). In many countries, land is categorized into different types such as public and private land, forest land and agricultural land. Also land is administered under several systems including registertion of land rights under formal system or customary laws bringing the overlaps and synergies in land policies (Burns & Dalrymple, 2008). Therefore, an unified integrated land policy can play effective role in management of three elements land use, land value, and land tenure in context of sustainable development to address climate change, food security and higher security of individual property rights, thus making households less vulnerable against disasters.

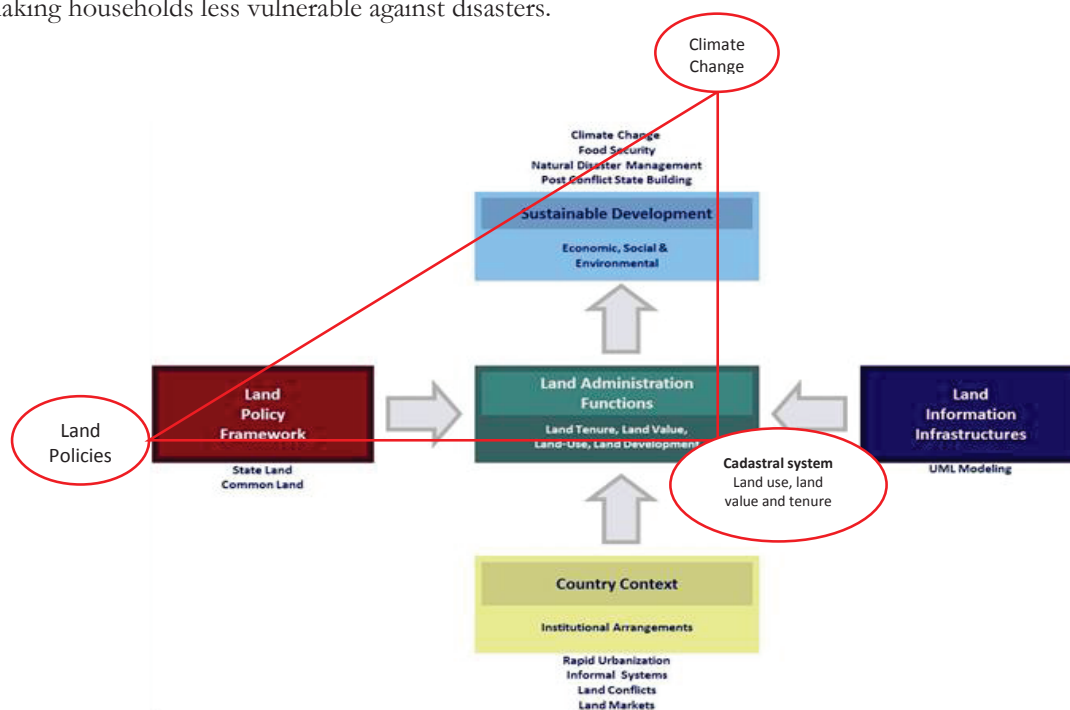


Figure 14: Land management paradigm and triangle of mutually linked three concepts, Source: modified and adapted from (S Enemark, 2007)

3.2.2. National land policies

As stated in section 3.2.1., land policies may consist of multiple documents. Many countries do not have a comprehensive land policy rather they have different policies for different types of land and for other natural resources like agriculture, water, forestry and urban /rural land use (UN-ECA, 2010). National policy set the domain for each stakeholder for playing their institutional role and responsibilities to govern land from different aspects (Schmithüsen, 2003). National land policy is the highest level of policy framework for land management to address land governance issues including access to land, tenure security, control of natural resources etc.

Like many other countries, in Pakistan, there is no consolidated document which can be regarded as National Land Policy. However there are some sort of legislations that serve the purpose of recognizing land rights and cover almost all the aspects of land governance (Ali & Nasir, 2010). Basically country have federal constitution system where all the provinces follow the same policy guidelines form central government to govern land within their territories.

A study report from Ministry of foreign affairs, Netherlands argue that an inadequate land policy is the major cause for insecure land rights and weak land management (MOFA, 2011). Land administration institutions there in study area have also this constraint of not having proper land development policies required for effective management of land and its related resources. As the responsibility of allocating land and resources, affecting rights, delivering titles to land holdings lies with these institution, so only the presence of appropriate land policy can determine their actual contribution towards effective management of land related issues highlighted in previous chapter. In conclusion, there is an ultimate need for revision and realignment of land policy and governance to incorporate concerns about climate change in consistent with international policy guidelines like “LGAF framework of land reforms” (Burns, Deininger, Selod, & Dalrymple, 2012) and “FAO guidelines for responses to climate change and emergencies” (FAO, 2012).

3.2.3. Local policies

The worldwide trend of decentralization of powers from central to local since last decade resulted in the establishment of more independent local governments and has created opportunities for more robust local resource tenure systems (Alden Wily, 2003). But our study concerns about the extent to which the powers over land use and resource management are localized or decentralized. For ensuring responsible governance at the local level, reforms in land policies at national level needs to be made that allows some degree of freedom of action on the part of local institutional level.

Although, local government in many countries have already some mandate for implementation of policies regarding management of land related environmental issues but community based natural resource management is often missing (Hilhorst, 2010). The local governments are at front line for response to all kind of hazards including climate related hazards. In many countries, existing land policies and legislation concerning agriculture, forests, water, fisheries and other natural resources cover the community role via legislation but implementation is lagging behind. Local governments can play a role by recognizing the community role in local land use planning aimed at reducing vulnerability by promoting sustainable natural resource use and environmental management.

In Chitral, Pakistan (our study area), presently district administration is acting as a local government body but with limited local resources. Strengthening local government requires sufficient local capacity (Deininger, 2003). Though district administration has mandate to make plans for administration of land and management of land related issues at local level but their implementation is limited because of limited budget allocated by provincial governments for the development projects at district level.

3.2.4. Agriculture policies

Agriculture remains the largest single contributor to the livelihoods of the 75% of the world's poor who live in rural areas. Encouraging agricultural growth is therefore an important aspect of agricultural policy in the developing countries. Price ceilings, agricultural subsidies and price controls are some of the policy tools

that governments use for providing incentive to farmers as well as to boost agriculture production (Hobbs, 2003). Further, the main objective of agricultural policies is not only to attain food security but also to provide support poor farmers whose livelihood depend on agriculture. In context of climate change, agricultural policies may encourage some land reforms in the interest of protecting the environment.

More than a billion farmers and their families around the world are on the front line of climate change (Essay, 2014) that has direct impact on their lives and livelihoods. Thus, an agricultural policy in the face of climate change must support the ways to increase productivity in a sustainable way that in order to reduce the effects of climate change.

Para 23, 2 & 25 of draft National policy recently approved by Ministry of National Food Security & Research (MNSFR), Pakistan in 2011, highlights the vulnerability of agriculture sector as well as the entire economy to extreme weather events (MNFSR, 2015). The revised policy consist of policy guidelines for climate smart agriculture covering actions regarding improvements in water harvesting infrastructure, better flood management and cropping and farming systems that can adapt to different weather conditions. At the same time, this document also give stress on the need for improved coordination mechanism between various institutions including MNFSR, National, Provincial and District Disaster Management Authorities, NGO's and civil society. The main aim of new policy is to minimize the leading role of central government and to draw government institutions at sub-provincial level particularly at District and Union Council level and working much more with the private sector, NGOs/CSOs, academia and farmers' organizations.

3.2.5. Water policies

Water resources in Chitral mainly depend on precipitation, snow melt and glacier melting. According to Pakistan's Water and Power Development Authority (WAPDA), the Chitral river emanate from the glaciers of the HKH is the main water channel flowing through upper part Chitral and is joined by various tributaries including Mustaj River and finally join the Indus river. The National Water Policy in Pakistan was drafted in 2005 which already incorporated climate change aspect into water policy. This policy emphasize for preparing and adapting conservation strategies. This policy also highlights the need for analysing the short term and long term impacts of glacier melting on water sources and for enhancement of storage capacity of existing dams as well as small check dams at different sites in whole northern areas of the country (IUCN, 2009).

3.2.6. Forest management policies

As discussed in previous chapter, forests not only are the major source of carbon stock but they also play a significant role in reducing vulnerabilities and enhancing adaptation capacity of people and ecosystems in context of climate variability. In the light of climate change future predictions, the sustainable forest management is widely recognized all over the world. In these days, due to present climatic changes and their significant impacts, it is vital to integrate climate change into forest policies, legislation and institutional framework.

According to FAO, Forest policy is defined as, *"A negotiated agreement amongst the government and relevant stakeholders on a shared vision and goals for a country's forests and trees, adopted by government"* (FAO, 2010). FAO through its publications, provides to the countries in order to develop and implement the forest policies. FAO also provides support for building capacity of countries at national level and regional level through technical projects.

In Chitral district, initially state forest department is responsible for forest management. However one cannot declare completely the failure of government to manage preservation and protection of forests. Unclear tenure rights of people in forest locality is another major factor for degradation of forests (Hasan, 2001). Existing tenure rights give only use rights for wood for their personal use. They have no any other potential benefits that encourage them for the protection of forests. Further, due to lot of restrictions imposed by forest management, individual poor people cannot get their right share to meet their timber needs required for construction of houses which led them to illegal cutting of trees without ensuring their regeneration in equal amount.

Although, in these days, the main objective of new forest governance is to promote adaptation by reducing deforestation and forest degradation through sustainable forest management (SFM). However, we cannot ignore the people living in forest communities who depend on forests for many goods and services and their livelihood is directly under the threats of climate changes. A scientific study report about emphasize on devising community base forest management policies so as to respond to the local condition of the forest site as well as to accommodate the needs of local people associated with forests (Buck et al., 2009). One of the best example for success of the community based forest policies and management practices is the case of forest communities of Nepal. Community based forest management program in Nepal encompasses a set of policy and instrumental innovations that were especially designed to empower the local livelihoods for the proper management and utilization of forest products (Gurung et al., 2011). Benefits of this tool has been recognized as an efficient forest governance tool for improving livelihood, improvement of forest as well as agricultural land infrastructure.

3.2.7. Environmental policies

Environmental policy sets the guidelines for sustainable management of environment by maintaining and improving the quality of the environment. It also deals with the environmental issues related to climate change and their impacts on economic development and safety of people. A national environmental policy also oblige for protection and sustainable management of environment in regional and global context.

Environmental policy in Pakistan has legal cover in shape of Environmental Protection Act 1997 which includes to include the management of natural resources, control over environmental degradation and hazardous materials. But it does not cover current global environmental issues related to climate change (IUCN, 2014) i.e. causes and effects of climate change on environment. Although, in present law and policy, assessment of environmental impacts has legal obligation for all institutions involved in projects related to sustainable development of environment but in real practice this aspect is completely ignored (O. Nadeem & Hameed, 2008) & (Saeed et al., 2012).

The latest policy version provides guidelines to federal, provincial governments and local governments for addressing all these issues related to climate change and effective management of the natural resources locally (MOE, 2005). Local governments can formulate their own policies and plans under these guidelines. Thus national policy already recognize the framing of local climate change adaptation policies for effective environmental management at local level as well as give emphasize to the active participation of all key stakeholders. And, studies (Constantino et al., 2012) reveal that for successful implementation of all environmental strategies and action plans is only possible when local people and local community are empowered and recognized as one of the key stakeholders.

3.3. Integrating land policies / issues into adaptation policies

3.3.1. Overview of adaptation practices (in study area)

To date, policies and actions implemented to address the issue of climate change in this region have focused mainly on assessing its impact on biodiversity, ecosystem, agriculture and food security, water storage and human health. Examples of such initiatives includes the Sloping Land Conversion Program (SLCP) in China (Bennett, 2008) with the goal of afforesting the degraded wasteland of mountain areas. SLCP is the project started by central government of China to convert retired sloping cropland into forests by paying cash and annual grain subsidies to farmers of villages and rural area. This project was completed by 2010 with a result of 10-20 % increase in China's national forest. Community based forestry initiatives in Nepal and Pakistan (Poffenberger, 2000) is another example case for protection of forest lands and biodiversity in mountain areas with the help of local households. These kind of projects represent a positive impact on carbon stock and an effective contribution of local community in reducing effect of climate change.

3.3.2. Adaptation in local climate change planning

As, local governments are entrusted as primary respondent in facing the challenges of climate change. Of course, they are responsible for public safety as well as for providing basic public services such as health,

water, food, sanitary and infrastructure. In addition to public safety and provision of basic service, they are also responsible to promise for reduction of GHG emission and preservation of carbon stock as its national and international obligation. Local government needs to prepare to adapt to changing climate conditions in their jurisdiction. Regarding climate change adaptation, the local government should set the rules accordingly for changing land use, building standards for construction of homes and buildings and for preservation of ecosystem in its area (Hamin. & M, 2011). Therefore, for both public safety and control over land use change, local governments need to plan ways to better accommodate a changing climate.

3.3.3. Role of integrated policies in local climate change planning

Agriculture, water, forests, food security, and sustainable development are all connected to each other. Therefore, an integrated solution is the only way to protect environment, to reduce its negative impacts on society, to maximize food productivity and finally to improve livelihoods. This new conceptual approach will led evolution of land administration systems towards greater complexity, and focus on issues of sustainable development and the inter-relationship of land management in context to meet the challenge of climate change.

In previous section, we discussed about different forms of policies related to land sector. A brief description of each form of land policy in context of climate change adaptations clearly shows the linkage between them. As stated in previous chapter, the consequences of climate change are more dominant on land sector, therefore, the land policies needs to be integrated and realigned in the context of climate change. Land administration policies could have central role while revisiting and linking these policies with adaption policies. The following figure 15, visualize the relation between land resource management related policies and land administration policy. The idea of unified land policy integrated with climate adaptation policy measures is emerged in this way.

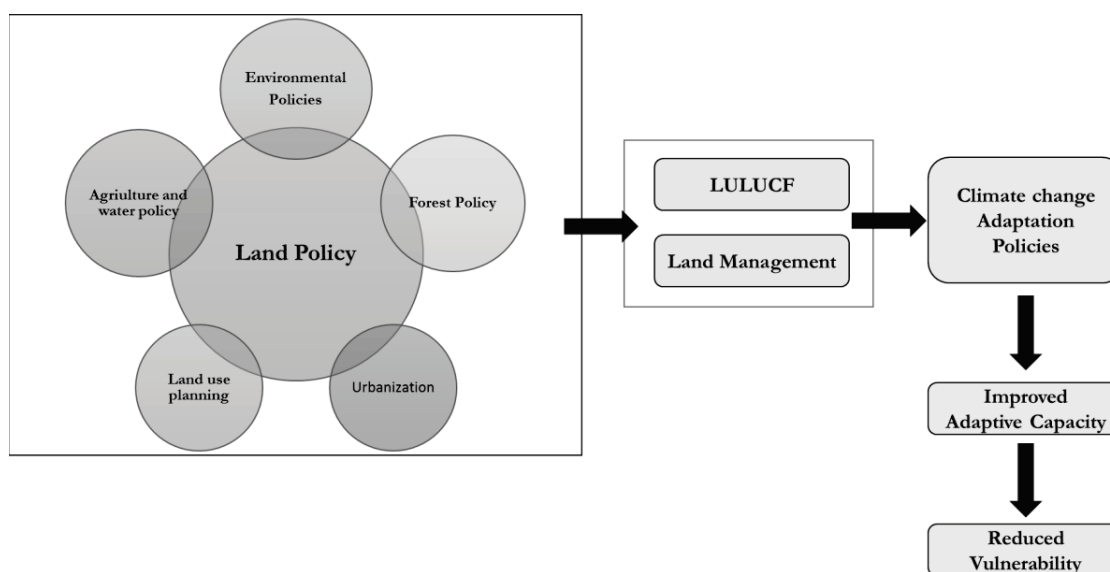


Figure 15: Linkage between integrated land policies and climate change adaptation policies for effective land management and reducing vulnerability

3.4. Stakeholders coordination / contributions in integration of adaptation policies

Effective engagement of stakeholders, exchange of information and mutual coordination is vital in supporting all adaptation activities at all levels. Contribution of local and international NGO's for building adaptive capacity of people at community level is always not recognized by government institutions. As these organizations are better aware about local knowledge and attitude towards adaptation, so by sharing information about their experiences among other stakeholders and local government can lead to better

adaptation plans. Further, access to information about government priorities and policies about climate change can help to make efficient development programs. Also access of latest information about climate predictions to people can help them to adjust and sustain themselves. Thus, effective coordination mechanism between all key stakeholders, institutions is vital to devise integrated approach for adaptations and resilience against climate change.

3.4.1. Role of land administration institution for developing integrated land policies for adaptation

Land administration refers to the social relationship between people and land with clear identification of land rights on parcels (Stig Enemark, 2008). The international organizations related to land administration system like FIG and FAO argue that Geo-spatial information can help to formulate policies for adaptation to climate change particularly focused to land user needs. The study research by Arko-Adjei elaborates that land administration is an effective tool for sustainable living (Arko-Adjei, 2011). The data comprised in the land information systems is always useful to facilitate government to develop policies and plans for adapting to climate change (Molen, 2009).

As stated in earlier sections that land and its resources are more vulnerable to disasters. Settlements on hazardous or environmentally sensitive land are big failure of land use and planning. Disaster impacts human society resulting destruction, displacement and life losses and resultant land tenure issues include access to safe land, security of land tenure, and restitution of land rights and inheritance of land. Effective tenure security can reduce environmental degradation and more secure property rights to land will provide incentives for greater resource conservation (Deininger, 2003) This is supported by evidence indicating that improved forest management in practices were adopted in Nepal after use rights to state forests were transferred to communities and to individual farmers (Gurung et al., 2011).

Land administration system can contribute in a way that it can facilitate climate proof use of land and support the vulnerable in the struggle for large scale investments in bio-crops. Further, institutional reform in land administration can support of more land tenure security and land reform can support land management for climate proof land use planning.

Effective land management in context of natural resources like forests is one of the emerging issue of the developing countries. There has been widespread debate about land governance by civil society and international development agencies that good land governance is the key tool to reform land policies in the context of forest reserves in order to minimize the impact of climate change. It is the basic tool to make effective land use and land use change planning by government institutions at the local as well as national level. Therefore, by strengthening governance in land administration can help the institutions to make new policies in reducing deforestation and degradation, and enhancing forest carbon stocks to tackle climate change.

Further, establishment of a consistent computerized land information database can improve transparency in government and public access to land information. Up-to-date computerized record management will enable the government to better implement legislation that is intended to protect the rights of people as well as protect them against environmental stress like climate change. Ultimately, it is vital to improve land administration governance by improving accessibility, transparency and accountability of land administration systems.

Security of tenure, including rights of local communities for access to use forest land and resources are critical to success of carbon stock reservation and management projects. Land governance has important cross-sectorial, multilevel and territorially specific dimensions (Quan, 2014). The current policies and laws are not supportive for realisation of the role of community based participatory approach in decision making, which is one of important governance tool to fight against threats of elite capture on land through corruption of land officials.

Climate is changing globally and from above study it is clear that, there is a linkage between transparent land administration system, society and climate change adaptation. We need to work on an innovative approach to fill the gap between land institution, transparency and governance that incorporate concerns about climate change to improve human resilience to multiple hazards/risks. With spatially enabled transparent land

administration system, the concept of management of land, water, and biological resources, along with human interactions can be integrated in a way that promotes sustainable and equitable development.

3.4.2. Role of Land Administration (LA) in risk assessment and adaptation

Risk assessment requires information on the likelihood of hazards and on a range of vulnerability factors. Hazard risk maps and vulnerability assessments help identify priorities for action, including decisions about resettlement, improving tenure security and land use planning. Where hazard risk is high and land tenure is insecure people are more vulnerable to disasters. Further, paper based land records itself are vulnerable and need to be ensured that data is safe from the impact of disasters.

High resolution satellite imagery and other spatial data are useful for disaster mitigation and urban planning. A variety of spatial data over the hazard-prone areas is required. Hazard /risk maps and assess risks to support decisions about land use planning and resettlement. Education on property rights can help for preparedness and adaptations capacity. Land administration scientists are now more convincing about considering carbon credit right as an unbundled property right, which meets the characteristics of 'property' and then their registration can affects the whole system design (Molen, 2009). Land tools for urbanization and slum control aimed for shelter can keep settlements away from prone areas and resulting more safe settlements. Sound information base for planning for example through LADM (Augustinus et al., 2009) improving access to land and shelter, (Burns et al., 2012) and the continuum of land rights (UN/Habitat) can lead sustainable urban development through expanding equitable access to land, housing and basic services and infrastructure.

Development of effective monitoring systems are needed to assist agencies in making decisions under uncertainty (Smith & Travis, 2010). Local governments and national government may need to carry out strategic planning for incorporating climate change into planning, setting priorities, and effective management of water resources. Land Administration (LA) is an effective tool for sustainable living (Arko-Adjei, 2011), but it requires new concepts and tools to deal with anticipated climate change impacts. There is a need to develop the transparent and equitable land administration services that can only help people against the expected risk and vulnerabilities to the livelihoods of the people due to the adverse effects of climate change/variability.

3.5. Proposed framework of integrated land policies

- i. The starting point is to find out region specific climate changes and their effects on weather patterns and sensitivity of extreme events.
- ii. The next is to assess the impacts of these changes on land and its resources, on environment and ecosystem. The natural extreme events are sensitive to climate changes and their intensity and frequency is increased. These changes have impacts on natural resources leading to increased risks in loss of biodiversity, changes in ecosystem and habitat loss. Further, climate changes also directly effects human society by changes in irrigation system, crops productivity and water quality.
- iii. Thirdly, consider the land related issues including land tenure, land use and land management. Implication of land tenure resulting from climate change induced land use changes include displacement of human settlement and land degradation, land losses due to floods and landslides etc. Further land use changes in agriculture and natural resource may also bring changes in tenure systems over time.
- iv. Although human societies learn naturally from the climate changes and adjust themselves but these responses always are slower and cannot reduce their vulnerability and generates the requirement of systematic adaptation planning. Systematic adaptation needs an integrated approach in land policies and polices related to natural resource management.

- v. Land related issues like secure access to land for safe settlements and food productions, accessibility of quality water for drinking and irrigation, land degradation, deforestation etc. Integration of these issues into land policies can build up a sound baseline for integrated adaptation plantings. These adaptations include changes in irrigation means, switching crops, changes in crop zones, use of technology and better seeds for increasing productivity, building safety walls, barriers and safe roads for access to land, water and pasture, rural development to reduce population pressure on urban settlements and to reduce informal settlements in peri-urban areas, and policies for improved land use, resettlement, effective regulation of using and protecting land based natural resources.
- vi. For effective identification and assessment of impacts on land and accordingly policy formulation requires good coordination and exchange of information among all stakeholders dealing with different types of land. Finally the role of communities need to be considered for planning adaptation programs for specific types of impacts at specific region level. Effective involvement of community is needed for successful implementation of these policies specifically at community level.

The proposed framework as shown in figure 16 is not specific to one region or level and can be applied to assess land policy implications of climate change impacts for different communities and under different types of land tenure systems.

3.6. Summary

Policies regarding land sectors such as agriculture, forest and water including urbanization need to be improved and demand for introducing an integrated approach to deal with climate change adaptation. To meet this challenging demand, land policies can play a leading role in improving adaptation policies in the face of climate change. A thorough review of literature is made in this chapter is to explore the ways of developing integrated approaches to integrate climate change issues related to land into land policies. This study reveals that land policy, economic growth, poverty reduction and sustainable development has a close link with each other.

In section 3.2, this research explore about present status of different forms of land policies in general and also in particular context of our study area. The section 3.3, focus on answering the research question (i) about incorporation of land issues related to climate change into land policies. In section 3.4, research investigates about the need of effective coordination mechanism between all key stakeholders, institutions is vital to devise integrated approach for adaptations and resilience against climate change. This answers the research question (ii) and suggests that participation of all stakeholders can build strong foundation for developing such integrations. Land administration institutions should coordinate with each other for management of information about land which is required for assessment of suitability of land before its allocation for different uses. Good land and resource management is only possible if update information is shared among all institutions as well as people and community who directly response for all adaptation activities. Thus land administration can play its central role for providing information services needed to cope with increasing land use change resulting from climate changes and potential extreme events. Finally, in section 3.5, a framework for integrating land related issues and policies into adaptation policies is proposed which basically provides the answer to the research question (i).

This chapter provides an insight about the implication of land policies in the face of climate change and role of institutions dealing with different types of land in developing such policies. It provides a rational approach for incorporating land issues into land policies that are the outcome of social impacts of climate change.

In the next chapter, main focus on identifying the role of community in improving climate change adaptation. Further scientific literature is explored in the next chapter in order to understand the role of community at each step from assessment of impacts of climate change to developing policies and their implementation at local level.

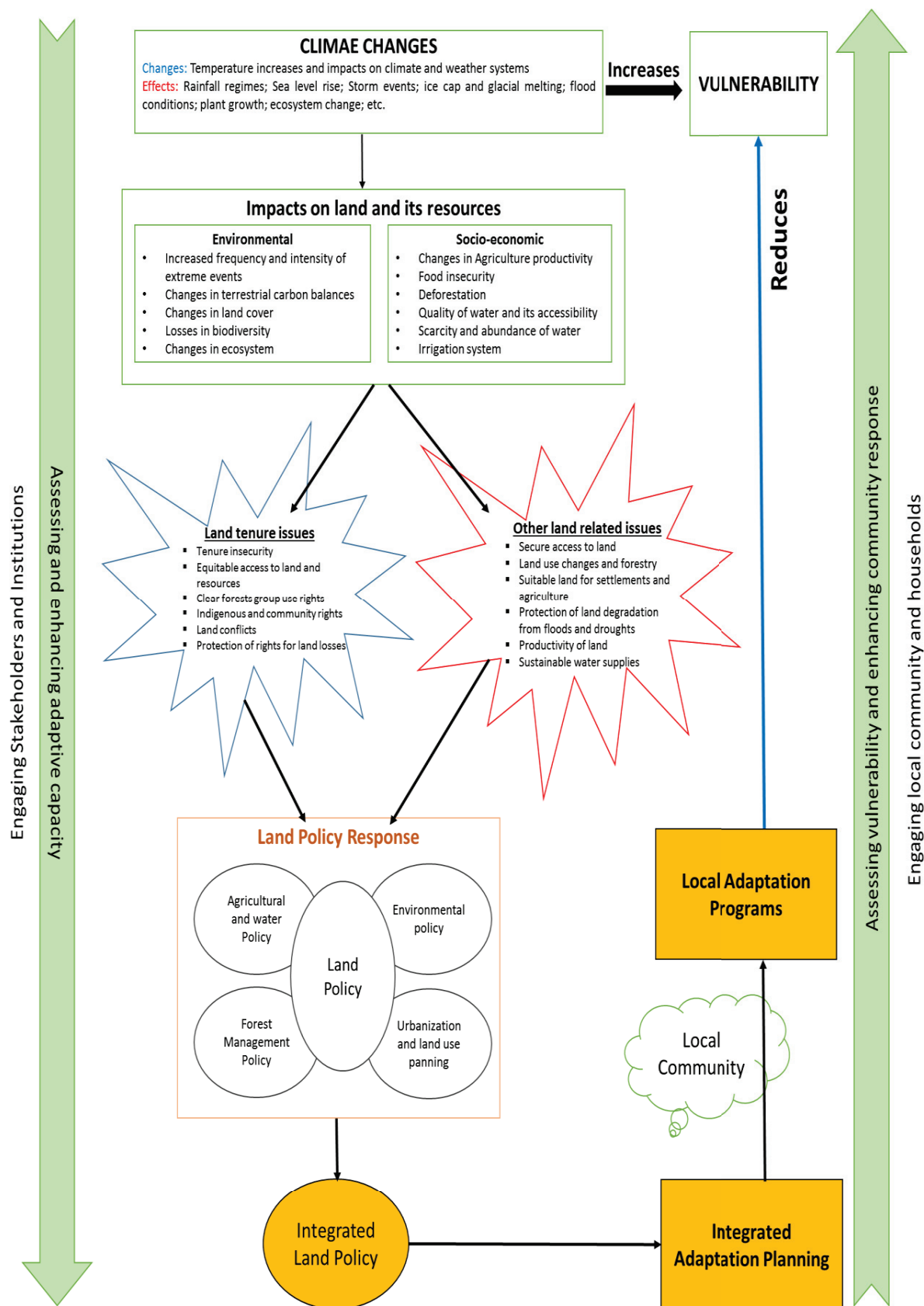


Figure 16: Framework for integrating land policies in adaptation planning

4. COMMUNITIES AND HOUSHOLDS IN ADAPTATION TO CLIMATE CHANGE

4.1. Introduction

Major population in Hindu Kush and Himalayas (KHK) mountain region is fragmented in different communities diversified by their traditional cultural, indigenous, religious demographics and economic behaviour. The whole area is vulnerable to effects of climate change, natural disasters and food insecurity. Yet, there is little attention about communities and individual people who are the most effected by the consequences of both climate change and government intervention policies regarding climate change in complying with international treaties and conventions like Kyoto protocol, “*UN convention on Biodiversity (CBD)*”, “*UN convention to combat desertification (CCD)*” and “*United Nations Framework Convention on Climate Change (UNFCCC)*”. These initiatives and agreements are set to keep climate change under control, whereas examining the relationship between climate change and land policy is the key demand for understanding the responsibilities, obligation of community and creating awareness among people for better response to climate change adaptation. The UN Food and Agriculture Organization (FAO) in its guidelines address this issue (FAO, 2012) but not in much details. However, these guidelines demand the participation of individuals and community for formulating legitimate tenure rights, laws and policies. Further, community based participation is important to understand obligations/responsibilities of community to prevent vulnerable people from the effects of climate change.

In this chapter, main objective of literature review is to analyse the obligations and responsibilities of stakeholders at community and household levels for adaptation to climate change. Main focus of this study is to find out the role of community for assessment of climate risks and vulnerability in context of people, agriculture and their livelihoods at local level. In addition, to develop an understanding of how adaptation to climate change can be improved, it is important to recognise that local knowledge of community can be a great source of information to learn about traditional adaptation practices and response behaviours of local community related to climate hazards. In order to keep the scope of this research limited, this study is focused to answers the following questions.

- i. What are the present activities on forest biomass and carbon stock in study area?
- ii. How can temporal carbon maps be used for improving climate change adaptation?
- iii. How can local knowledge of households and community support them for a better adaptation to climate changes?
- iv. What are the responsibilities of households and community for adaptation to climate change?

In order to develop an understanding to answer the above questions, a systematic review of all available documents, handbooks and guidelines related to community based participation for disaster risk management is conducted. For compiling this part of this research study, a broad search of published literature (journal articles and book chapters) on spatial analysis of vulnerability, mapping of climate related risks and hazards. A study of well-known geo-web portal administrated by ICIMOD for KHK region and its publications about the present status of carbon sink and sources in study area are reviewed in order to know about present situation of climate change impacts on land and other resources.

To find out relevant material to make it possible for this research, relevant abstracts were searched on academic databases including ITC academic library, Web of Science, Google Scholar search database, and FAO, IPCC, UNHABITAT, and ICIMOD Publications. Grey literature including conference proceedings, technical reports, working papers, project reports and policy documents available at official websites of ministries and online resources were also searched, however the ratio of peer-reviewed literature (journal articles and book chapters) is lower as compared to grey literature cited for in this chapter.

This chapter is divided into five sections. Section 4.2 address the conceptual background of regions specific assessment of climatic impacts and vulnerability of local community particularly to agriculture and livelihood. This section also provide an overview of present status of spatial and non-spatial information about land use

and land use change. Section 4.3 focuses on highlighting the role spatial analysis of vulnerability assessment with the key approaches of community based participation for collecting information about vulnerability. This section also highlights the potential role of local knowledge about climate change predictions and traditional adaptation practices in overall improving local adaptation strategies. Then in Section 4.4, some key responsibilities of individuals and groups at community level are identified for improving adaptation to climate change. Section 4.5 summarizes the findings and provides preliminary answers to the questions raised at above.

4.2. Assessment of region specific local impacts of climate change

While many projections about climate change are made at a large scale, but the impacts of climate change vary with different areas and regions in a different way according to the geographic location and nature of landscape. Frank Duerden in his article claim that impacts and responses are dependent on local geography as well as on variety of other factors like demographic trends, ethnic styles, means of livelihood and economic conditions of the area (Duerden, 2005). It is well recognized that climate change have considerable impact on the mountain areas due to their diverse nature of landscape whether they are Mediterranean or Tropic mountains. Studies show that high altitude mountain regions are experiencing more seasonal warming rates as compared to other land areas. For example, a study of four high mountain regions including the Swiss Alps, the Colorado Rocky Mountains, Hindu Kush and Himalayas, and the Tropical Andes for an elevation-dependent climate response provide evidence about the sensitivity of high hilly mountain areas (Rangwala & Miller, 2012).

Glaciers are retreating in Hindu Kush and Himalayas due to global climate changes and have significant impacts on ecosystem of this region (IPCC, 2007b). Impacts associated with these changes are more severe in this regions because these glaciers are source of water for ten major rivers water which is essential source for agriculture and hydropower there. This ecosystem supports the livelihoods of 210 million people living in the watershed of these mountains, and also provides essential water for more than 1 billion people living downstream (ICIMOD, 2011). In addition to weather pattern changes, degradation of glaciers is likely to exaggerate the problem of sustainable development, energy and food security of the region.

Downscaling of global circular model (GCM) outputs is widely used approach for assessment of climate change impacts and response at regional level. Available RCM and GCM Dataset nested with local meteorological data can be used to assess the impact of climate change on agriculture, forests and general landscape both at local and regional scale. Similar downscaling technique has been successfully applied by ICIMOD in the districts of Jumla and Mutsang, located in high mountains area of Nepal (ICIMOD, 2014a).

4.2.1. Status of forests land cover in study area

In assessment of climate change, two major factors causing climate change are accountable. One is deforestation and the other is GHG emission. Statistics about the status of forests in the area is summarized below in Table 2. The time series analysis from 2000-2009 show a continuous and considerable decrease in forests area which is ultimately reducing carbon stock (Shehzad, Qamer, Murthy, Abbas, & Bhatta, 2014). This change analysis was done by using supervised land cover classification of Landsat TM satellite images with maximum likelihood algorithm from 1992 to 2009. The total accuracy rate for dataset was 87.6% while both the producer's accuracy and user's accuracy for all classifications was over 80% except agricultural fields which was 78.9%.

Table 2: Land cover change in Chitral district, Pakistan Source: (Shehzad et al., 2014)

Land cover class	1992	2000	2009	Change (1992-2000)	Change (2000-2009)
Dense Conifer Forest	37,134	36,830	35,128	-304	-1702
Sparse Conifer Forest	21,958	21,610	20,472	-348	-1,138

Dense Mixed Forest	3,369	3,382	3,167	13	-215
Sparse Mixed Forest	1,293	1,230	1,232	-63	2
Grassland /shrubs	123,008	123,081	127,710	73	4,629
Alpine grassland	5,699	5,517	6,007	-182	490
Agriculture	23,276	23,330	14,332	54	-8,998
Bare soil	319,413	296,979	342,667	-22,434	45,688
Snow / glaciers	45,945	69,129	29,966	23,184	-39,163
Water bodies	748	753	1,160	5	407
Total Area	581,843	581,843	581,843	0	0

Out of total 60,000 ha of the study area, 3759 ha have already lost while the practice is still going on which is very alarming for the area and demands or urgent interventions of concerned authorities. Figure 17 shows the forest land cover distribution in 2009 in left and temporal analysis of forest degradation from 1992-2009 is shown in right.

In the light of above, depletion in forest reserves is a major environmental problem in the Chitral district. Based on this temporal analysis, projection for future degradation of forest in this area are estimated a further increase of 23% by 2030 (Figure 18) and if simulated this trend as per predictions, it is worse. The trend of deforestation at such a huge level shows the failure of state forest management and policies. People living in the village areas of district are highly dependent on these forests for their livelihood in many ways. For example, they depend on non-timber forests products for feeding of their livestock, for getting firewood for cooking and material for construction of their houses. People living in this area are already poor and dependent on agriculture and forests for their livelihood. Thus the present trend of forest degradation will further effect badly their livelihood conditions. Forest management and policies are also weak and not proactive to deal with this situation. Keeping in view of the present and future scenario, efforts to conserve and expand the forest and rangelands in Chitral are essential. In this regard, research study suggests options for diversifying livelihood to make people less dependent on forests and providing alternative sources of energy to reduce pressure on forests for fuelling purpose. Forest management practices needs to be improved by inducing participatory approaches and recognizing the role of community in the area.

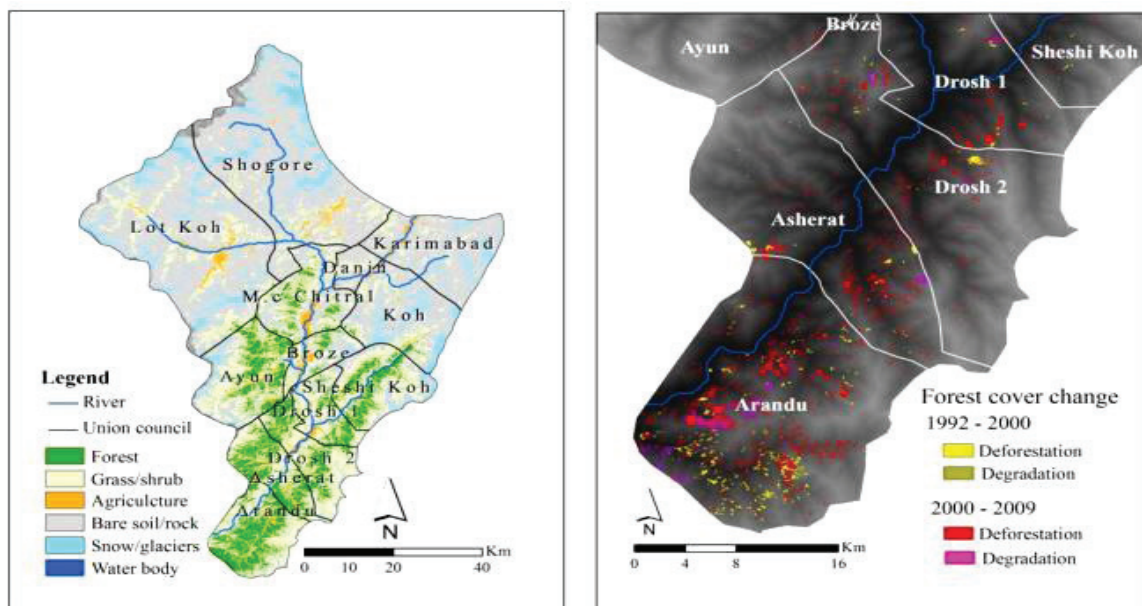


Figure 17: (a) Land cover in 2009 (b) Deforestation and forest degradation from 1992 to 2000 and 2009
Source : (Shehzad et al., 2014)

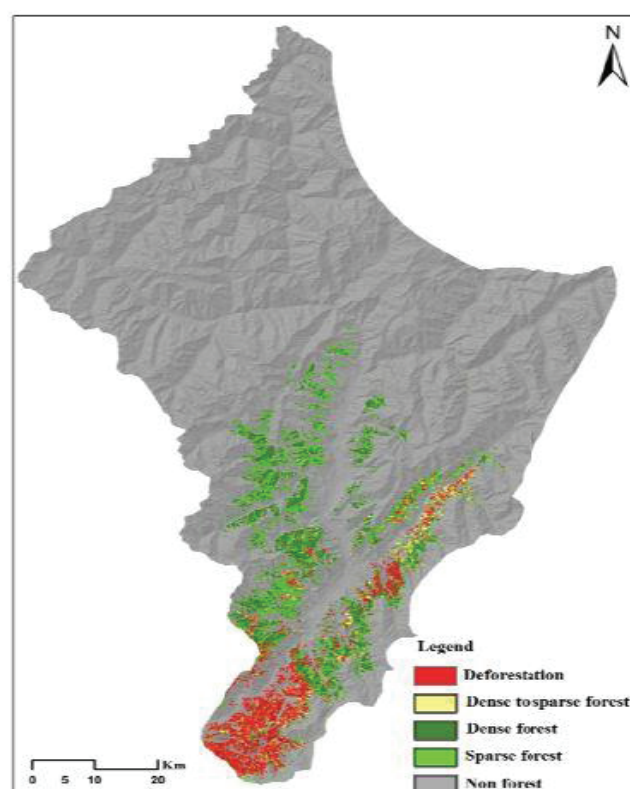


Figure 18: Simulated forest landscape for the year 2030 with base year 2009 (Shehzad et al., 2014)

4.2.2. Statistics of biomass and carbon stock in study area

The correct estimation of GHG emission depends on reliable land use change information. Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), the national space agency is actively engaged in research studies of impact assessment of environmental changes.

In Chitral district, it involve in monitoring of glaciers, mapping of snow cover mapping and carbon biomass and impact assessment of flood hazards due to outburst of glaciers in the area. The Global Change Impact Studies Centre (GCISC), Pakistan established in 2002 is mandated to keep track of the current and likely future trends of global climate changes in country scenarios. GCISC with the partnership of UNFCCC, prepared an initial summary report National Economic and Environmental Study (NEED) which is first systematic effort to project GHG emissions in this area for the coming decades under the BAU scenario as well as under specific policy scenarios (UNFCCC, 2010). Present forest policy Statistics for estimated greenhouse gas emission (GHG) in Pakistan with present status and projected growth is shown in Table 3 and figure 19.

Total GHG emissions is expected to increase by 60% by 2020 with compared with emissions in 2011 and increase by a factor of 13.3 by 2050 i.e. 4621 Mt CO₂eq. Overall this expected increase in next four decades in GHG emission from 347 to 4621 Mt CO₂ eq. shows a serious concern for climate change. Thus assessment of these two main accountable factors “forest land cover” and “GHG emission inventory” is important because of their considerable impact in changing the temperature, precipitation, glacier reseeded and water resources in the area.

IPCC special report on Carbon Dioxide Capture and Storage (IPCC, 2010) provides information about the sources of CO₂ emissions. According to this study report, 20% of the greenhouse effect is related to agricultural activities. Society is already concerned with the issue of food security for human being. Although,

safety and quality issues of food is of great importance but besides food, environmental and ecology issues related with global warming are also important. Therefore, ensuring food security with increased agricultural production without further stressing risks of GHG emissions is a big challenge.

Table 3: Projected GHG emission in Pakistan for 2020 and 2050 Source: (Malik et al., 2011)

Sector	2011	2020	2030	2040	2050
Energy	176	295	560	1250	2730
Agriculture	134	210	408	812	1765
Industry	20	30	52	61	75
LULUCF	10	13	15	20	35
Waste	7	9	11	13	16
Total GHG Emission (Mt CO₂ eq.)	347	557	1046	2156	4621

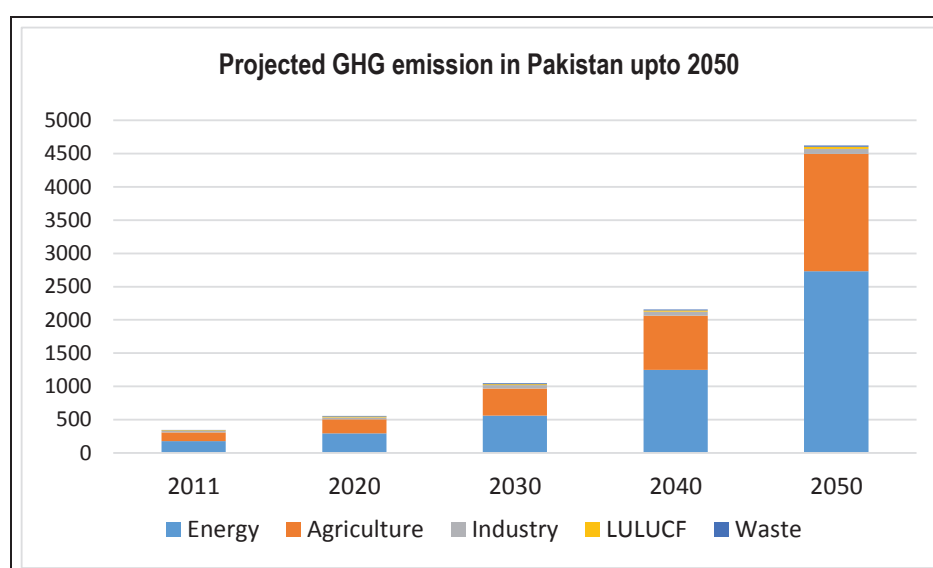


Figure 19: Projected GHG emission in Pakistan for 2020 and 2050 Source: (Malik et al., 2011)

4.2.3. Risk assessment in the context of people, agriculture, water and their livelihood

It is apparent from the study about community-level experience of climate change and associated risks on people's livelihood that assessment of impact of environmental changes on ways of their life is not an easy task. Different community groups within the same terrestrial area may respond differently to identical environmental changes because of different local situation, culture, and economy (Duerden, 2005). A study by Maarten K. van Aalst and others review about the community risk assessment (CRA) as a tool for climate change adaptation and highlight the importance of community engagement in climate risk assessment and reduction (van Aalst et al., 2008). In this study report, participatory community risk assessment is recommended as a tool for developing strategies to deal with the climate change impacts particularly at community level. While a large number of adaptation initiatives are ongoing across the globe however till to-date little attention is made toward assessment of vulnerability at community level. Only few examples are on the scene of vulnerability reduction of people, agriculture and water at community level. Situation become more worse where communities are poor and are more dependent on agriculture, water, forest, grasslands for food supply and for their livelihood.

The International Centre for Integrated Mountain Development (ICIMOD) is a regional intergovernmental panel of eight regional member countries of the Hindu Kush Himalayas including Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. ICIMOD provides the most up-to-date compilation of information on the current status of climate change in the Hindu Kush-Himalayan (HKH) region. One of ICIMOD report on current status of climate change impact on people and environment in Hindu Kush and Himalayas state that climate change has great impact on water, biodiversity, human health, disasters, and agriculture in the HKH region (ICIMOD, 2011).

Brief overview in country context

Pakistan is an agricultural country and 70 % of irrigation depends on water obtained by rivers mainly fed by the Hindu Kush, Himalayan and Karakoram glaciers. This natural water resources are rapidly decreasing due to weather changes in this area as a result of global warming. Due to the temperature variation, in summer season, there is also an increased variability in moon soon rains. Hence, whole country is in danger of frequent flooding in summer and droughts in winter. Being an agricultural country, its economy is largely dependent on agriculture, and, hence, highly sensitive to climate change. Study area, Chitral located in North West frontier of Pakistan, have very limited cultivated land due to its steep and sloppy mountainous terrain nature. Mostly population living in this area is poor and dependent on agriculture productions. This area is also very sensitive to climate change and is the home of frequent flash floods, outburst floods from glaciers, heavy rainfalls, landslides and droughts. Therefore, water, food and energy resources as well as infrastructure and economic growth are highly vulnerable to climate change here.

Pakistan with a diverse nature of terrain, have glaciers which are the major source of water for its river basin. Due to global climate change, it is facing extreme weather changes resulting floods, droughts and other disasters like earthquakes and land sliding in mountainous areas. The melting of glaciers and heavy rainfalls due to weather changes provide the irrigation water as well but also causing the flash floods in the rivers. Most of the population in study area is living close to the streams and river sides directly impacting on livelihood, land farms and infrastructure. According to a study by Maple-croft World 2010/11 rankings, the country is categorized as one of the prime climate change victim reporting the worst casualties due to climate change related disasters. Table-4 shows a comparison among most vulnerable Asian countries which indicates that Pakistan's rank is increased from 29 to 16 in one year.

Table 4: Maple croft Climate Change Vulnerability Ranking (Source: www.maplecroft.com accessed on 02-12-2014)

Maplecroft Ranking 2010 : Extreme Risk Asian Countries		
Country	Rank 2010/11	Rank 2009/10
Bangladesh	1	12
India	2	56
Philippines	6	44
Pakistan	16	29
Nepal	4	11
Afghanistan	8	3
Source: Maplecroft website October 2010		

Chitral

In Pakistan, Chitral District is located within the vicinity of KHK and is divided into two parts named "Upper Chitral" and "Lower Chitral". The main Chitral Valley consist of rugged and narrow subsidiaries all located along the criss-cross flow of Chitral River and its tributaries. The river originates from the Chiantar Glacier and enters into Afghanistan after passing through the 354 km long valley of Chitral. Apart from one main city "Chitral city", major population is diversified into variety of traditional settlements under discrete indigenous cultures situated in Lower Chitral. The district is in the rain shadow of high mountains and does not receive any monsoons (ICIMOD, 2011). In upper Chitral, mean precipitation is about 200 mm while in

lower Chitral, it is about 500 mm. Mostly rainfalls are received in spring and winter while summer and autumn are extremely dry receiving only 10 to 25 mm approximately (GoNWFP & IUCN, 2004). Below some statistics showing mean annual rainfall statistics are given in Table 5.

Table 5: Main annual rainfall of Chitral, Source (ICIMOD, 2011)

Month	Drosh			Chitral		
	Total (mm)	Share in annual rainfall (%)	Average/month (mm)	Total (mm)	Share in annual rainfall (%)	Average/month (mm)
Jan-Feb	162	25	81	91	18	47
Mar-Apr	245	37	123	278	54	139
May	61	9	61	41	8	41
June-Nov	150	23	25	62	12	10
December	40	6	40	44	8	44
Total	658			519		

Majority of rural people living in the area is dependent on agriculture. They also use nearby forests and rangelands for grazing and collection of dry wood for firewood. Property, agricultural land, and irrigation channels are under constant threats due to likely floods and droughts. Limited availability of land for settlements is also an issue because of the vertical nature of landscape (Shahid Nadeem, Elahi, Hadi, & Uddin, 2009). Life losses due to flash floods are reported very few, however, they become vulnerable for their livelihood because of their dependence on natural resources.

4.3. Improving climate change adaptation at local level

Before investigating about how to improve adaptive capacity of community and household at local level, it is necessary to understand how climate risks and adaptations are perceived, assessed and responded at local level. The previous section analyses the importance of community based assessment of climate change impacts on land resources, people and their livelihood. In this regard, review of literature and various project documents confess to make use of assessment approaches like community based climate risk and vulnerability assessments, and dynamic downscaling of global and regional climate change trends. Community based assessment approach is useful to identify region specific potential climate change impacts on land and its resources such as agriculture, forests, water and local hydrology and eco systems. In addition to scientific data about climate variability obtained through downscaling techniques, studying the existing local knowledge about climate variability, analysis of local resource management systems and an in-depth investigation about existing local coping strategies are essential in order to identify the needs and priorities for adaptation planning and bringing improvements in climate change adaptation actions.

4.3.1. Spatial analysis for vulnerability assessment to climate change

Since the emergence of evolving role of geo-information sciences to deal with societal concerns, there is a growing demand of using maps or spatial data to illustrate climate change impacts and vulnerability. Spatial data integration and spatial analysis have become standard tools in the toolkits of climate change vulnerability assessment (Sherbinin, 2014). Various approaches are being used for mapping exposure, sensitivity and adaptive capacity of target sectors or groups. Out of them, community based risk mapping is more contextual approach which engages both local authorities and community members for vulnerability mapping (Morrow, 1999). Spatial data acquired by using this approach can be useful for understanding enhancing adaptive capacity of communities and can help in making policies for building local responses to climate change.

With the aid of GPS technology and GIS software, geo-referenced risk maps can be produced. In order to identify and locate the most vulnerable households in community relative to climate hazards, these risk maps must have information about community resources as well as information about local organizations and institutions who facilitate for service deliveries (Tripathi & Bhattarya, 2004). Such kind of maps can only be

produced with the help of community participation (McCall, 2008). Participatory Risk Analysis (PRA) and Mapping is one of the successful tool that is already in practice in various places. Participatory Risk Analysis (PRA) and Mapping methodology was piloted in East Africa and South East Asia regions while its successful implementation is underway in Latin America, where a project by Trocaire (NGO) is ongoing project aiming at community based disaster risk reduction in 379 communities of the region.

In the light of above, it is clear that better visualization of complexity of human /environmental system can be done through spatial analysis of vulnerability assessment with emphasis on local context. Further, the growing demand for spatial information regarding vulnerability to climate change at local community level points towards vulnerability mapping. A recent study suggest that vulnerability mapping is not only a useful tool for geographic visualization of complexity in coupled human/ environmental systems but also builds understanding for subsequent discussions about adaptation (Preston, Yuen, & Westaway, 2011). But exclusion or inclusion of different kind of information in such mapping depends on different goals and objectives such as for enhancing adaptive capacity and / or reducing vulnerability. It is also obvious that spatially explicit information regarding vulnerability assist institutions for making policies and for facilitating adaptation process. Thus, integrating participatory information into technical exercise of mapping climate change at local scale subsequently provide better assistance the improvements in adaptation processes.

4.3.2. Spatial information for temporal carbon maps

As stated in previous section, while society is under the constant threats of by climate change effects, geo-spatial information play a crucial role in climate change analysis and adaptation for its potential impact on human society and ecosystem. Remote sensing (RS) and geographical information system (GIS) are applicable in producing variety of maps showing information about climate change that helps in assessing as well as in managing climate change related problems. Examples of such maps include temporal maps of snow/ glacier, land cover maps, carbon maps, maps of atmospheric dynamics, terrestrial temperature change maps, soil erosion maps, and hazard maps etc. All these kind of maps provide useful information to policy makers for developing mitigation and adaptation strategies.

Collection of past and present RS imagery make possible to analyse spatiotemporal patterns of environmental changes (Eniolorunda, 2014). Accurate information about sinks and sources of CO₂ is fundamental for correct analysis of carbon stock and derivation of GHG emissions to account for climate changes. On the other hand, this information provides the starting point for estimating climate change effects and future forecasting. Present and past researches only focus on revealing this kind of information in shape of carbon maps for mitigation. But climate change adaptation is also connected with climate change. In addition to mitigation, how adaptation efforts can be improved by using this kind of spatial information is still under question. And very little research studies has been made so far. Changing land use sites for agriculture, forest and settlements lead to increases in carbon (C) inputs as well as contribute to the sequestration of atmospheric CO₂. Thus, information about exact locations of carbon sources and their behavioral changes with time scale can help for choosing better methods of adaptation for improving these resources. Further, as these maps showing accurate inventory of above ground biomass across forest types can help in identifying degrading levels of forests. On the base of this information, better planning is possible for replantation of forest trees, choosing appropriate land for agriculture and importing seeds from other localities having better resistance to climate change which ultimately contributes towards improvements in overall C inventory.

Apart from mitigation option, evaluating carbon dynamics from temporal carbon maps contributes towards planning for better land use management strategies and ultimately enhance overall adaptive capacity of the system. As stated earlier, HKH region consists of diverse rugged lands with diverse soil types situated on steep slopes and highly sensitive to landslides and degradation. Main problem is that reliable data needed to estimate C stock for this region is not available. The Land Resource Mapping Project (LRMP) and Soil Science Division of Nepal (SSD) have conducted soil surveys in Nepal with the purpose of assessing soil types and distribution of soils for land-based planning for future agricultural development (Sitaula, Bajracharya, Singh, & Solberg, 2004). However, due to diverse nature of fragmented land in this region, the data available from this study is not suitable for estimating soil C in whole region.

Thus, there is an urgent requirement of managing dataset that include past and present condition of soil for understanding soil processes. This source of information database can improve adaptation strategies by effective land management in context of land conversion, soil management for carbon pools and better decision in choosing specific farming and vegetation systems such as organic farming that can contribute more for carbon sequestration rates as well as reducing vulnerability of agriculture sector.

4.3.3. Local community knowledge for better adaptation measures

In previous sections, the importance of participation of local communities in assessment of vulnerability and planning for local adaptation plans is highlighted. Indigenous people learn from the past and present climatic variations and adjust their ways of life and agricultural practices according to their indigenous knowledge transferred from their elders to new generation. Although present scientific knowledge about climate change variability have more precise estimations and prediction of future climate changes and its stress over natural resources, but the local knowledge of these community people cannot be ignored. Records show that integrating local indigenous knowledge and traditional adjustment practices with modern scientific knowledge about climate change can build dynamic information base that can support these communities better for adaptation to constantly changing climate (Nyong, Adesina, & Elasha, 2007).

Before the world recognized the emerging issue of climate change based on their scientific studies, local people already have awareness of local changes in climate and they try to make strategies by themselves to cope with the extreme events like droughts and floods and with changing weather conditions according to the local knowledge. Presently, Louis Lebel studied about contribution of local knowledge in adaptation to climate change in the Asia-Pacific Region and argue that meaningful hybridization of local knowledge and scientific knowledge can expand the opportunities of adaptation at community level (Lebel, 2013). In support of this argument, similar kind of studies about local knowledge regarding climate change was done in north eastern region of Bangladesh (Anik & Khan, 2012). Another study survey of social impacts of climate change on indigenous people in Latin America also suggest the integration of indigenous peoples' knowledge with local and government-supported adaptation schemes for cost effective and successful adaptation plans (Kronik & Verner, 2010).

Inclusion of local knowledge and existing traditional adaptation practices can be useful for effective planning of land and water resource management, building secure physical infrastructure and for improving adaptive capacity of both at individual and community level. For example, communal forest reserves are very important source of livelihood in traditional societies and of course, well managed forests not only provide food and timber resources to the community but also serve as C sinks. In this regard, local farmers well know about the fallow system of cultivation and can well manage the forests as compared to government institutions.

In addition, agroforestry techniques are being applied widely in order to extend forest reserves. These techniques are effective to cope with the changing conditions of soil and lead to an increase organic matter in the soil as well as improve agricultural productivity. But traditional knowledge of plants can be useful for scientists to gain knowledge about how different plant species can perform well under different environmental conditions. Local farmers make decisions at their own for planting and harvesting dates and crop switching based on local predictions of climate which show the wealth of local knowledge. Wealth of this knowledge can be utilized in developing early warning system that can help them for better prediction and interpretation about changing weather conditions and for making better adaptive strategies in agriculture in relation to weather.

In Hindu Kush and Himalayan region (KHK), a research study reviews about the support of traditional knowledge and local institutions for adaptation strategies at local or community level to reduce vulnerability to water stress and hazards (Shahid Nadeem et al., 2009). Research was carried out in four countries of KHK and Himalayan region where Chitral district was selected as case study in Pakistan where agriculture sector is badly effected due to floods as well as due to depletion of water resources mainly springs. The results show that the wealth of indigenous knowledge of communities to predict floods and droughts. For example they carefully observe the cloud density and movement of clouds, unusual bird and the smell of clay in order to forecast about weather changes. Further, people are shifting from plain areas near to steams and Nallas and building their houses on slopes due to the increasing rate of flash floods. In villages, traditional system of

perineal water channels is an effective way of water manage and supports modern adaptation strategies. For protection of livestock from negative impacts of climate change, people are able to identify safe grazing pastures and they also store dry fodder for future droughts.

In summary, integration of local indigenous knowledge into adaptation strategies is highly beneficial. It can provide the fundamental base for community based participatory approaches. Most climate change adaptation projects are created with the aim of improving livelihood and adaptive capacity of communities but these project can gain success only when local knowledge of communities is grasped in designing and implementation of these projects. Thus can be achieved only when communities effectively participate as joint partners in these projects. Finally, for effective communication between local intuitions and community, climate change policy should address the recognizing role of community and their indigenous knowledge in order to reduce the vulnerability and for sustainable development of the communities.

4.4. Role and responsibilities of community in local climate change adaptation

Local climate change adaptation programs bring significant benefits directly to individuals and groups at community level but there is need to define their role and responsibilities at different levels while planning, implementing and monitoring. In previous sections, participatory role of community in managing information for risk and vulnerability assessment is already discussed. Importance of local knowledge in planning and implementation of adaptation measures is also highlighted. Purpose of this section is to highlight roles and responsibilities community and households for adapting to climate change at Local level.

There are three major stakeholders who are involved managing the risks at local level: government institutions, private parties i.e. NGO's, and local community including individual and groups. Today, management of risks related to climate change at local level is becoming more significant due to specific nature of climate change impacts in different places under local environmental and cultural and economic conditions. Thus all these stakeholders have their own roles and responsibilities in improving adapting to the impacts of climate change.

In previous chapters, while some land related issues are highlighted and a framework for integrated land policies is proposed whose implementation can influence private sector activity. Many actions in adapting to anticipated climate change in study area will need to be undertaken by communities who directly respond to climate change risks in the same way they respond to other risks potentially affecting their livelihoods. However, both governments and communities may differ in their adaptive capacities to climate change depending on their sensitivity and exposure to risk, and access to resources and knowledge. Although, governments are primarily responsible for managing climatic risks to natural environment, land assets and service infrastructure but people have also some responsibilities for managing risks that supports and promote for private adaptation. Therefore, it is reasonable that communities must understand their role and responsibilities where individuals as well as groups can improve their responses to climate change related risks.

In order to manage risks from climate change impacts, local communities and people need to be aware of their rights on land assets and natural resources. They need to know how to manage them and they should have enough awareness and access to information about anticipated climate risks for developing their strategies to manage these risks. They should also well aware about the public goods and services provided by local governments for emergency responses and management of risks related to climate change. In order to support these actions, legitimate cover for recovery for losses and a well-functioning market such as insurance is needed that can provide enough incentives for their adaptation to manage risks. Further, they should also know about their rights to use natural resources, the regulations about land use planning and basic design of infrastructure such as building codes, restrictions for land use change.

It is also important that individuals and communities must improve their abilities to manage risks which is referred to as adaptive capacity. For effective actions to adapt climate changes, individuals and community should well aware about its potential impacts and risks. However, it is only possible if relevant institutions are able to provide accessible and usable information about region specific climate projections. All these

mentioned role and responsibilities were identified during the study of various documents and report out of them some are given below.

- A handbook for practitioners for Community based disaster risk management (CBDRM) (Abarquez, Murshed, & Center, 2004)
- A guidebook of disaster risk management (Westen & Kingma, 2007)
- Traditional Knowledge and Local Institutions Support Adaptation to Water-Induced Hazards in Chitral, Pakistan (Shahid Nadeem et al., 2009)
- A document titled "*VICTORIAN CLIMATE CHANGE ADAPTATION PLAN*" published by the Victorian department of environment and primary industries (DEPI) presently known as the department of environment, land, water & planning, Australia (DEPI, 2013)
- Adapting to Climate Change for Sustainable Agribusiness in High Mountain Watersheds A case study from Nepal (ICIMOD, 2014a) and
- CBDRM in Nepal (Laursen & Haigh, 2015)

4.5. Summary

The impacts of climate change vary with different areas and regions in a different way according to the geographic location and nature of landscape. In KHK region these impacts are more severe because of increasing stress on watershed of ten rivers due to melting of glaciers. Water resources are essential for agriculture and hydropower. Natural resources of these mountains are essential for more than 210 millions of people living there. Available RCM and GCM Dataset nested with local meteorological data can be used to assess the impact of climate change on agriculture, forests and general landscape both at local and regional scale. Thus assessment of "forest land cover" and "GHG emission inventory" is important because of their considerable impact in changing the temperature, precipitation, glacier reseeding and water resources in the area. Depletion in forest reserves is a major environmental problem in the Chitral district. Out of total 60,000 ha of the study area, 3759 ha have already lost and expected to increase of 23% by 2030. Total GHG emissions is expected to increase by 60% by 2020 with compared with emissions in 2011 and increase by a factor of 13.3 by 2050 i.e. 4621 Mt CO₂ eq. These projected estimations if stimulated further due to ongoing climate changes then situation is really concerning and needs attention. People living in the village areas of district are poor and highly dependent on these forests for their livelihood in many ways. They depend on non-timber forests products for fodder, firewood and building material. Thus the present trend of forest degradation will further effect badly their livelihood conditions.

Geo-information sciences have played an important role in providing information to illustrate climate change impacts and vulnerability by using maps and other forms of spatial data. For making risk maps and collecting information about vulnerability of people and land resources, community based risk mapping is more contextual approach which engages both local authorities and community members for vulnerability mapping (Morrow, 1999). This approach can be useful for understanding enhancing adaptive capacity of communities and can help in making policies for building local responses to climate change. For better visualization of complexity of human /environmental system can be done through spatial analysis of vulnerability assessment with emphasis on local context. Accurate information about sinks and sources of CO₂ is fundamental for correct analysis of carbon stock and derivation of GHG emissions to account for climate changes. This information can also provide help for choosing better methods of adaptation for improving these resources. Further, it helps for planning activities of land conversion such as choosing better places for replantation of forest trees, selecting appropriate land for agriculture which ultimately contributes towards improvements in overall C inventory.

Local people already have awareness of local changes in climate and they try to make strategies and adjust themselves to cope with the extreme events according to their local indigenous knowledge. Inclusion of local knowledge and existing traditional adaptation practices can be useful for effective planning of land and water resource management, building secure physical infrastructure and for improving adaptive capacity of both at

individual and community level. Local farmers well know about the fallow system of cultivation and can well manage the forests and rangelands as compared to government institutions. Thus, integration of local indigenous knowledge into adaptation strategies can be highly beneficial for better adaptation to climate changes.

There are three major stakeholders who are involved managing the risks at local level: government institutions, private parties i.e. NGO's, and local community including individual and groups. Although, governments are primarily responsible for managing climatic risks to natural environment, land assets and service infrastructure but people have also some responsibilities for managing risks that supports and promote for private adaptation. Local climate change adaptation programs bring significant benefits directly to individuals and groups at community level.

In order to manage risks from climate change impacts, local communities and people must:

- They need to be aware of their rights on land assets and natural resources.
- They need to know how to manage their land assets and
- They should have enough awareness and access to information about anticipated climate risks for developing their strategies to manage these risks.
- They should also well aware about the public goods and services provided by local governments for emergency responses and management of risks related to climate change.
- They should know about legitimate cover for recovery for losses and market based incentives such as insurance etc.

Further, they should also know about

- Their rights to use natural resources
- The regulations about land use planning
- The restrictions for land use change and
- Rules about basic design of infrastructure such as building codes etc.

At the end of this chapter, review of literature in context of this research study is complete. At the end of each chapter second, third and fourth, discussion about understanding the research objectives is made. However this study is not complete yet until it do not get input from primary data collected through field work. It is important for a research study to validate the assessment of findings from literature reviews with the help of original data collected through field work. Thus next chapter is about research data collection and analysis of results from field data collection. These results coming from field data will further discussed in later chapters along with the findings from literature review.

5. RESEARCH DATA COLLECTION AND ANALYSIS

5.1. Introduction

It is important to consider all possible data sources for getting information in order to build an appropriate background and understanding for illustrating the concept relevant to this research study. So far, in previous chapters, a systematic reviews of literature is done in order to build up an in-depth understanding about this research study. At the end of chapter 2, 3 and 4, a summary of knowledge building about each sub objective is given. However, these findings alone are not complete enough to draw the final conclusions about this research study. In addition to literature review, primary data is also an important piece of information for answering the specific questions posed during the research. Section 1.5 of chapter No. 1 describes in detail about the research design and methods used for conducting this research study. Multiple methods are used to collect the research data. Choice of an appropriate data collection method not only determines the suitability of data and also drives the direction of research towards its right way.

In this chapter, section 5.2 provides the brief description of selection strategy of different field sites for collecting field data. Section 5.3 illustrates in detail about the preparation for data collection including a brief about designing questionnaires and planning of data collection. The section 5.4 briefly discuss about data collection procedures and an overviews of data collected at field sites. Then, section 5.4 is about the data analysis approach, tools used for qualitative data analysis and a summary of analysis and results obtained from focus groups, meetings and interviews. In the end, section 5.5 gives the overall summary of this chapter.

5.2. Selection of study sites in study area

5.2.1. Field work sites

District of Chitral is chosen based on three reasons, one it is situated in Hindukush Mountain regions which is now globally recognised as one of the most sensitive area to climate change risks. The other reason is; it is the homeland of Calash people, one of the ancient indigenous group belonged to Greek Ancestor Alexander and they have ancient history of preserving their indigenous culture and thus can provide a rich source information about inherited local knowledge and practices that also relates to this research study for assessment of potential role of local knowledge in adaptation to climate change. The third reason is that Chitral had a status of state under its ruler called “Mehtar” and was merged into Pakistan in 1960 as one of the district of Khyber-Pakhtunkhwa province. Since then, it is one of the most neglected part of the country by the government for its economic development. Literature research confirms that only NGO’s are actively playing their role along with the community participation for improving disaster preparedness and economical betterment of different communities in whole district Chitral.

Three sites are selected for conducting the field work, one representing famous indigenous group “Calash” from lower Chitral. Main valleys of Calash include Rumbur, Bumburet, and Birir Valley. Climate Change in this area is leading to droughts, longer summers, short winters and less rain falls while declining forest and grazing land is effecting livestock particularly goat population which is a religious animal of Calash indigenous people. The other site “Shogore” is located in the valleys of one of the highest mountain peaks of the world called “Trich Mir”. Climate Change in both Shogore and Booni is leading to heavy rain falls, floods, landslides, river bank collapses, longer summers and short winters. In this area, streams contains higher ratio of sulphur in water coming from high mountain peaks which is effecting soil PH of the land in this area. Third site include the small town of Tehsil Mustaj called as “Booni”. Surrounding junction of two stream flows that are main cause of eroding fertile land into streams effecting cultivated land and urban land of Booni town. Figure 20 shows the location of selected field sites on map of Chitral.

In chapter 1, section 1.5.2 provides the complete description of study area regarding present situation of the climate and its environmental, social and economic impacts on local community. Further, with the help of resource information from literature, section 4.2 gives a brief information about the present status of GHG inventory as well as an assessment of vulnerability of people in context of their livelihood, agriculture, water

and forests. Table 6 gives the summary of major environmental risks of climate change related to land sector and their effects on communities living in this area.

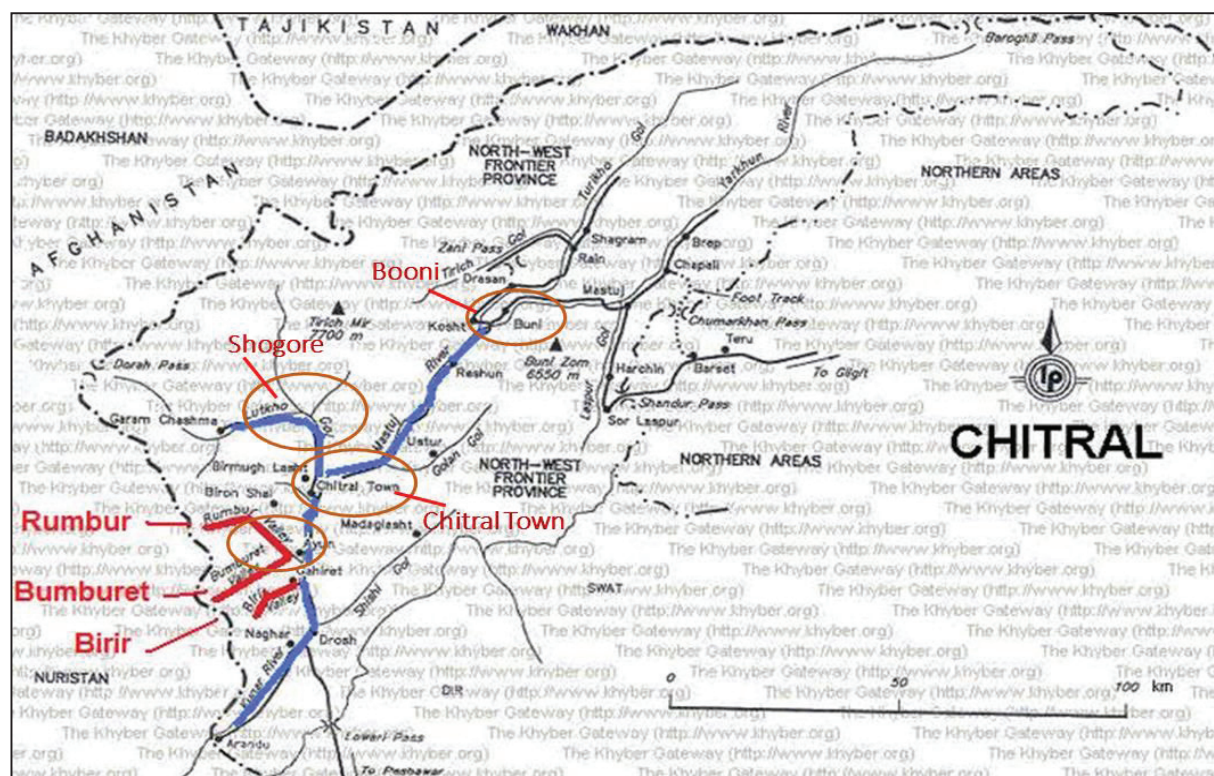


Figure 20: Locations of sites for filed data collection in study area (Source: <http://nativepakistan.com/kalash-valleys-of-chitral-pakistan>)

Table 6: Major climate related risks and it impacts in study area

	Land related risks	Major reasons linked with climate change	Effects / Impacts
1	Landslides	Avalanches, weather changes, Heavy rain falls	Forest degradation, Rangeland degradation , Degradation of sloppy land, Damage to settlements
2	River bank collapses	Heavy rain falls, River run off, Glaciers outburst	Effects on livelihood, Life losses and damage to livestock, Damage to settlements and infrastructure, Risks to tenure security
3	Soil erosion	Avalanches, Weather pattern changes, Heavy rain falls, Debris flow, Over grazing, Land degradation, Shifts in land use	Forest degradation, Reduced fertility of agricultural land, Decline in grasslands
4	Droughts	Heat waves, Glacier retreat, Weather pattern changes, changes in monsoon rains, Limited water supplies	Effects livelihood, life and property, Scarcity of water resources, Effects agriculture and forests
5	Floods	Changes in Precipitation, Glacier outbursts, Heavy rain falls, Unpredicted winter rains, Decline in forest reserves in upper stream,	Effects livelihood, life and property, reduced fertility of agriculture land, Effects on forests, grasslands and agriculture

5.2.2. Reasons for choice

While selecting these three different sites for data collection, main reasons are the severe impacts of climate change that are highlighted in Table 7 in previous section, but the other important reason is that these areas are highly populated and majority of people living in the villages of these areas are farmer and mainly depend on agriculture. Almost 90% of people in Calash and Shogore depend on agriculture and livestock as their income resources. Booni is small town located at 90 km to the north of Chitral main city and is one of the greenest part of Chitral having rich agriculture land and lands of apple, pear and grapes. Further, due to poor infrastructure of road network, almost whole Chitral is almost inaccessible. So, while selecting these field sites, accessibility of fieldwork location is important to collect as much as possible data within the limited time frame and resources.

5.3. Field data collection

5.3.1. Preparation

Designing field questionnaires

While designing questionnaires, on the basis of research findings from literature review in chapters 2, 3 and 4, a list of topics was constructed for the purpose to testify the assessment of these findings with the help of field data. Then questions were generated for each topic in order to get response from the respondents. Mainly questions were text based however they were supported by key choices included in each question in order to quantify the answers into response scale (strongly agree, agree, disagree, strongly disagree) for further analysis of the answers at later stage.

Procedures for data collection

There are many methods of primary data collection such as interviews, focus group discussions, meetings, observations and reporting etc. The most common methods for collecting qualitative data within limited time are interviews, meetings and focus groups and are selected for data collection for this research study.

(i) Focus groups

Focus groups is the methodology that produce data from listening people in groups and learning from them (Morgan, 1998). According to Munday (2006), initially this methodology was developed for the purpose of conducting academic research but since then 1950, it become more popular for collecting research data in health, social sciences and market research. The reason behind the popularity of using focus group as a method for gathering data is that this method can produce data and results very quickly and thus suitable for collecting data at low cost and within minimum time (Kitzinger, 1995). Thus, the focus groups methodology is suitable for collecting data for this research study. The main argument for using them in this context is being a cost effective method for collecting complex information in a short time. According to Berg & Lune (2004), a flexible and less structured approach is suitable for conducting focus group discussions to encourage the participants to talk openly to each other instead of direct answering the questions in order to develop an understanding for useful interpretations of collected data in later. The detailed guidelines for conducting focus group discussions and set of questions to be discussed in focus groups is annexed as B in appendix.

Objectives of focus groups are to discuss the climate change issues with participants in order to build understanding about local knowledge of community people, local adaptation practices, and their understanding about the climate changes in study area.

Sampling strategies for participants of focus groups

According to MQ Patton (2005), convenience sampling means to select whoever is easiest and closest, etc to save time, money and effort. This kind of sampling technique has its own limitation because it might affect the credibility of information collected, but it provides a flexible criteria to select group of participants who

can represent the local community as whole. Basic criteria for selecting participants under this sampling technique is to choose who is available that day or next coming day at the local community center, however, examples from ICIMOD study approaches for organizing focus group discussions in the study area were also considered. So, keeping this strategy, an average of 8-10 participants for focus group discussions were selected from farmers, highly reputed people of community and local school teachers who all come from similar social and cultural backgrounds and have similar experiences about the present climate changes in the area.

(ii) Interviews or individual meetings

Interviews, whether structured or semi-structured, are the most common source of data for qualitative research studied (Harrell & Bradley, 2009) because interviews gather the most factual material and data. For this research study, semi-structure interviews are more appropriate and considered useful because of their loose structure with open ended questions for collecting information from interviewee and explore in depth understanding from their knowledge and experiences.

Purpose of conducting interviews is to collect latest information about present situation of climate related issues, information about land policies, key activities related to adaptation and building understanding about the integration of land policies in context of climate change. Interviews are targeted to participants with high level positions in different institutions in order to get policy insight about the issue of climate change and adaptation.

A guidelines for conducting interviews with different participants along with set of questions is annexed as C in appendix. For interviews, officials of different land sector institutions such as agriculture, forest, water, local administration and participants from NGO's were selected. The length of each interview differs according to the nature of topic, but flexible structure approach allows to ask research questions in prioritized manner according to the time constraint, however all interviews are aimed to last for maximum 60-90 minutes only.

5.3.2. Planning Data collection

In order to collect data, three focus groups and two individual meetings officials of a local NGO's AKRSP and with country representative of international organisation ICIMOD were planned. Four interviews were also planned with officials of agriculture, forest, land administration, and local government authorities. A list of focus groups, meetings and interviews is given below.

- i. Focus group discussion in villages of Calash area
- ii. Focus group discussion in Booni and its surroundings
- iii. Focus group discussion in Garam Chashma, Shogour and its surroundings
- iv. Individual Meeting with representative of Local NGO AKRSPP
- v. Individual Meeting with country representative of ICIMOD in Islamabad
- vi. Semi structure Interviews with Local government representative
- vii. Semi structure interview with official of Agriculture office
- viii. Semi structure interview with forest officer
- ix. Semi structure interviews with Local land administration authorities

For conducting focus group discussions, at each site, people from nearby villages were invited with the help of people at the place of stay where the focus group was decided to conduct. On the next day, people who were available at the site in response to invitation were asked to join the sessions for discussions. For individual meetings and interviews, correspondence was made through Emails, telephone contact and by direct visit of relevant offices. A detailed list of activities performed during the period of field work is annexed as D in appendix.

5.3.3. Data collected

Type and amount of data collected

Data collected through both focus groups and individual interviews is basically a qualitative data type. A lot amount of data is collected which contain records of focus group discussions, summary notes of discussions, tapes in local language, however translated into scripts. Field data also includes the summary notes and set of answers from semi-structured interviews. Each session of focus group discussion and interviews is labeled and numbered separately to allow further processing of data systematically and efficiently. Further it is important to ensure that all the information is collected and recorded before leaving the study area.

Objectives of the meetings, discussion sessions and interviews of the officials were to assess the findings about integrating land related policies into climate change adaptation policies with the participatory role of people at community level. Overall response of all the respondents were remained satisfactory and data obtained through their answers is good for further processing and interpretation. A summary of qualitative data collection is shown in Table 7.

Table 7: Overview of how much data was collected.

	Unit of Analysis	Total No. of Respondents	No of Questions	No. of Session	Data Collection Methods / tools
1	Local People (Community)	29	23	06	Focus Groups
2	Agriculture Officials	02	12	02	Individual Interview
3	Local govt. Officials	02	24	02	Individual Interview
4	Forest Officials	02	10	02	Individual Interview
5	Land Administration Officials	02	24	02	Individual Interview
6	NGO's	03	24	04	Individual Interview
		40	117	18	

Quality of data

By taking care of selection of respondents for focus groups and officials for individual interviews made possible to collect reliable and good quality information. Both focus groups and interviewees were asked some direct questions and some other supportive questions in relevant to each topic listed for discussions, thus the respondents were able to discuss in details and they provided the maximum possible information what they know. After quick screening of and cleansing of raw data, some answers were directly quantifiable to answer the specific research questions while others provide a description of perception and experiences of the participants for a specific issues and thus the whole data collected is valuable for analysis and producing the unbiased and good results.

Limitations experienced at field sites

As far as data is concerned, there is no limitation about the data collected, however, due to inaccessibility of remote areas and shortage of time, only few sites were chosen. Bad condition of roads and dangerous zigzag unpaved tracks and travelling on rocks from Ayon (a place in Chitral) till Calash was a barrier to visit as many as village people for gathering them for group discussions. It was really difficult to manage focus groups and for getting appointments for interviews in short time. If the time and budget allowed, then it was quite possible to select more sites from different parts of Chitral for conducting more focus groups and interviews from civil society. However, overall experience was good and the amount of data collected is quite satisfactory for further analysis.

5.4. Data Processing and Analysis

The processing of raw data collected in field work is essential for arranging the facts before creating outputs in context of particular issue and raised research questions. Writing a field report is necessary to provide brief

summary of activities performed during data collection and is necessary for preservation and dissemination of the collected data for its further analysis.

5.4.1. Approach for data processing and analysis

The primary data collected from the field is in raw form which is not more useful until it is converted into well organised form for extraction of valuable information. Transformation of raw data into organized form immediately after each interview and focus group discussion session is essential to make it valuable for further processing and analysis. Sorting out relevant and irrelevant discussions information, although both may be valuable later, but this sorting can provide an immediate picture of results that are going to be as output later. Before starting actual analysis of data, processing of data includes a list of following actions to be taken for well organization of data.

- Sorting out and ordering of data
- Assigning initial codes according to the list of questions which is called labeling as in case of qualitative data usually the codes are in text form.
- Making of other additional analytical notes during through reading of transcripts
- Organizing and classifying codes and analytical notes by manual processing and managing them by using computer aided software such as “ATLAS Ti” as proposed in section 1.5 of chapter 1.
- Finally conceptualization of text labels and codes for their classification into tabular and graphical forma.

After sorting and processing the data, it has to be analysed in order to produce output and deliver specific information required for answering research questions. The procedures for analysis of both qualitative and quantitative data are quite different. Data collected through qualitative techniques consist of self-notes from interviews, group discussions and/or transcripts. Actually from the beginning, while sorting, ordering, labelling the data and then describing, summarizing, and interpreting data, already starts its analysis. During analysis, different appropriate qualitative statements are made based on the findings of organised data which produce the results. However, use of observations and other written data in shape of reports and photographs is also important to validate and interpret correctly what the participants actually say or mean.

In summary, for this research study a thematic kind of approach is suitable to use for data analysis which is the most common method for analysing descriptive qualitative research data (Thorne, 2000). After organising the labels and codes, steps involve the identifying themes for concept mapping using tables and graphs under the specific themes relevant to sub objectives of research study. Finally, in writing the results and summary of key findings, any difference if found are also illustrated.

5.4.2. Analysis and results

Analysis of focus group discussions

As stated in previous sections, three focus groups was planned for data collection about various aspects of this research study. These aspects include to get people and community views about local climate changes, its impact on land, and identification of land related issues and to get information about the local knowledge of communities about climate change. A summary of results is given in next paragraphs while the detailed analysis of data and results is included in appendix as annex-E which contains all the list of categorized and coded grouped data in the form of tables and charts in order to describe the level of response, agreement and disagreement on key points during the discussions extracted from group notes.

Some respondents replied that climate changes are from God’s will but analysis shows disagreement between focus groups about this belief. Others felt that reason is human activities/intervention to natural environment and global warming. All of them were able to identify the occurrence of more frequent glacier outbursts and heavy rainfalls in the area due to climate changes. Regarding coping with climate change impacts, majority of participants agreed on selection of safe areas for building houses and building of safety walls along river sides to protect nearby lands from damage. Participants of focus group F2 showed their concern about

encroachments in nallaas, and streams land. Respondents from Booni also suggested the construction of more water channels from rivers to divert river water into different places which can also provide the water source for remote areas which is facing the issue of lack of water availability.

Majority of the participants from all focus groups were agreed on weather changes due to climate causing for dry winter seasons in some parts of Chitral like Calash Valleys. Overall strong agreement was shown on occurrence of extreme events like heavy rainfalls, floods, landslides, glaciers outbursts in rivers and earthquakes. All the respondents were agreed that floods are being managed up to some extent by construction of safety walls with loose stone / wood with the help of NGO's and local volunteer participation but major length of river banks is still without safety walls and nearby settlements and cultivated lands are in constant danger. Due to changes in weather, changes are occurred in land use like shifts in land farms or conversion of land along with little effect on land holdings too. Over all response was in agreement among all focus groups F1, F2 and F3 about all the key points answered including only difference in opinion for dry winter seasons which are more prominent in Calash area as shown in Figure 21.

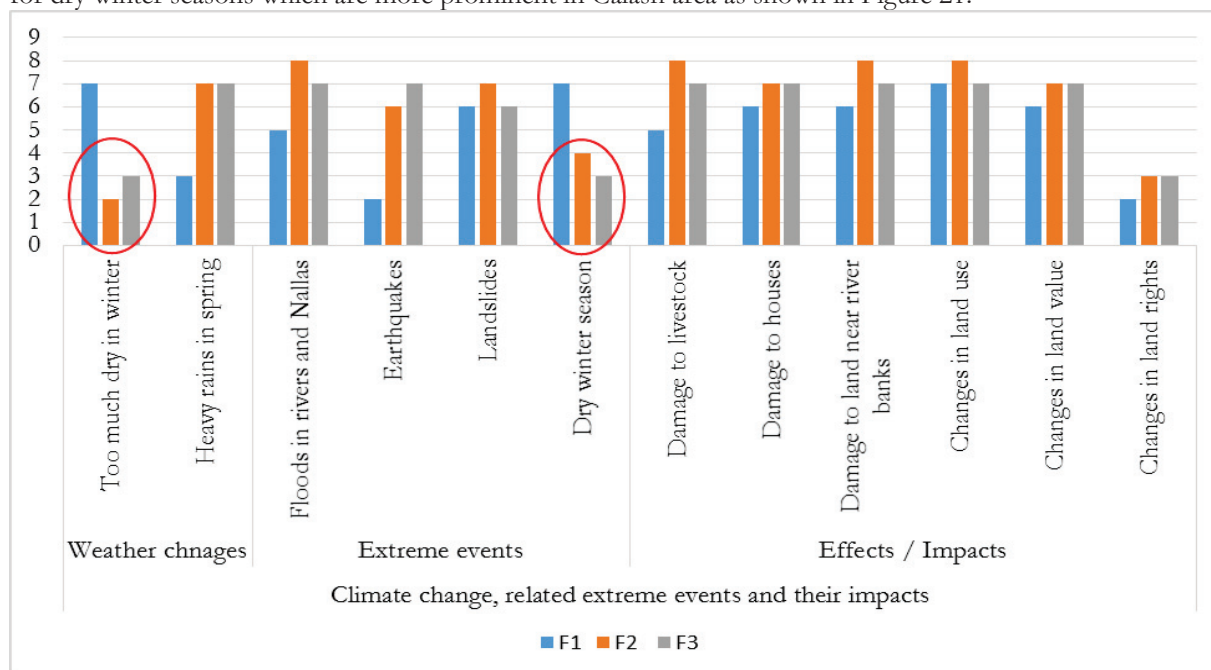


Figure 21: Response level and difference in opinion about weather related extreme events and their impact on land

Majority of the respondents from all focus groups were agreed upon the climate related issues with water sources in the study area. All the participants identified the rivers, springs, rains and glaciers melting as one of the major sources of water in the area. They also highlighted about the traditional system of perennial pipes which is mainly used as water resource for agriculture in all over Chitral. Calash people were complaining about heavy monsoon rains in the area of Drost and kalash valleys causing flooding in streams, however, participants of focus groups from Booni and Shogore were not agreed about the moon soon rains in summer. Most of the villages from Calash valleys like Bamburate, Bhumber and Birir complained about the shortage of water during dry winter seasons and demanded for setting up more water channels for enough supply of water where as people from Booni and Shogore surroundings being located near to Mustaj river are suffering from frequent collapses of river banks damaging nearby agricultural farms and settlements.

In focus group discussions, it was highlighted that mostly forests are belonged to provincial government. All the respondents were not satisfied about the present unclear use rights of forests and the rules of permit for wood use enforced by forest officials. All were agreed for awarding more financial benefits and transparent procedures. They also highlighted overgrazing, illegal harvesting of trees and weak management as the main causes of decline in forest reserves.

A mixed response was received about the knowledge about climate change and adaptation practices inherited from elders. Participants of focus group F2 are from Booni Town, who are mostly educated so they agreed a

little about the importance of traditional knowledge and they prefer to rely on information from media campaigns, NGO's recommendations and government announcements. Analysis of discussions also reveals that people living in rural areas rely on elders / seniors advices for adaptation measures related to agriculture but they were also willing to consider recommendation of NGO's working in their valleys.

Regarding adaptation to climate change, all were agreed that people are helpless for coping with extreme flooding now a days due to flash floods and glaciers melting water coming in the river. During discussion, some key adaptation measures including crop switching, adapting better seeds, building safe houses and at safe places were identified as shown in table 8 , but it was also highlighted that people don't know about these building standards set by government in case if they exist. Thus they agreed upon need of awareness programs as well as fair access to information about future climate change projections.

Table 8: People's view about climate change stakeholder's responsibility for adaptation

Theme	Code	Key points from answers	Calash	Booni	Shogore	Pattern of response
			F1	F2	F3	
			Participant = 08	Participant = 08	Participant= 07	
Causes of Climate change	Causes	Natural changes	6	3	3	C
		Human Activities	4	8	7	B
		Global warming	3	7	5	B
	Coping with effects of extreme events	Safety walls	6	7	7	A
		Stopping Encroachments	6	8	7	A
		Building Safe houses	8	8	7	A
	Who's responsible	Central government	3	6	6	B
		Provincial government	5	6	6	B
		Local govt.	7	7	7	A
		People	4	8	5	B

A: Strong agreement either positive or negative B: Mixed Response C: Disagreement

For discussion about the efforts being made by public and private institutions regarding building capacity of people and providing relief against climate risks, respondents from focus group F2 emphasized that local administration is responsible for adaptation planning but it is not active so far due to its limited resources. All the respondents were agreed on community role. They were willing to provide support like cheap labour / volunteer in case of projects related to manage disaster risks.

Summary of findings from analysis of focus group discussions

Analysis of focus group data result into following key findings that will support for further discussion in next chapter and for reviewing of key findings about research questions made through literature review in chapters 2, 3 and 4.

- A part from natural changes and global warming, human activities are also responsible for changes in climate. People living in this area are being effecting and due to their poor livelihood, they are vulnerable to cope with these climate changes.
- There is significant change in weather patterns in the study area due to climate change. Climate related extreme events are occurring with increased frequency and intensity and have great impacts on land sector including agriculture, forest and houses.
- Mainly land sector issues are related with agriculture including land use change, changes in land value and increasing potential on forest reserves. Other land related issues include land losses for people who own lands nearby river banks, streams and nallas. There is also increasing potential on forest reserves and forest are continuously declining in the area.

- There is continuous decline in forest reserves due to climatic related extreme events. Over grazing and unclear use rights of forests for local community are other major threats for forest reserves.
- Climate change also have impact on water resources. These impacts vary from area to area as in some areas it's the main cause of floods while in some areas it's one of the main barrier for water supply.
- As irrigation system mainly fed through water, therefore agriculture as well as livelihood of people is directly effecting due to changes in climate in this area.
- Local indigenous knowledge is of great value and a great source of information regarding local climate changes.
- Although other sources of information including scientific knowledge about climate change and its future predictions is important but at the same time significance of adaptation practices by communities according to their own traditional knowledge cannot be ignored.
- All have their individual responsibilities as they realize. Local authorities should impose restriction for informal settlements in prone areas likely close to river and should make concrete walls on shaky river banks. It is the responsibility of local government to frame rules and restrictions to stop environment unfriendly activities.

Analysis of data from meetings

For learning from experiences of private organisations involved in developmental projects in the study area, two most prominent organizations, “The International Centre for Integrated Mountain Development (ICIMOD)” and “Aga Khan Rural Support Programme (AKRSP)” were chosen as both have vast international and local experience and a lot of projects specifically related to climate change are at their credit. One meeting was conducted with chairman ICIMOD who is country representative in Pakistan and has a diverse background about running different projects in Chitral. The second meeting was arranged with representatives from AKRSP. During the meeting various issues were discussed like issues related to climate change and its adaptation, capacity building, land related issues, issues with land policies and coordination of stakeholders for information sharing related to current situation of climate related disasters etc. Overall respondents from both organisations were agreed to each other. Following figure 22 shows the level of 76 % agreement when both were agreed while on 6% of key points they disagreed with each other. However, a detailed comparison analysis of data obtained is annexed as F in appendix.

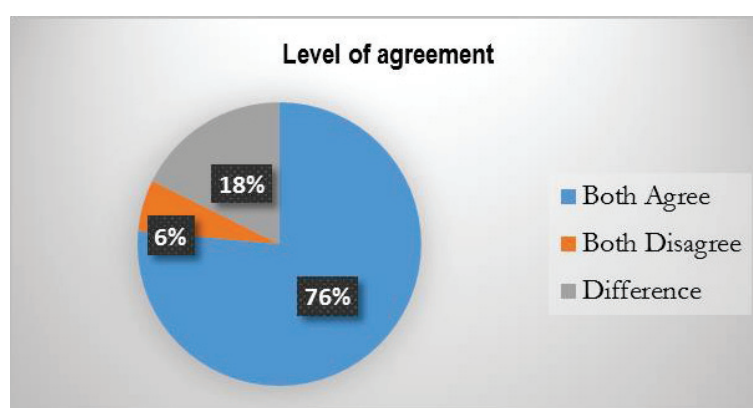


Figure 22: The level of agreement between the interviewees about identifying land related issues in context of climate change

The respondents from both organisations were agreed on majority of key arguments made during answering the questions. According to the both, the area is facing too much dry winter seasons and heavy rain falls during the spring season, which are more prominent weather changes due to climate change. Due to these changes in weather, frequency and intensity of extreme events like floods, landslide and earthquakes is increased as compared to past decades. They were also agreed that climate change have countable impacts on land sector including agriculture, forests and other land use like settlements. The land degradation is also prominent due to landslide which effect the land holdings as well changes in land value. A summary of these extreme events and their impacts on land is given in table 9. However, there was complete disagreement

about the argument about changes in land tenure and they were unable to link changes in tenure and climate change which actually shows the lack of information access about the land records from land officials.

While talking about forests, respondents from both organisations highlighted that the similar issues as discussed in focus groups related with forest tenure like unclear use rights on forests, complex permit rules for wood use for locals and lack of transparent procedures for allowing benefits to local's quantity for harvesting trees. Both were agreed on decline of forests due to weather changes related with climate change apart from other issues like timber mafia. Illegal cutting of trees for fire wood and over grazing which shows poor management and weak monitoring from forest authorities. Some suggestions were made regarding adaptation activities for example re-plantation of forest trees, effective monitoring of illegal harvesting and protection of forest trees from environmental changes. Both were agreed on the actions to be taken like redefining use rights, introducing group rights at community level as well as offering cash benefits to people for offering their participation in management of forests. Figure 8 shows the high level of agreement on key viewpoints.

While during discussions, they were agreed that people have strong inherited knowledge about climate changes. They stated that people in the community already know about the different kind of lands as well as they know about the nature of lands that can help them for better improvements in agriculture. However, at the same time, both disagreed for their level of knowledge about the fertility of crop lands and identification of safe settlements.

Table 9: Causes of climate change, climate related extreme events and their impact on land sector

Questions / Themes	Code	Key points from answers	ICIMOD	AKRSP	Level of Agreement
Climate change, related extreme events and their impacts on land	Weather changes	Too much dry in winter	A	B	Both Agree
		Heavy rains in spring	A	A	Both Agree
	Extreme events	Frequency	A	A	Both Agree
		Intensity	A	A	Both Agree
		Floods in rivers and Nallas	A	A	Both Agree
		Earthquakes	B	B	Both Agree
		Landslides	A	B	Both Agree
		Dry winter season	B	C	Difference
	Effects / Impacts on land	Damage to livestock	C	B	Difference
		Damage to houses	C	A	Difference
		Effect on cultivated land	A	A	Both Agree
		Damage to land near river banks	B	A	Both Agree
		Effect on land holdings	A	A	Both Agree
		Changes in land use	A	A	Both Agree
		Changes in land value	A	B	Both Agree
		Changes in land rights	C	C	Both disagree
		Damage to Informal settlements	C	A	Both Agree

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Classification of key points extracted from meeting notes provides information about some key efforts made by public and private institutions for capacity building of people as well as give an understanding about the role of community to cope with climate changes. Further, issue of lack of coordination among all these stakeholders including community was also highlighted during the meetings. Overall they agreed upon that people at community level should have access to information so that they can better respond for activities like crop switching and selection of better seed to cope with climate change effects on agriculture, and building their houses at safe places.

When they were asked about the present status of land policies and possible integration of land related issues into climate change adaptation strategies, both claimed that as such there is no any concrete policy exist at national and local level. According to their knowledge, they argued that some documents are available which can be classified as a set of national land policies but there is no clear cut policy which can address the issue of conservation of carbon stock and reduction of GHG emissions as well as can provide guideline for structuring adaptation strategies and implementing them at local level. Additionally they highlighted the disaster relief programs of National Disaster Management Authority (NDMA) but also claimed that due to absence of coordination among NDMA and private organisations and due to lack of concrete policies, efforts being made for risk management, relief and adaptation programmes are not fruitful till to date.

Summary of findings from analysis of meetings

The assessment of this data from meetings shows overall agreement with the assessments and findings made through focus group data, however detailed summary of analysis for similarities and difference between two sources of information is discussed at the end of this chapter. Analysis of data collected in these two meetings come up with the following key findings that will support for further discussion in next chapter for finalizing the answers to the research questions.

- There is significant change in land use due to climate change.
- Increasing frequency floods and landslides have affected the existing cultivated areas, forests and land holdings particularly near to nallaas.
- Informal settlers and people living in nearby river beds and streams are mostly effected for their damages their houses, cultivated lands and livestock.
- Forests in the area are continuously declining due to many reasons including climate changes, human activities and poor management.
- Further, unclear use rights are also responsible for promoting illegal harvesting of trees thus causing decline in forest areas.
- Community participation is really important in adaptation activities like re-plantation of forest trees, effective monitoring of illegal harvesting and protection of forest trees from environmental changes
- Prompt actions are suggested to be taken by authorities like redefining use rights, introducing group rights at community level and defining proper mechanism of cash benefits to people for their participation in management of forests.
- Agriculture and people livelihood is strongly effected due to climate changes in the study area and adaptation program can only get success if community is actively involved.
- People have limited scientific knowledge about the recent climatic impacts on land.
- Local community need more access to information held with different institutions in order to learn more about the nature of changes in land occurring due to climate.
- Poor coordination exist between all public and private stakeholders regarding data sharing which highlights the weak structure of policies as well as a barrier for access the information to people and community who are directly going to response for the adaptation activities.

Interviews with forest officials

In order to collect information about present status of forest, and relevant key policies for its management, two individual semi structured interviews were conducted with the senior officials of local forest office of Chitral and Booni respectively. Similar questions were asked to both officials. Both officials shared enough information about the present status of forest tenure and the present status of forest reserves in the area, however both were reluctant to provide information about policy issues related to forest management linked with climate change. The detailed analysis is given in appendix as annex G.

Officials informed that mostly forests are government property mainly classified as Forest Reserves, Protected Forests and Private forests. For local people, legal rights include use rights of timber for non-commercial use, fodder and fuelling. Forests decline is mainly due to poor forest management and monitoring and discarded land tenure. They also reported that presently 4000 ha area has been declined in past 15 years.

They agreed about the present discordant structure of property rights on forests for which details are summarised in table 10. They accepted that quantity restrictions for cutting trees for non-commercial use of local people is being applied so local people are enforced to use illegal ways for getting wood for building their houses. Also, due to weak governance and non-efficient monitoring, both timber mafia and even some corrupt government officials are involved in illegal harvesting of trees. Further, they highlighted that, at present, local community have no much influential rights of use on forests.

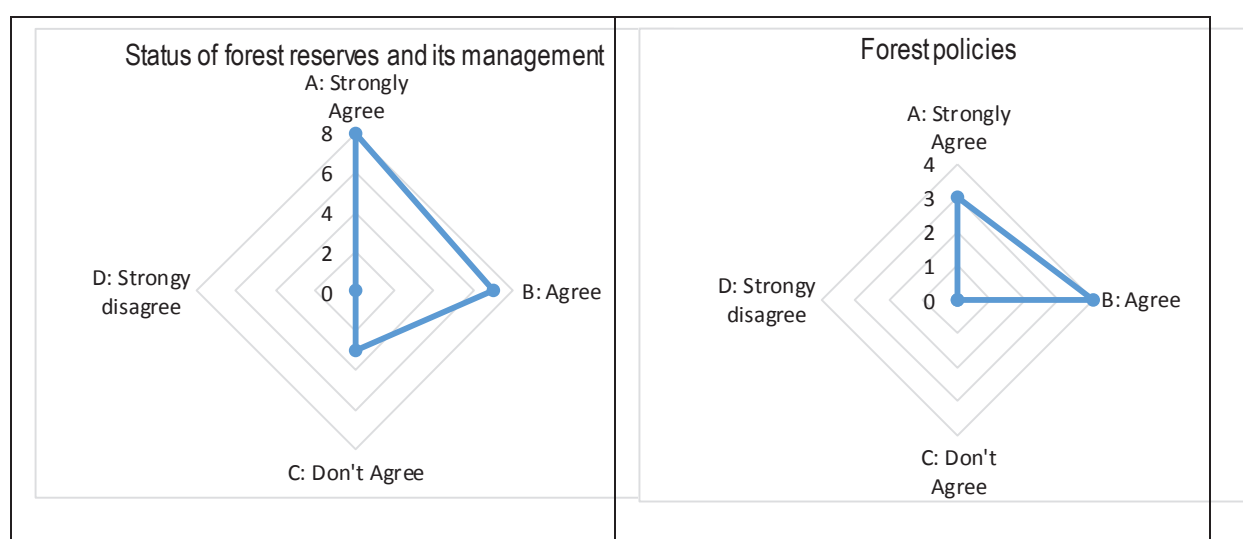
Table 10: Tenure issues particularly for forest areas and assessment of community role in bringing reforms in forest tenure

Code	Key points from answers	Response
Tenure issues	Restrictions for cutting trees by local	C
	Discordant structure of property rights	B
	Unclear system of contractors	B
	Unclear use rights	B
Community's role	By introducing influential rights of locals	A
	Revising system of contractors and permits	B
	Introducing cash incentives for re-plantation	B
	Benefits for protecting forests by locals	B
	Promoting farming to reduce pressure on grasslands	A
	Promoting private forest farming	A

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Both officials claimed that forest policy exists at provincial level including some ordinances addressing issues of deforestation related to climate change. Other policies include energy conservation, renewable resource policy etc. But they also accepted the weak level of implementation at local district level.

While querying about coordination with other stakeholders, they claimed that enough coordination exists among all the stakeholders particularly among public organizations. They further declared that information about the development plans for natural resources relate with forests is shared among all institutions and also any sort of information can be accessed through requests at any time. Figure 23 shows the level of agreement in opinions from both officials which shows that their answers mostly fall in the area of agreement showing no any prominent difference about any key information provided by one after the other.



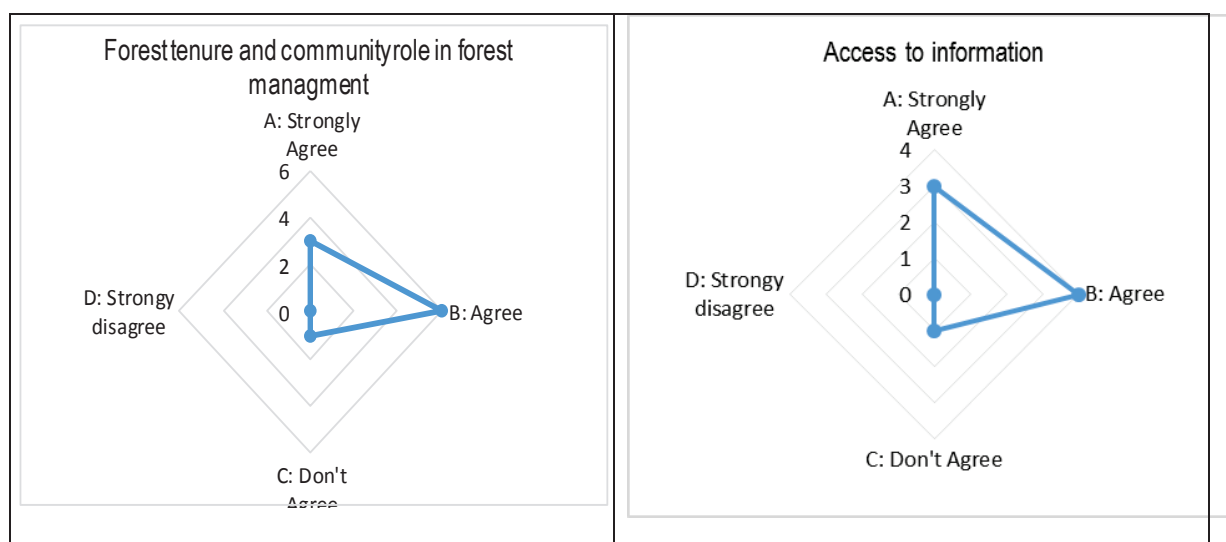


Figure 23: Level of agreement between respondents for four major concepts

Summary of findings from analysis of interviews of forest officials

Data collected through semi structured interview from officials of forestry department provided a lot of information for understanding the present situation of forests in the study area and causes of degrading forests including issues related to forest tenure. Analysis of data collected from these officials bring the accountable results that can support for further discussion for answering the research questions particularly related with community's role for improving adaptation plans at local level as well as identifying the two fold benefits associated with this approach, one is effective management of forests and the other by helping community for improving their livelihoods who directly or indirectly also depend on forests resources. Following key findings are summarised in the light of above analysis.

- Forests are mainly of government property so it is solely responsible for management of forest reserves.
- The forest are quickly declining due to various issues likely climate changes as well as due to weak management of forestry department. Thus, locals should share ownership rights of nearby forests as well as a mechanism of incentives can be devised to encourage them for planting trees in their nearby areas of residence to increase the population of trees in forest land.
- Implementation of land policies at local level is totally absent. Present policies do not have enough room for addressing all the issues related to land sector including land tenure issues for effective management of forest for both preserving carbon stock and for better adaptation measures to improve the production of forest trees and natural grasslands.
- Limited use rights and unclear structure of ownership rights on forest and grass lands is a major barrier which is further boosting decline in forests.
- The present level of mutual coordination among stakeholders is satisfactory but there is need to assess the quality of data related to carbon stock as well as estimation of above and below ground biomass so that local adaptation planning can be made more effective and fruitful.

Interviews with agriculture officials

A detailed analysis of all the information gathered through interview with agriculture officials is enclosed as annex-H in appendix. Due to change in weather, no significant changes occurred, however, planting and harvesting dates have been changed. In this regard they claimed that office of the agriculture department based on recommendation of agricultural research council, proceed the information to farmers regarding cropping dated and they are adapting accordingly. Further they also informed that aluminium and urea fertilizers are most suitable for the area due to present condition of the land. They highlighted the other issues with agriculture land like limited growth in cultivated land due to its terrain nature and further it is declining due to presence of farm lands closed to river beds being damaged by floods and its conversion into urban land due to population pressure and unplanned housing schemes.

Regarding soil condition of the study area, they informed that deforestation due to climate change and cutting shrubs for firewood weakens the soil among rocks which is the major cause of soil erosion. Watersheds are also responsible for soil erosion. Flash floods are also causing soil erosion in this area. Soil of district is slightly acidic to slight alkaline while increasing intensity of flood water flow also effect soil PH. Although, they were aware with the fact that agriculture land is being effected by floods and other climate related extreme events including landslides, and changes in weather patterns, but they were unable to quantify about the level of direct damage to ownership rights of farmer who own the land particularly near to streams and rivers.

While discussing about the water resources in the area, both officials highlighted that water channels also called perineal pipes are the major ways of irrigation adapted from historical times. It is the old and successful way, because farm lands usually are at higher level from river and streams. Mainly glaciers melting, snow fall fed while in some area monsoon and unpredicted winter rainfalls are the major sources of water in river and streams. They also highlighted the issue of shortage of water in winters as mostly winters are dry.

Both officials were well aware about the issue regarding information sharing about the latest quickly changing climate conditions for agriculture sector, and its timely access to farmers, however they emphasized that they have registration schemes for all farmers to be registered with agriculture department, so that they can send information updates about seeds, plantation dates and suggestions for crop switching. Further they also highlighted that coordination with other departments like forest, water management board and district government. They claimed that the new kinds of species are readily available to registered farmers at discount rates.

Summary of findings from analysis of interviews of agriculture officials

The summary of key results obtained through analysis of interview data from agriculture officials is given as under.

- Climate change have its significant impacts on agriculture land in terms of its fertility, soil erosion and changes in planting and harvesting seasons.
- Mostly cultivated land is situated near the rivers and streams, so due to frequent floods cultivated land is also being damaged besides its conversion into urban land due to population pressure and unplanned housing schemes.
- Glaciers melting and rainfalls are the main sources of water tributaries of the study area, therefore changes in glaciers melting and rainfalls due to present changes in climate conditions have strongly effected water resources as well as its associated beneficiaries like agricultural land and people.
- Present structure of water channels is poor and its capacity need to be improved in the light of future projected climate changes for fair availability of water supply for drinking as well as for irrigation purpose.
- Information related to short term climate changes and its possible impacts on crops needed to be passed to famers well on time.
- Further, information updates about seeds, plantation and harvesting dates and suggestions for crop switching and other coping strategies is not transferred quickly on time.

Interviews with land administration officials

Land administration system in Pakistan is based on land registers and cadastral maps (Ali & Nasir, 2010). The present land administration system only maintains land records for the purpose of collecting revenue from rural agriculture land. In order to collect data for in depth understanding of the institutional capacity, structure of land rights, present status of land policies and present status of spatial data and land register, interviews were conducted with the assistant commissioners of Chitral and “Tehsildar” from Booni. Efforts were also made to interview Patwari who looks after the whole land administration system at grass root level, but remained unsuccessful to catch these officials due to two reasons. They were not willing to meet for interviews pretending to be very busy, but the other main reason was their bad reputation among the society due to which they were reluctant to meet for exposing their real character. Further overall response from

both officials was a mix of agreement and disagreement between both as shown in figure 24 below. However important results were extracted from their responses during the analysis which are summarized in next paragraphs while the detailed analysis is enclosed as annex-J in list of appendixes.

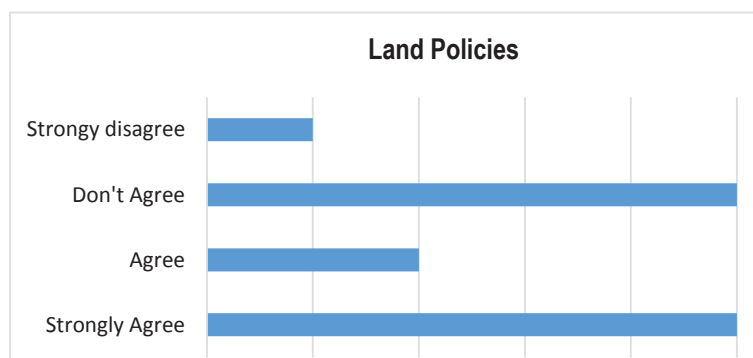


Figure 24: A mix response against different key points regarding policies

In response to query about present status of land policies, they claimed that there is law forced by federal government and adopted by KPK government which is also applicable at district level. So same is applicable in this area after its merging into KPK province as district in 1960. They denied about the existence of such policies related to climate change regarding land use change, changes in land value or about new emerging use rights / restrictions related to climate change. Table 11 shows an overview of information about land policies given by the land officials. They were seemed to be confused to recognise the role of land administration in present scenario of climate changes and its responsibilities for combined efforts for adaptation to climate change and to control over the human interventions that are causing climate changes.

Table 11: Information about existing structure of land policies at national, provincial level and local level

Code	Key points from answers	Response
Policy defined	Set of documents	A
	Laws and legislation	A
	Rules and Procedures	A
Status of land policy	Federal law adopted by provincial government	A
	Historical law before merging into province in 1960 from old rulers	B
Rules about land tenure	Federal tenancy act	A
	Inheritance laws	B
	Islamic laws	C
Policy about climate change	Buffer zoning along river beds	C
	Safe areas for settlements	C
	use rights restrictions	C
	Engineering and building standards	D
	No policy about monitoring encroachments in river beds	C

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Regarding status of land records and spatial data, cadastral maps are in paper format along with some old maps and sketches that show demarcated boundaries and limits of rivers, lakes and streams but there are no any marked safe zones on these maps. They were also aware of the fact that informal settler have mostly illegal encroachments on land inside the river beds. Land department only updates the land records based on the owner's request after the occurrence of disaster events, Tehsildar and local Patwari visits the area for re-measurement and acquisition of land according.

Questions were also asked to the land officials regarding their view point about climate change and its impacts on land. Both were agreed that due to climate changes in the area, weather is being changed and thus causing expansion in river beds, degradation of forest lands, and changes in agriculture area. They claimed that due to large area of rural agriculture land now being kept as uncultivated and also is effecting the land revenues obtained through agriculture lands.

They also informed that this office provide land records as wells take part in front line with NDMA during the monitoring and rehabilitation work after floods or disasters events. It means they are preparing the record of damages to land, property and life but how these statistics are accessible to other public and private organisations is questionable and unclear.

Summary of findings from analysis of interviews of land administration officials

Following are the key findings regarding results of analysis of these interviews with land officials. These key findings can further help for discussion of answers to the research questions in next chapter.

- Land policies for land tenure and management of land should be transparent and must be integrated with the climate related policies and adaption practices in the study area.
- The existing structure of land administration system shows weakness in intuitional capacity of this department.
- There is also a lack of recognition of roles and responsibilities that land administration can play for effective management of land use, land use change in context of climate change.
- Demarcation of latest boundaries and re-measurement of all land holdings closed to river banks are mostly in from of sketches and not in digital format.
- Digital spatial information can provide support to all public and private organizations who are actively involved in planning developmental projects for improving adaptation capacity of people and institutions.
- There are significant changes in land use, land use change, land tenure in response to changing climatic conditions of the area.
- Data collected during disaster relief activities may be readily available to all public and private organizations who make plans for adaptation activities as well as for future risk management.
- Thus, land administration can provide up to date spatial information in shape of hazards maps, as well as up to date land records and cadaster maps for assisting the relevant institutions to assess the vulnerability of agriculture, water and people.

Interviews with district government officials

Local administrations including local governments, union councils and municipalities are the first line of defence in responding to challenges related to climatic changes (Ingram & Hong, 2011). Local administrations also respond at very first for any disasters occurring in their jurisdiction. Thus, they need to adapt. Interviews were also conducted with the officials of district government Chitral and tehsil administration of Booni in order to understand the role of local governments in adaptation planning, land policies related to climate change and implementation of these adaptation policies at local level. Detailed analysis is annexed as K in list of appendices.

Like other respondents from focus groups and interviews, they were also agreed upon the fact that climate change have a significant impact on land including changes in land value, land losses due to climate related hazards like floods and dry winter seasons. They also explained about the accountable manages to land, livestock, individual land holding and public infrastructure due to frequent floods in the area.

Thus both officials were asked some questions about their responsibilities in responding to the challenges of climate changes and related hazards. They claimed that the federal and provincial governments are initially responsible for planning and financing the adaptation and risk management projects however they accepted that local governments are first line of defence against climate related hazards and they are responsible for public safety as well as adaptation to the changing environment.

Regarding queries about policies for preserving carbon stock and priority policies, both of them stated that policies about climate change adaptation are available both at national and provincial level. In addition to national developmental plans, local government also have programs in implementation of these guidelines that can improve carbon reserves in the study areas. Further they also indicated that they were planning at local for providing the better basic services like health, safe evacuation, river bunds, efficient water drainage system, early warning systems etc. but at the same time, they also highlighted the issue of limited budget resources for local authorities. In response to query about linking carbon taxing with revenue system, both denied about applying such kind of taxes. They also accepted that presently neither any restrictions are present that can stop the people to build their houses on their private lands, nor any set of rules regarding standard design to build stronger houses in context of present climatic related extreme events.

In response to query about adaptation planning at local level, both of them indicated about plans for building disaster proof infrastructure, protection of people and their properties nearby river banks, improving irrigation water channels and support for rebuilding houses damaged by the floods etc. During interview, one of the official stated that we are trying to invest more in building strong bridges, roads, safe from landslides. In Chitral city infrastructure is quite satisfactory but situation in Booni tehsil is not up to the mark. Further in village areas people usually make their houses in traditional way, but they need to adopt technological advances as well. Figure 24 shows that most of the time both officials responded in the same way and provided similar information with no any point of difference in opinion between them.

Similar questions were also asked to these officials to get their view point about coordination, collaboration among public and private organisations, and about exchange of information and data sharing. In response, they said that district government is maintaining the record about forecasting the floods and rainfalls while in the directions issued from NDMA, they also initiate the warnings on media and other public forums before flooding expected. Further they claimed that district and tehsil administrations shares all the information with agriculture, municipalities and union councils, wildlife department, forestry department, health authorities, police and irrigation department etc. However assistant commissioner Booni was not agreed about the access of all information to people and private organisations particular information about developmental programs initiated by local governments.

Summary of findings from analysis of interviews of local administration authorities

Following is the summary of key findings as a result of data analysis from these interviews.

- Present nature of extreme events like floods, landslides, earthquakes, and droughts are being intensified due to recent climate changes and these events have a significant impact on land sector including agriculture, water, infrastructure, land holdings and livelihoods of people.
- Local authorities understand their responsibilities regarding responding against the challenges of climate changes and they are already making plans and developmental programs as part of adaptation plans, building capacity of local people and improvement of infrastructure to cope better with changing climate conditions.
- Policies about dealing with climate changes and planning for adaptation are present. In the guidelines of these policies, local adaptation program are also being made.
- Budget constraints are one of the main barrier for local authorities to make these plans successful and in partnership with donor agencies and NGO's they can better implement their adaptation strategies and plans for improving the adaptation capacities of local community.
- Public and private partnership can help to manage this issue of lack of funds and effective adaptation activities can be practised in the area.
- Local authorities are well aware about the issues related to climatic challenges and their responsibilities to adapt.
- Finally, local authorities realize that there should be a proper mechanism to communicate between all the government and private organizations with each other so that both public and private organization can work together in reducing disaster risks in this area.

5.4.3. Triangulation of results

The purpose of data collection by using multiple methods through focus groups and individual meetings or interviews is to validate the results of analysis with multiple confirmation. Triangulation is not only the convergence of agreement between the data obtained through different methods but it is actually the validation process to ensure and enhance the belief that the results are valid and are not a methodological artefacts (Jick, 1979). The results from focus group data and interviews are combined under three following main categories using convergence strategy of triangulation.

Impact of climate changes on land and identification of land related issues

According to the results from analysis of focus group data and interviews it is revealed that apart from natural changes and global warming, human activities are also responsible for changes in climate. There is significant change in weather patterns in the study area due to climate change. Climate related extreme events are occurring with increased frequency and intensity and have great impacts on land sector including agriculture, forest and houses.

Mainly land sector issues are related with agriculture including land use change, changes in land value and increasing potential on forest reserves. Other land related issues include land losses for people who own lands nearby river banks, streams and nallas. Mainly, informal settlers and people living in nearby river beds and streams are mostly effected for their damages their houses, cultivated lands and livestock

There is also increasing potential on forest reserves and forest are continuously declining in the area. Unclear use rights of forests for local community is another major threats for forest reserves. Further, unclear use rights are also responsible for promoting illegal harvesting of trees thus causing decline in forest areas. Although government is solely responsible for management of forest reserves but local community can be involved for its effective management whose livelihood also depend on forest resources.

Climate change have its significant impacts on agriculture land in terms of its fertility, soil erosion and changes in planting and harvesting seasons. Mostly cultivated land is situated near the rivers and streams, so due to frequent floods cultivated land is also being damaged besides its conversion into urban land due to population pressure and unplanned housing schemes.

Climate change also have impact on water resources varying area to area as at some places in the form of floods where at other places causing shortage of supply. Glaciers melting and rainfalls are the main sources of water tributaries of the study area, therefore changes in glaciers melting and rainfalls due to present changes in climate conditions have strongly effected water resources as well as its associated beneficiaries like agricultural land and people. As irrigation system mainly fed through water, therefore agriculture as well as livelihood of people is directly effecting due to changes in climate in this area. Consequently people living in this area are being effecting and due to their poor livelihood, they are vulnerable to cope with these climate changes.

Present structure of water channels is poor and its capacity need to be improved in the light of future projected climate changes so that enough water would be available for drinking as well as to meet the need for irrigation purpose. Budget constraints are one of the main barrier for local authorities to make these plans successful and in partnership with donor agencies and NGO's they can better implement their adaptation strategies and plans for improving the adaptation capacities of local community. Public and private partnership can help to manage this issue of lack of funds and effective adaptation activities can be practised in the area.

Land policies in the face of climate change and assessment of present coordination between stakeholders including community for responding against climate changes

Interviews from officials of different land sector institutions reveals that policies about dealing with climate changes and planning for adaptation are present up to some extent but implementation at both national and local level is absent.

Local authorities are well aware about the issues related to climatic challenges and their responsibilities to adapt and they are already making plans and developmental programs as part of adaptation plans, building capacity of local people and improvement of infrastructure to cope better with changing climate conditions. During the interviews, respondent from all institutions agreed about the integrated framework of policies that can address all the issues related to land sector including land tenure issues for effective management of forest for both preserving carbon stock and for better adaptation measures to improve the production of forest trees and natural grasslands.

All have their individual responsibilities so they should realize. Local authorities should impose restriction for informal settlements in prone areas likely close to river and should make concrete walls on shaky river banks. It is the responsibility of local government to frame rules and restrictions to stop environment unfriendly activities. Information related to short term climate changes and its possible impacts on crops needed to be passed to farmers well on time. Quick information updates about seeds, plantation and harvesting dates and suggestions for crop switching and other coping strategies are only possible when there is present a single platform for exchange of information at local level where all kind of information would be readily available altogether.

The existing structure of land administration system shows weakness in intuitional capacity of this department. There is also a lack of recognition of roles and responsibilities that land administration can play for effective management of land use, land use change in context of climate change. Data collected during disaster relief activities is hardly accessible to all public and private organizations who make plans for adaptation activities as well as for future risk management. Poor coordination exist between all public and private stakeholders regarding data sharing which highlights the weak structure of policies as well as a barrier for access the information to people and community who are directly going to response for the adaptation activities.

Assessment of local knowledge about climate change and responsibilities of community and households for adaptation to climate change

Local indigenous knowledge is a great source of information regarding local climate changes. However, these people have limited scientific knowledge about the recent climatic impacts on land. They should have access to information about future projected climate changes as well as government priorities regarding climate change adaptation. Although other sources of information including scientific knowledge about climate change and its future predictions is important but at the same time significance of adaptation practices by communities according to their own traditional knowledge cannot be ignored.

Local authorities understand their responsibilities regarding responding against the challenges of climate changes and they are already making plans and developmental programs as part of adaptation plans, building capacity of local people and improvement of infrastructure to cope better with changing climate conditions. But community has also its responsibility to involve and participate effectively in adaptation activities. Community participation is really important in adaptation activities like re-plantation of forest trees, effective monitoring of illegal harvesting and protection of forest trees from environmental changes. Although government is solely responsible for management of forest reserves but local community can be involved for its effective management whose livelihood also depend on forest resources.

5.5. Summary

Objectives of the meetings, discussion sessions and interviews of the officials were to assess the findings about integrating land related policies into climate change adaptation policies with the participatory role of people at community level. Overall response of all the respondents were remained satisfactory and data obtained through their answers is good for further processing and interpretation. Based on the findings from literature review and keeping in view of research questions, a total of 63 questions were drafted for assessment of findings in the field survey. For finding the answers and collecting qualitative data regarding answering the research questions, semi structure interviews and focus group discussion questionnaires were framed. Results from the field data are summarised in section 5.4. In next chapter, the significance of these results along with findings from literature review are discussed in order to interpret them for bringing final conclusions of this research study.

6. DISCUSSION

The purpose of discussion is to assess the key findings of literature review found in previous chapters 2.3 and 4 based on the results obtained through analysis of field data. The main purpose of this chapter is to discuss and reason the results so we can answer the questions posed in the introduction and to explain how the results of data analysis confirms the findings through literature. The basic technique adopted for discussion of results and key findings of literature is ‘compare and contrast’ technique. The whole discussion is divided into three main sections based on the sub-objectives mentioned in chapter 1 and then followed by a summary section. Section 6.1 provides opinion and interpretation of findings about impact of climate changes and identification of land related issues caused by climatic changes. Section 6.2 explains the implications of land policies in the face of climate change and section 6.3 discuss about the role of community and people’s responsibilities for adaptation to climate change. Section 6.4 provides the overall summary of discussions made.

6.1. Impact of climate changes on land and identification of land related issues

Now a days, the scientists agreed that major cause of current climate change is due to present human activities on earth (IPCC, 2014a) & (IEA, 2013). According to the results from analysis of field data, it is also clear that human activities are major contributor for present changes in climate in the study area. Weather related extreme events such as droughts, landslides, floods, glacier bursts and heat waves, all of them are now strongly linked with climatic changes (Williams & Hardison, 2013). The same happening is also confirmed in the study area because weather patterns in the study area are also changing and the extreme events such as droughts, landslides, floods, glacier bursts and heat waves, all of them are now occurring there with increased frequency and intensity. These extreme events have great impacts on land sector including agriculture, forest, water and human settlements (Lohani, 2007). The results of field data analysis also confirms the impacts of climate related extreme events on mountain communities living in the study area because results of field data show that in Hindu Kush mountain areas, unpredicted rain falls, floods and droughts in winters are more common in these days. Thus, in the light of finding through previous researches (see section 2.2 for details) and analysis of field data, it is clear that land serves for both causes and effects of present climate changes.

The findings from previous literatures (see section 2.3) capture the impacts of climate change on land. Mendelsohn in his research states that in fact most of the impact of climate change can be viewed as impact on land (Mendelsohn, 2011). Other scientists (Molen & David, 2014) also consider the issue of land use, land use change and changes in forest lands and demand for the management of land in both prospective for improving carbon storage and reducing impacts of climate change on land. Studies by Tinker et al. (1996) confirm that vulnerability of populations is one of the major concern in ‘climate hotspots’. It effects not only the settlements but also effects people’s livelihood because agriculture, forestry, water and households all involve land and are sensitive to climate change related hazards. Unplanned urbanization also contributes in changing land cover by reducing prime croplands (Lambin et al., 2001) & (Veldkamp & Lambin, 2001).

Quan and Dyer (Quan & Dyer, 2008b) highlight the issues related to tenure insecurity and suggest that strong land tenure necessitates the improvement of land capability for secure resettlement and enhancing productivity of land. Thus, fair access to resources, land conflict, settlement, indigenous rights, and resettlement rights, all are different kind of issues related to land rights that are strongly linked with climate change consequences. Scientists have also linked tenure security with deforestation (Robinson et al., 2013) and claimed that tenure insecurity is one of the major cause of forest degradation. Findings of the analysis of field data also confirm the existence of all these land issues related with climate change in the study area as highlighted in above paragraph. Data analysis reveals that main land sector issues are related with agriculture are changes in land use, changes in land value and increasing potential on forest reserves. Other land related issues include land losses for people who own lands nearby river banks, streams and nallas. Mainly, informal settlers and people living in nearby river beds and streams are mostly effected for their damages their houses, cultivated lands and livestock. These land issues have also their consequences on land rights and their

security. Thus major impacts of climate change in different land sector including agriculture, forests and human settlements are accountable in terms of changes in land use, land value and its tenure.

Reviewing previous literature (refer to section 2.2.3 and 4.2) on the climatic conditions of mountain systems of Hindu Kush-Himalayan (HKH) reveals that these mountains are most sensitive to changing climatic conditions in the world. Literature studies for climatic effects on HKH Mountains, also reveal that climate change have its significant impacts on agriculture land in terms of its fertility, soil erosion and changes in planting and harvesting seasons. Results from field data report that mostly cultivated land is situated near the rivers and streams, so due to frequent floods cultivated land is also being damaged besides its conversion into urban land due to population pressure and unplanned housing schemes. While analysing the field data, it brings another major issue with forests in the area because of unclear use rights of forests for local community which is promoting illegal harvesting of trees and thus further declining in forest areas.

Climate change also has impacts on water resources varying area to area as at some places in the form of floods where at other places causing shortage of supply. This also confirms with the argument of respondents that Glaciers melting and rainfalls are the main sources of water tributaries of the study area, and definitely changes in glaciers melting and rainfalls due to present changes in climate conditions effect water resources. Agriculture as well as livelihood of people is directly effecting due to changes in climate in this area because irrigation system in Chitral mainly fed through water. Consequently people living in this area are being effecting and due to their poor livelihood, they are vulnerable to cope with these climate changes.

While answering to questions about climate change adaptation policies and current initiatives about adaptation in study area, literature and study of relevant policy documents confirm the pity situation of policies at national level in Pakistan and its implementation at local level in Chitral (ICIMOD, 2012). The consequences of climate change in this region are more severe due to lack of adaptation planning at national and local level because of limited role of policies in adaptation to climate change at national level and specifically at local community level in Pakistan. The same is confirmed in meetings with AKRSP and ICIMOD who claimed that, communities are active in adaptation at their own and NGO's and GO's are investing in mediating adaptive capacity for climate changes. However, in other countries of HKH region is not very bad. National Adaptation policies in Nepal (NAPA) is appeared to be great effort for integrating climate change into policies as well as its implementation in adaptation at local level.

ICIMOD with the collaboration of national institutions like Pakistan Agriculture Research Council (PARSP), National Disaster Management Authority (NDMA) and Pakistan Metrological Department (PMD) is focusing mainly on monitoring and assessing impacts of climate change on natural resources and human in Hind Kush and Himalayas region (HKH). Information collected through interviews and focus groups exposes the current efforts made by NGO's and Government organizations which are focusing mostly on effective management of water, improving safety walls along river sides and for drinking water supply. Although, all these initiatives are linked with livelihoods and are also supportive for improving adaptive capacity against hazards, but they still don't reflect or take into account the future climate risks.

6.2. Land policies in the face of climate change

Land policies in the face of climate change and assessment of present coordination between stakeholders including community for responding against climate changes

To cope with the climatic impacts on land policies regarding land sectors such as agriculture, forest and water including urbanization, policies need to be improved. Literature review (see section 3.2) confirms that land policies can play a leading role in improving adaptation policies in the face of climate change. Interviews from officials of different land sector institutions reveals about the weak structure of land policies in study area because the analysis of this information provided by respondents shows that policies about dealing with climate changes and planning for adaptation are present up to some extent but implementation at both national and local level is absent.

For investigating a solution based on literature review (refer to section 3.3.3) bring an understanding about introducing an integrated approach to deal with climate change adaptation. A thorough review of already

developed some policy frameworks like the Adaptation Policy Framework (APF) (Ian Burton et al., 2004) provides the pathway for developing integrated approaches to integrate climate change issues related to land into land policies. The suggestion for this kind of revisiting land policies in context of climate change is also supported by the positive response while interviewing the officials of institutions during field work. Thus this kind of response also support the proposed framework for integrating land related issues and policies into adaptation policies in section 3.5 for revisiting the land policies in study area enabling for better response against climate changes. This proposed framework suggests the engagement of all stakeholders at all level from assessment of climate impacts to developing adaptation plans while at the same time it emphasise the engagement of local community at all level from developing policies up to implementation for improving their adaptive capacity and reducing vulnerability (see Figure 16).

Further, findings of research from literature (section 3.4) also highlight the need of effective coordination mechanism between all key stakeholders, institutions for devising an integrated approach for adaptations and resilience against climate change. Good management of land and its resource is only possible if update information is shared among all institutions as well as people and community who directly respond for all adaptation activities. This evolving role of institutions also confirmed from the answers of participants of interviews and focus groups because informants highlighted the weaknesses of existing structure of land administration system. For example, data collected during disaster relief activities is hardly accessible to all public and private organizations who make plans for adaptation activities as well as for future risk management. Poor coordination exist between all public and private stakeholders regarding data sharing which highlights the weak structure of policies as well as a barrier for access the information to people and community who are directly going to response for the adaptation activities.

6.3. Communities in climate change adaptation

Spatial analysis of Vulnerability with the evolving role of community, evaluation of their local knowledge about climate change and their responsibilities for adaptation to climate change

While seeking information about the present statistics of forest biomass and carbon stock, although not enough information was available with relevant institutions but geo-portal for northern areas of Pakistan managed by ICIMOD provides information about the land cover changes in Hindu Kush and Himalayas (HKH). Forest official claimed that 3700 ha area of forest has declined and the same information is also publically available on website of provincial government but source of this information is absent. However, the same statistics are claimed by a scientific study reports recently published (Shehzad et al., 2014). Out of total 60,000 ha of the study area, 3759 ha have already lost and expected to increase of 23% by 2030 (see section 4.2). Total GHG emissions is expected to increase by 60% by 2020 with compared with emissions in 2011 and increase by a factor of 13.3 by 2050 i.e. 4621 Mt CO₂ eq. Thus, depletion in forest reserves is a major environmental problem in the Chitral district (UNFCCC, 2010). These projected estimations if stimulated further due to ongoing climate changes then situation is really concerning and needs attention. People living in the village areas of district are poor and highly dependent on these forests for their livelihood in many ways and the present trend of forest degradation will further effect badly their livelihood conditions.

Findings about role of spatial information in vulnerability assessment and adaptation planning indicate the role of maps and other forms of spatial data in providing information to illustrate climate change impacts and vulnerability (van Aalst et al., 2008). Previous studies emphasize on the community based risk mapping which engages both local authorities and community members for vulnerability mapping (Sherbinin, 2014). Findings of literature review (Section 4.3) shows that accurate information about sinks and sources of CO₂ is fundamental to account for climate changes as well as can also provide help for choosing better methods of adaptation for improving these resources because it helps for planning activities of land conversion such as choosing better places for replantation of forest trees, selecting appropriate land for agriculture that ultimately contributes towards improvements in overall C inventory. However, to support these conclusions, no enough information is available through field data however land officials stated that they can provide the up-to-date information about changing river beds and changes in agriculture and forest area but in paper format. They also have the statistics about damages and loses for land and property due to climate related disasters, so this information if available to other public and private institutions, can help in better planning for adaptation.

Previous studies (Anik & Khan, 2012) claim that local indigenous knowledge about local climate changes is a great source of information. The assessment of community people knowledge during focus group discussions supports this argument. This is also supported by the information obtained through other field data. Local people in the study area are already aware of local changes in climate and they try to make strategies and adjust themselves to cope with the extreme events according to their local indigenous knowledge. However, experts from The International Center for Integrated Mountain Development (ICIMOD) and Aga Khan Rural Support Program (AKRSP) during meeting also claimed that these people have limited scientific knowledge about the recent climatic impacts on land. Researchers already highlighted in previous studies (Nyong et al., 2007) about integrating local indigenous knowledge and traditional adjustment practices with modern scientific knowledge about climate change. Thus, inducing both local knowledge and scientific knowledge about climate change can improve adaptation practices by communities because of build dynamic information base through such inclusions that can support these communities for better adaptation to constantly changing climate.

There are three major stakeholders who are involved managing the risks at local level: government institutions, private parties i.e. NGO's, and local community including individual and groups. All have their responsibilities for risk management (Abarquez et al., 2004), (Westen & Kingma, 2007) & (ICIMOD, 2014a). It is also confirmed by the findings from analysis of field data. Although, governments are primarily responsible for managing climatic risks to natural environment, land assets and service infrastructure but people have also some responsibilities for managing risks that supports and promote for private adaptation. Local climate change adaptation programs bring significant benefits directly to individuals and groups at community level.

6.4. Summary

In summary, this research study provides an insight about the environmental and social impacts of climate change particularly related with land and its resources and community. The findings during this research contributes towards better understanding about land related issues into climate change. In fact most of the impact of climate change on agriculture, water and human are land intensive. The consequences of climate change in HKH region are more severe due to lack of adaptation planning at national and local level. Although, communities are active in adaptation at their own and NGO's and GO's are investing in mediating adaptive capacity, but role of policies, institutions and civil society including community and households in adaptation to climate change is manifest.

In the light of above discussion in section 6.2, it is clear about the implication of land policies in the face of climate change and role of institutions dealing with different types of land in developing such policies. This study provides an understanding about the adoption of a rational approach for incorporating land issues into land policies that are the outcome of social impacts of climate change. The land sector institutions should coordinate with each other for management of information about land which is required for assessment of suitability of land before its allocation for different uses. Among them land administration can play its central role for providing a platform for sharing up-to-date information among all institutions as well as to people and community who directly respond for all adaptation activities.

Last but not least, community has some responsibilities. In order to manage risks from climate change impacts, local communities and people must know about the structure of tenure rights on land assets and natural resources. They need to know how to manage their land assets, thus they should get information about the regulations related with land use planning, restrictions for land use change and rules about basic design of infrastructure such as building codes etc. They should have awareness about how to access the latest information about anticipated climate risks for developing their strategies to manage these risks. They should also well know about the public goods and services provided by local governments for emergency responses and management of risks related to climate change. Some scientist also emphasize on the knowledge about legitimate cover provided by authorities for recovery for losses and market based incentives such as insurance etc. Further, they should also know about their legitimate rights to use natural resources.

Based on the discussion made in this chapter, conclusions drawn from this research study are elaborated in the next chapter along with some recommendations for future studies.

7. CONCLUSION AND RECOMMENDATION

7.1. Introduction

The purpose of this chapter is to conclude the study conducted. This study was conducted to explore the impacts of climate change on land and its resources. This study has also sought for the land issues due to climatic changes, integrating these issues into land policies and to know the role of local community in improving climate change adaptation. The study has three specific objectives: (1) to identify land related issues into climate change (2) to integrate land related issues with land policies and (3) to demonstrate the role and responsibilities of local community for adaptation to climate change. This research was specifically concerned with improving adaptive capacity of communities belonged to Hindu Kush mountains region to help them against the expected risks and the adverse effects of climate change.

7.2. Answers to research questions

As stated in chapter 1 (section 4.1), this study mainly concerns about the integration of land issues related with climate change into land policies with a focus on mountain community. Based on the findings from literature review and discussion of the results of field data, the answers to the research questions are summarised in the following sections under each specific sub objective.

Sub Objective I: To identify land related issues in climate change adaptation policies:

1. What are the land related issues in the face of climate change?

Answer: Climate change has significant impacts on all land sectors including agriculture, forests, human settlements and infrastructure as well as on water resources. Issues related to land include changes in land use, land value and land tenure. These include the issue of secure access to land and its resources, land degradation, effects on agriculture productivity, insecure formal and informal settlements, tenure insecurity, forest use group rights and sustainable water supplies etc.

2. What is the present knowledge about climate change adaptation policies?

Answer: Currently there are three approaches that are being made as policy options for adaptation. One is adaptation under UN Framework Convention on Climate Change (UNFCCC) which is mainly about to facilitate national adaptation plannings. The other is an integrated approach which is about integrating adaptation with development projects through climate change risk assessment for the projects. Third one is a proactive type of approach which mainly focus on covering damages though climate related hazards. The most widely accepted is the Adaptation Policy Framework (APF) developed by United Nations (UNDP-GEF) which provide a guideline to those countries who intended for integrating adaptation concerns into their national development action plans for protecting people and enhancing their adaptive capacity in the face of climate change.

3. What are current initiatives related to climate change adaptation in the study area?

Answer: Present status of climate change adaptation policies in study area, Chitral, Pakistan is not so impressive. Although policies are present at national level but its implementation at local level in Chitral is very poor due to weak governance at institutional level and due to limited resources. Although, communities are active in adaptation at their own and NGO's and GO's are investing in mediating adaptive capacity. Thus it is clear that community adaptation strategies should be integrated in making policies in the face of climate change. However, National Adaptation polices in Nepal (NAPA) is appeared to be great effort for integrating climate change into policies as well as its implementation in adaptation at local level.

Sub Objective II: To integrate these land related issues into land policies:

4. How these land related issues in climate change adaptation policies can be incorporated into land policies?

Answer: A framework of integrated policies can be devised based on already available frameworks and approaches in practice worldwide specifically in developing countries where communities have effective role in planning and implementation of policies. Based on this information from literature, a framework is proposed (Figure 16) and explained in section 3.5.

5. How stakeholders particularly government, community and households can coordinate with each other to combat against climate change?

Answer: An effective coordination mechanism between all key stakeholders, institutions is vital to devise integrated approach for adaptations and resilience against climate change. Thus, participation of all stakeholders can build strong foundation for developing such integrations. Good land and resource management is only possible if update information is shared among all institutions as well as people and community who directly response for all adaptation activities.

Sub Objective III: To analyse the obligations and responsibilities of stakeholders at community and household levels for adaptation to climate change:

6. What are the present activities on forest biomass and carbon stock in study area?

Answer: Mainly forests are government property in the study area. Forest department is responsible for managing forest reserves and monitoring forest protection. ICIMOD geo-portal provides information about the present status of land cover and statistics about forest biomass by using available RCM and GCM Dataset nested with local meteorological data.

7. How can temporal carbon maps be used for improving climate change adaptation?

Answer: Apart from mitigation option, evaluating carbon dynamics from temporal carbon maps contributes towards planning for better land use management strategies and ultimately enhance overall adaptive capacity of the system. This source of information database can improve adaptation strategies by effective land management in context of land conversion, soil management for carbon pools and better decision in choosing specific farming and vegetation systems such as organic farming that can contribute more for carbon sequestration rates as well as reducing vulnerability of agriculture sector. HKH region consists of diverse rugged lands with diverse soil types situated on steep slopes and highly sensitive to landslides and degradation. But, reliable data needed to estimate C stock for this region is not available.

8. How can local knowledge of households and community support them for a better adaptation to climate changes?

Answer: Local people have awareness of local changes in climate and they try to make strategies and adjust themselves to cope with the extreme events according to their local indigenous knowledge. Inclusion of local knowledge and existing traditional adaptation practices can be useful for effective planning of land and water resource management, building secure physical infrastructure and for improving adaptive capacity of both at individual and community level. Local farmers well know about the fallow system of cultivation and can well manage the forests and rangelands as compared to government institutions.

9. What are the responsibilities of households and community for adaptation to climate change?

Answer: In order to manage risks from climate change impacts, local communities and people need to be aware of their rights on land assets and natural resources. They need to know how to manage them and they should have enough awareness and access to information about anticipated climate risks for developing their strategies to manage these risks. They should also well aware about the public goods and services provided by local governments for emergency responses and management of risks related to climate change. Further, they should also know about their rights to use natural resources, the regulations about land use planning and

basic design of infrastructure such as building codes, restrictions for land use change. It is also important that individuals and communities must improve their abilities to manage risks which is referred to as adaptive capacity.

7.3. Imperical findings

Based on discussions made in previous chapters, the following critical issues are needed to take into account while formulating integrated land policies in context of climate change adaptation at local community level.

- i. Land use and settlement issues in climate prone areas
- ii. Provision of secure rights for households in safe areas to increase their adaptive capacity
- iii. Facilitation of resettlement in case of displacement due to disasters including recovery of damages to tenure rights.
- iv. Allowing access to local communities to their neighborhood forest for effective their management and direct benefits associated with climate change adaptation measures
- v. Protecting the poor and vulnerable from loss of livelihood and finally
- vi. Targeting of adaptive measures on women and indigenous groups who are more vulnerable to climate risk because of poverty and their weak rights of access to land and natural resource.

Further, following measures require a policy cover for building adaptive capacity of people living there in the study area. These measures are needed to take into account while planning climate change adaptation strategies at local community level.

- i. Equitable access to information to local people about priorities and adaptation policies
- ii. Supporting adaptation practices of indigenous mountain communities to cope with seasonal variability in water supplies and water related hazards like floods and droughts.
- iii. Supporting adapting techniques like crops changing, switching and introducing new species who are more resistive and tolerant with climate change.
- iv. Disseminating scientific information about best conservation and use of water resources
- v. Benefiting from best adaptation practices according to local knowledge of people
- vi. Support active participation of community for watershed managements programs of NGO's and GO's.
- vii. Take into account sacrifices by upstream people for the betterment of the lives of the downstream people in watersheds.
- viii. Strengthening of property rights for effective ecosystem services based on payment and incentives.
- ix. Allocation of public funds and enough financial resources for local administration enabling them to plan actions according the local level needs.

7.4. Theoretical Implication

Study of literature determines that major cause of today's climate change are human activities. Abrupt changes in weather pattern and climate related extreme events such as flood, droughts, heat wave, glaciers and landslides have strong impact on our ecosystem. Secure access to land and its resources, safe places for human settlements, land degradation, tenure insecurity due to land losses etc. are the major land related issues that are needed to address while integrating climate change into policies. This study reveals that land policy, economic growth, poverty reduction and sustainable development has a close link with each other. Participation of all stakeholders can build strong foundation for developing such integrations. A framework for integrating land related issues and policies into adaptation policies is proposed.

Engaging both local authorities and community members together can be useful for enhancing adaptive capacity of communities. Inclusion of local knowledge and existing traditional adaptation practices can be useful for effective planning of land and water resource management, building secure physical infrastructure and for improving adaptive capacity of both at individual and community level.

This research study provides an insight about the environmental and social impacts of climate change and at the same time it contributes towards better understanding about land related issues into climate change. While concluding this research study about the implication of land policies in the face of climate change and role of institutions dealing with different types of land in developing such policies, it suggest for integrating land issues into land policies that are the outcome of social impacts of climate change.

7.5. Recommendation for future research

Organic agricultural systems supports for sustainable agriculture management system and have potential to reduce GHG emissions and to increase carbon sources. Further, organic agriculture is better over conventional production systems because it can meet the both demands: food security and reduce stress on environment. Therefore, a study is needed to assess the organic farming methods in the study area that can have significant impact in environmental conservation as well as can increase capacity of farmers for adapting to climate change.

Land revenue office need to be more open for information access and the mutual coordination among stakeholders need to be improved. Land administration system can play its role in providing up to date information about land records and cadastre maps for developing latest hazards maps, as well as can help the relevant institutions to assess the vulnerability of agriculture, water and people. Thus, further research study is recommended to assess the new enhancing role of land administration department in context of the present climatic changes in the region.

It is also obvious that spatially explicit information regarding vulnerability assist institutions for making policies and for facilitating adaptation process. Thus, integrating participatory information into technical exercise of mapping climate change at local scale subsequently provide better assistance for the improvements in adaptation processes. Thus a research study needs to be conducted specifically for the study area for devising a framework for development of spatial data infrastructure using participatory approaches.

There is an urgent requirement of managing dataset in study area that include past and present condition of soil for understanding soil processes. This source of information database can improve adaptation planning by effective land management in context of land conversion, soil management for carbon pools and better decision in choosing specific farming and vegetation systems such as organic farming that can contribute more for carbon sequestration rates as well as reducing vulnerability of agriculture sector.

Mostly climate change adaptation projects are created with the aim of improving livelihood and adaptive capacity of communities but these project can gain success only when local knowledge of communities is grasped in designing and implementation of these projects. Thus can be achieved only when communities effectively participate as joint partners in these projects.

Finally, it is important that individuals and communities must improve their abilities to manage risks which is referred to as adaptive capacity. However, it is only possible if relevant institutions are able to provide accessible and usable information about region specific climate projections. For effective communication between local intuitions and community, climate change policy should address the recognizing role of community and their indigenous knowledge in order to reduce the vulnerability and for sustainable development of the communities.

7.6. Conclusion of the conclusion

This research study provides an insight about the environmental and social impacts of climate change. At the same time the finding of this research study also contributes towards better understanding about land related issues into climate change. In fact most of the impact of climate change on agriculture, water and human are land intensive. The consequences of climate change in HKH region are more severe due to lack of adaptation planning at national and local level. Although, communities are active in adaptation at their own and NGO's and GO's are investing in mediating adaptive capacity, but role of policies and institutions in adaptation to

climate change is manifest. Thus it is clear that community adaptation practices should be integrated in making policies in the face of climate change.

While concluding this research study about the implication of land policies in the face of climate change and role of institutions dealing with different types of land in developing such policies, it suggest for integrating land issues into land policies that are the outcome of social impacts of climate change. The critical issues highlighted are secure access to land and water for both agriculture and safe settlements as well as provision of secure access to indigenous people and communities to their immediate environment on which their livelihood depends. Climate change not only possess the question on tenure security but it also alarmed about the vulnerability of informal settlements in prone areas and resettlement in case of displacement due to climate related disasters.

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APPENDICES

Annex-A: Research Matrix

Research Objective I: To identify land related issues in climate change adaptation policies

Research Questions	Research Methods	Required Input Data	Expected Output
1. What is the present knowledge about climate change adaptation policies?	1. Literature review 2. Desk Study	1. Related Journals, Articles, working papers 2. laws, reports Official, Documents (Published / unpublished),	1. Added knowledge about current status of climate change adaptation policies.
2. What are land related issues in the face of climate change?			2. Identified land related issues with climate change.
3. What are current initiatives related to climate change adaptation?			3. Present status about climate change adaptation programs with the focus on study area.

Research Objective II: To integrate land related issues into land policies

Research Questions	Research Methods	Required Input Data	Expected Output
4. How land related issues in climate change adaptation policies can be incorporated into land policies?	1. Community Discussion Forums 2. Interviews guides	1. Discussion 2. Interviews	4. Integrated land policies linked climate change adaptation
5. How stakeholders particularly government, community and households can coordinate with each other to combat climate change?	3. Desk Study	3. Maps, laws, reports Official, Documents (Published / unpublished),	5. Identified coordination between local government, local public agencies and community.

Research Objective III: To analysis the obligations and responsibilities of stakeholders at community and household levels for adaptation to climate change

Research Questions	Research Methods	Required Input Data	Expected Output
6. What are the present activities on forest biomass and carbon stock in study area?	Literature review	Related Journals, Articles, working papers	6. Up-to-date information about forest activities on forest biomass and carbon stock in study area
7. How carbon stock mapping can be used for quantifying climate change impact?	Text based Analysis	Text data from Interviews, discussions and Observations	7. Presentation of climate change maps of area
8. How can local knowledge of households and community support a better evaluation of climate changes?			8. Identified role of community for adaptation to climate change.
9. What are the responsibilities of households and community for adaptation to climate change?			9. Identified obligation and responsibilities of households and community for adaptation to climate change

Annex-B: Questionnaire for Focus group discussions

Session I:

1. What is water source for households and agriculture? (Rain fed irrigation / irrigation through water channels or others?)
2. What is the information about water source in streams, nalaas, rivers (rainfalls, glaciers)?
3. What about water accessibility with the changing weather? (Water per unit of land).
4. What kind of changes in weather have been appeared in this area today?
5. What is the occurrence of extreme events like earthquakes, landslides, rainfalls, floods etc. and how they manage them?
6. What is the information /statistics about damage of livestock, houses / land rights?
7. Are they forced to shift their land farms due to occurrence of these events?
8. Does it have any effect on land holding / rights?
9. Can they identify by their own knowledge about the drought areas, grazing lands, safe lands for houses?
10. Do they understand which land is best suitable for grazing, living, crops and forestation?
11. How people can play their role in managing reserve areas of forests?
12. What is the status of tenure for forests?
13. Can we increase more carbon by adding more rights?

Session II:

1. How people in community frame their own view about climate change irrespective of scientific grounds?
2. What are the actions to be made or being made for climate change adaptation? Include options
3. Can people identify themselves as main beneficiary for the adaptive measures to reduce carbon emission?
4. How efficient the concept of benefit /incentive for yourself by participating in adaptive activities? (settlements, tax rates, fertilizers)
5. Are they ready to make adjustments in response to climate change like crop switching, building houses in safe areas and implementing infrastructure standards in buildings set by authorities?
6. Is the government helping people for their re-settling?
7. Who owns / answerable for the responsibility of public safety?
8. What are the responsibilities of each stakeholder i.e. government, community, people, and land administration authorities in setting the rules for managing risks with land related to climate change?
9. What is role of state, local government in land policies and policies for adapting to climate change in people's view?
10. What are the efforts made by local NGO's, REDD+, UN and ICIMOD etc. in this area for raising awareness among people and community for better response to climate change adaptation?

Annex-C: Questionnaire for individual interviews

For ICIMO and AKRSP

Session I:

1. What is the impact of climate change on the changing the value of land in terms of land use, land holdings, land rights?
2. What is the status of forest in the area?
3. How people can play their role in managing reserve areas of forests?
4. What is the status of tenure for forests?
5. Can we increase more carbon by adding more rights?
6. What is the nature of extreme weather events like droughts, floods, landslides, debris flow or another etc. in the study area?
7. What is the information /statistics about damage of livestock, houses / land rights?
8. What is the occurrence of these extreme events and how they manage them?
9. Do they understand which land is best suitable for grazing, living, crops and forestation?
10. What are the actions to be made or being made for climate change adaptation?
11. How efficient the concept of benefit /incentive for people and community by participating in adaptive activities?
12. Are they ready to make adjustments in response to climate change like crop switching, building houses in safe areas and implementing infrastructure standards in buildings set by authorities?

Session II:

1. What is the information about key policies to reduce carbon emission like alternate energy resources like Nuclear power, Dams, Solar, day light access etc.?
2. Who owns / answerable for the responsibility of public safety?
3. What are the responsibilities of each stakeholder i.e. government, community, people, and land administration authorities in setting the rules for managing risks with land related to climate change?
4. How forestry, agriculture, water management, metrological & disaster management and land administration authorities are coordinating with each other on the policy plans related to climate change?
5. Who is preparing and maintaining projected climate conditions/ forecast data for the area?
6. Is this data being communicated and shared with all relevant authorities?
7. How PES is active in balancing of land use between forests and agriculture in the study area?
8. Why PES is more active in land conversion to forests?
9. Why do so few PES schemes feature agriculture changes?
10. What is role of state, local government in land policies and policies for adapting to climate change in people's view?
11. What are the efforts made by local NGO's, REDD+, UN and ICIMOD etc. in this area for raising awareness among people and community for better response to climate change adaptation?

Forest Officials

1. What is the present status of forest in the area?
2. How people can play their role in managing reserve areas of forests?
3. What is policy related to preserving carbon stock and reducing carbon emission?
4. Is there any intensive policy about climate change adaptation?
5. What is the information about key policies to reduce carbon emission like alternate energy resources like Nuclear power, Dams, Solar, day light access etc.?
6. What role can play community in preserving forests, carbon stock and for reducing carbon emission?
7. What are the restrictions, rights defined or can be imposed for increasing carbon stock?
8. What is the status of tenure for forests?
9. Can we increase more carbon by adding more rights?
10. How forestry, agriculture, water management, metrological & disaster management and land administration authorities are coordinating with each other on the policy plans related to climate change?

Agriculture Officials

1. What is the present status of richness / fertility of soil for agriculture with the time due to changes in weather, changes in precipitation etc.?
2. What are the irrigation means /ways are common in this area?
3. What about adaptation by changing crops and planting dates?
4. What is the information about water source in streams, nalaas, rivers (rainfalls, glaciers)?
5. What is the source of water for agriculture? (rain fed irrigation / irrigation through water channels)
6. What about water accessibility with the changing weather? (Water per unit of land).
7. Have people forced to shift their land farms due to these climate changes?
8. Does it have any effect on land holding / rights?
9. How water reservoirs are being protected in the study area either by use-restriction or by use-modifying approaches?
10. How water shed are responsible for soil erosion?
11. How soil degradation can be treated in a way without effecting water reservoirs?
12. How forestry, agriculture, water management, metrological & disaster management and land administration authorities are coordinating with each other on the policy plans related to climate change?

Land Officials

Session I:

1. What is the present status of land policy?
2. Is there any intensive policy about climate change adaptation?
3. What is the current status of cadastral maps?
4. Are they updated frequently for climate prone areas?
5. Is the information about land related to climate change being integrated into these maps?
6. What kind of information about rights, restrictions and responsibilities can be provided by the land administration authorities that can bring awareness among people about their rights and responsibilities about land?
7. What kind of spatial information about land use like forest lands, agriculture land, appropriate areas for housing, porous pavements etc. is included in cadastral maps?
8. Is there present any favored land policy that include changing engineering standards to meet climate change issues for household safety?
9. What are the protection measures, buffering for safe zoning along river and stream banks?
10. What is the policy regarding control over encroachments on river beds?

Section II:

1. What is the impact of climate change on the changing the value of land in terms of land use, land holdings, land rights?
2. Does it have any effect on land holding / rights?
3. Are they forced to shift their land farms?
4. What is the status of tenure for forests?
5. Is the government helping for re-settling?
6. What is the status of informal settlements?
7. How efficient the concept of benefit /incentive for yourself by participating in adaptive activities?
8. What is the information about key policies to reduce carbon emission like alternate energy resources like Nuclear power, Dams, Solar, day light access etc.?
9. Who owns / answerable for the responsibility of public safety?
10. How is the plan of human settlement for adjusting to changing weather conditions?
11. What restrictions for housing are imposed by land authorities near the streams, nallas and river banks?
12. What are the responsibilities of each stakeholder i.e. government, community, people, and land administration authorities in setting the rules for managing risks with land related to climate change?
13. How forestry, agriculture, water management, metrological & disaster management and land administration authorities are coordinating with each other on the policy plans related to climate change?

Local Administration Authorities

Session I:

1. Local government is first line of defense in responding the challenge of climate change. What do you think about it?
2. Is there any intensive policy about climate change adaptation?
3. What is the impact of climate change on the changing the value of land in terms of land use, land holdings, land rights?
4. What is the information / statistics about damage of livestock, houses / land rights?
5. Is the government helping for re-settling effected people in safe areas?
6. What is the status of informal settlements?
7. What are the actions to be made or being made for climate change adaptation?
8. How efficient the concept of benefit /incentive for yourself by participating in adaptive activities?
9. Are they ready to make adjustments in response to climate change like crop switching, building houses in safe areas and implementing infrastructure standards in buildings set by authorities?
10. What is the information about key policies to reduce carbon emission like alternate energy resources like Nuclear power, Dams, Solar, day light access etc.?
11. What are the terms they set by which land should be used, designing the houses, building the infrastructure etc. in accordance with the adaptation measures?
12. How the preservation of ecosystem services are being planned by the local authorities?

Session II:

1. Who owns / answerable for the responsibility of public safety?
2. What sort of threats are addressing by municipality / local governed plans?
3. What priority adaptation plans/policies are being preferred by local government?
4. Are these polices / actions addressing dual goals of improving adaptive response of people as well as emission reduction?
5. How is the plan of human settlement for adjusting to changing weather conditions?
6. What restrictions for housing are imposed by land authorities near the streams, nallas and river banks?
7. Who is preparing and maintaining projected climate conditions/ forecast data for the area?
8. Is this data being communicated and shared with all relevant authorities?
9. What kind of local land use planning decisions are present for potential adaptation to climate change?
10. How forestry, agriculture, water management, metrological & disaster management and land administration authorities are coordinating with each other on the policy plans related to climate change?
11. Is there any plan for carbon taxing and its linkage with fiscal revenue system?
12. What is Government policy about low carbon transportation fuels like CNG and electricity consumption in the study area?

Annex-D: As summary of daily activities during data collection in Field area

Day No.	Date	Activity Performed
1	Sunday, September 28, 2014	Departure from Netherlands (Afternoon)
2	Monday, September 29, 2014	Arrival at Islamabad Airport
3	Tuesday, September 30, 2014	Preliminary work at Islamabad before field work including emails to officials for seeking appointments for interviews and meetings
4	Wednesday, October 1, 2014	
5	Thursday, October 2, 2014	
6	Friday, October 3, 2014	Meeting with ICIMOD country representative, Islamabad
7	Saturday, October 4, 2014	Official meeting at Survey of Pakistan, Rawalpindi
8	Sunday, October 5, 2014	Holiday
9	Monday, October 6, 2014	Eid-ul-Aduwa HOLIDAYS
10	Tuesday, October 7, 2014	
11	Wednesday, October 8, 2014	
12	Thursday, October 9, 2014	
13	Friday, October 10, 2014	
14	Saturday, October 11, 2014	Departure from Islamabad to Peshawar, followed to Upper Dir.
15	Sunday, October 12, 2014	Departure from upper Dir. to Chitral and arrival at Chitral City
16	Monday, October 13, 2014	Meetings with land revenue officials
17	Tuesday, October 14, 2014	Meetings with local / district government officials
18	Wednesday, October 15, 2014	Meeting with Director Forest and extensions, Chitral
19	Thursday, October 16, 2014	Meeting with AKRSP officials
20	Friday, October 17, 2014	Departure from Chitral city to Calash villages (Bommberate)
21	Saturday, October 18, 2014	Preparation for focus group discussions
22	Sunday, October 19, 2014	Execution of focus group discussions
23	Monday, October 20, 2014	Visit of nearby villages for sightseeing and self-observation
24	Tuesday, October 21, 2014	Departure from Calash valley to back Chitral city
25	Wednesday, October 22, 2014	Meeting with agriculture department officials
26	Thursday, October 23, 2014	Departure from Chitral to Booni town
27	Friday, October 24, 2014	Preparation for focus group discussions
28	Saturday, October 25, 2014	Execution of focus group discussions
29	Sunday, October 26, 2014	Departure from Booni to Shogore
30	Monday, October 27, 2014	Preparation for focus group discussions
31	Tuesday, October 28, 2014	Execution of focus group discussions
32	Wednesday, October 29, 2014	Departure from Shogore to back Chitral and sight seeing
33	Thursday, October 30, 2014	Departure from Chitral to Upper Dir town
34	Friday, October 31, 2014	Departure from Upper Dir. to Islamabad via Mardan city
35	Saturday, November 1, 2014	Departure from Islamabad airport to Netherlands

Annex-E: Analysis of focus group discussions

Looking for patterns, similarities and differences in opinion

As stated in previous sections, three focus groups was planned to be conducted for data collection about various aspects of this research study in order to obtain people and community views about local climate changes, its impact on land and identification of land related issues. Further information was also needed in order to get understanding about the local knowledge of communities about climate change and how it can be improved to help them for better adaptation to climate change. Keeping in view of all the prospective, discussions were recorded which is analysed under different group of questions / themes and is shown in tables and while charts are included in order to describe the level of response, agreement and disagreement on key points during the discussions extracted from group notes.

Theme 1: Identification of climate related issues with water resources and its accessibility

Table 12: Level of response of participants of different focus groups about climate related issues with resources of water and its accessibility in study area.

Theme	Code	Key points from answers	Calash	Booni	Shogore	Pattern of response
			F1	F2	F3	
			Participant = 08	Participant = 08	Participant = 07	
Sources of water and its accessibility	Sources of water	Perennial Pipes	6	7	7	A
		Rivers	3	7	6	B
		Springs	8	6	7	A
		Rainfalls	4	8	5	B
		Glaciers	5	8	7	B
		Monsoon	7	2	2	C
	Issues	Floods	6	7	7	A
		Abrupt Rainfalls	5	7	6	A
		Dry season	7	5	3	B
		Glacier melting	5	8	7	B
	Accessibility	Shortage	6	2	3	C
		Excess	2	7	6	C
	Barriers	Limited water channels	1	6	2	C

A: Strong agreement either positive or negative B: Mixed Response C: Disagreement

Above table shows that majority of the respondents from all focus groups were agreed upon the climate related issues with water sources in the study area. These issues include frequent floods, abrupt rainfalls, dry winter seasons and glacier outbursts. All the participants identified the rivers, springs, rains and glaciers melting as one of the major sources of water in the area. They also highlighted about the traditional system of perennial pipes which is mainly used as water resource for agriculture in all over Chitral. Calash people were complaining about heavy monsoon rains in the area of Drost and kalash valleys causing flooding in streams, however, participants of focus groups from Booni and Shogore were not agreed about the moon soon rains in summer. The reason of this disagreement is that both Booni and Shogore are located in upper Chitral where most of the areas don't receive too much monsoon rains as compared to lower Chitral. There was also a difference in opinion among all the group of participants about water availability for agriculture and other daily use. This shows the diverse nature of impacts of climate change over different areas of Chitral. Most of the villages from Calash valleys like Bamburate,

Bhumber and Birir complained about the shortage of water during dry winter seasons and demanded for setting up more water channels for enough supply of water where as people from Booni and Shogore surroundings being located near to Mustaj river are suffering from frequent collapses of river banks damaging nearby agricultural farms and settlements. Over all response was in agreement about all the key points answered including some differences in opinion as shown in Figure 1.

Key finding: Main threats to water resources are due to climate change. Also impacts of climate on water resources are very diverse in nature as in some areas it's the main cause of floods while in some areas it's one of the main barrier for water supply and its accessibility. As irrigation system mainly fed through water, therefore agriculture as well as livelihood of people is directly effecting due to changes in climate in this area.

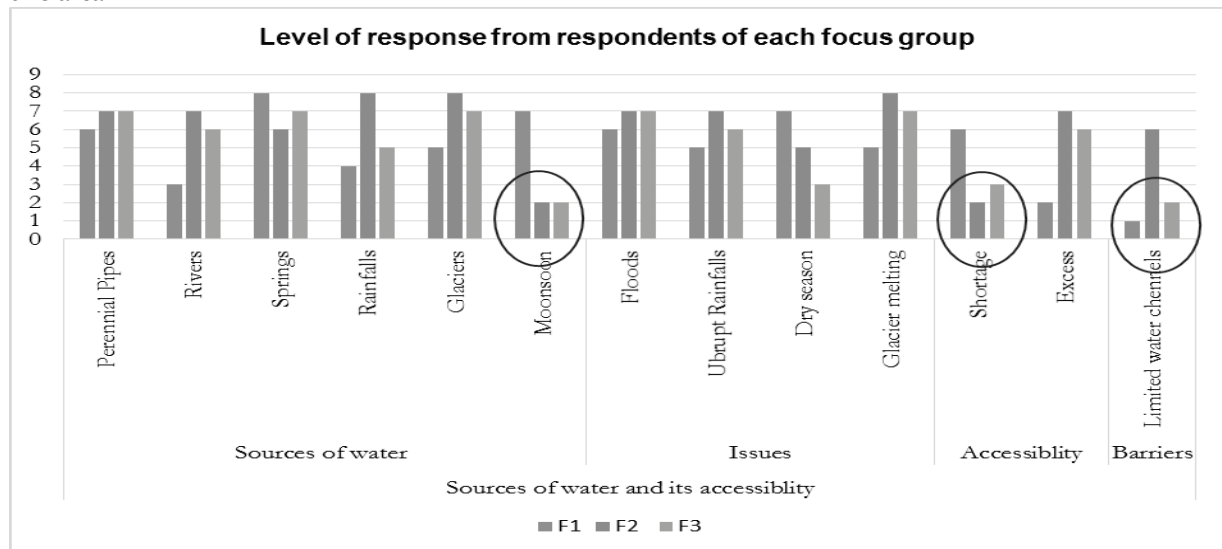


Figure 25: Chart showing the difference in opinion among three participants of three focus groups F1, F2 and F3.

Theme 2: Climate related Extreme events and their impacts on land:

Table 13: Analysis of key information provided by focus groups about climate related extreme events and their impacts on land in study area

Theme	Code	Key points from answers	Calash	Booni	Shogore	Pattern of response
			F1	F2	F3	
			Participant = 08	Participant = 08	Participant= 07	
Climate change, related extreme events and their impacts	Weather changes	Too much dry in winter	7	2	3	C
		Heavy rains in spring	3	7	7	B
	Extreme events	Floods in rivers and Nallas	5	8	7	A
		Earthquakes	2	6	7	B
		Landslides	6	7	6	A
		Dry winter season	7	4	3	B
	Effects / Impacts	Damage to livestock	5	8	7	A
		Damage to houses	6	7	7	A
		Damage to land near river banks	6	8	7	A
		Changes in land use	7	8	7	A
		Changes in land value	6	7	7	A
		Changes in land rights	2	3	3	A

A: Strong agreement either positive or negative B: Mixed Response C: Disagreement

Table 13 shows that majority of the participants from all focus groups were agreed on weather changes due to climate causing for dry winter seasons in some parts of Chitral like Calash Valleys. Overall strong agreement was shown on occurrence of extreme events like heavy rainfalls, floods, landslides, glaciers outbursts in rivers and earthquakes. But, participant of focus group F1 claim that there area is remained too much dry in winter as compared to spring season since last 10 years.

Earthquakes are common but not dangerous while landslides are frequent and mainly effects forest areas and also damage the residential areas to some extent. In Shishi and Birir, due to flooding, 20% of houses, livestock near river banks in 10 villages of valley were damaged last year. Huge losses of life, livestock and houses in Charun, Kuragh and Khost including severe damage of infrastructure in Booni town was occurred last year.

All the respondents were agreed that floods are being managed up to some extent by construction of safety walls with loose stone / wood with the help of NGO's and local volunteer participation but major length of river banks is still without safety walls and nearby settlements and cultivated lands are in constant danger. Due to changes in weather, a little shift in land farms or conversion of land use. Most of the respondent replied that now they have other means of income so mostly the agriculture land is kept barren. After discussion, all the three focus group were agreed about little effect on land holdings and rights besides other factors that land is being grabbed by powerful outsiders. Over all response was in agreement about all the key points answered but including only difference in opinion for dry winter seasons which are more prominent in Calash area as shown in Figure 26.

Key finding: There is significant change in weather patterns in the study area due to climate change. Climate related extreme events are occurring with increased frequency and intensity and have great impacts on land sector including agriculture, forest and houses. Mainly land sector issues are related with agriculture including changes in land use and land value thus have also impact on people livelihood. Other land related issues include land losses for people who own lands nearby river banks, streams and nallas.

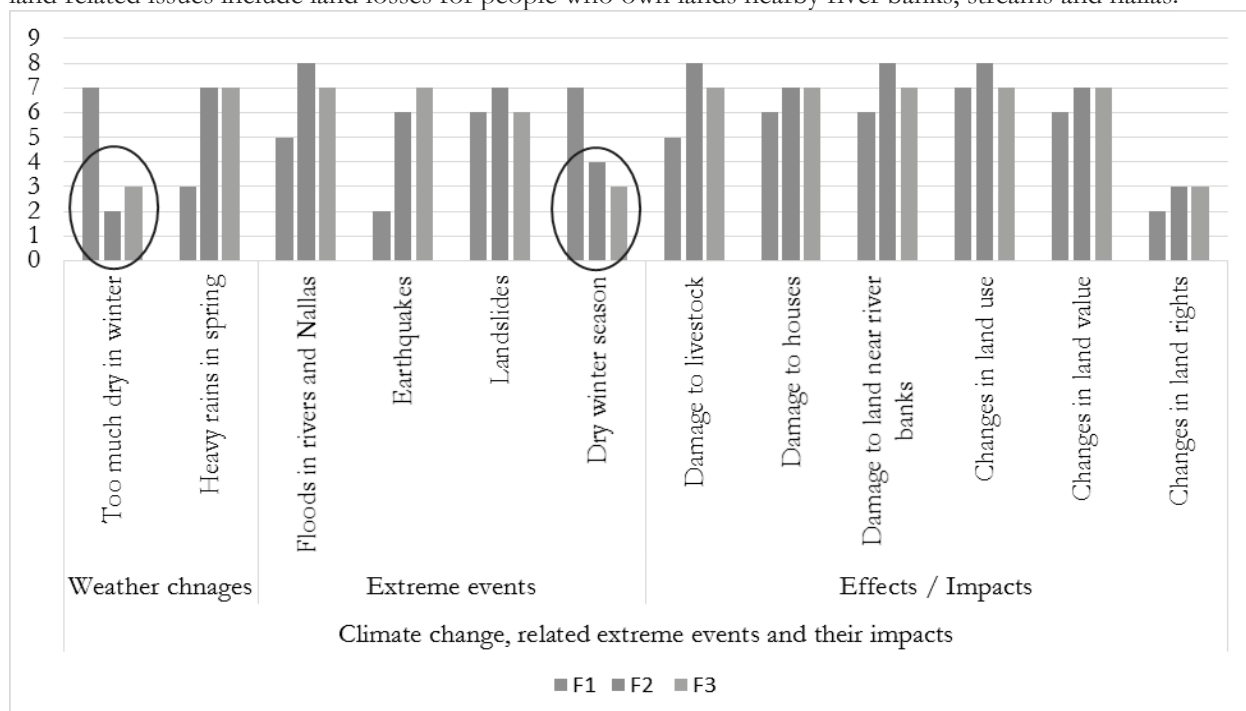


Figure 26: Response level and difference in opinion about weather related extreme events and their impact on land

Theme 3: Role of local community and indigenous knowledge about climate change and adaptation

Table 14: Assessment of local indigenous knowledge about climate change and adaptation

Theme	Code	Key points from answers	Calash	Booni	Shogore	Pattern of response
			F1	F2	F3	
			Participant = 08	Participant = 08	Participant= 07	
Local knowledge about climate changes	Source of knowledge	Inherited knowledge	5	3	5	B
		NGO's	4	4	4	B
		Media	2	6	3	C
		Authorities	2	5	3	C
	Level of knowledge	Strong	7	5	7	A
		Enough	1	2	0	A
		Weak	0	1	0	A
	Knowledge about nature of changes in land (Y/N)	Dry lands	6	7	7	A
		Grazing lands	5	7	7	A
		Safe settlements	5	6	5	A
		Crop lands	6	7	6	A
		Forest lands	5	7	4	A

A: Strong agreement either positive or negative B: Mixed Response C: Disagreement

As shown in table 14, mixed response was received about the knowledge about climate change and adaptation practices inherited from elders. Participants of focus group F2 are from Booni Town, who are mostly educated so they agreed a little about the importance of traditional knowledge and they prefer to rely on information from media campaigns, NGO's recommendations and government announcements. Very few respondents from focus group F1 also replied that all the changes occurring in climate are natural. However, many respondents also claimed that due to over grazing and deforestation these changes are happening which means they know the human interventions as one of the root cause of climate change in the area. They also informed that some crop lands has been converted into fodder and residential areas.

Analysis of discussions also reveals that people living in rural areas rely on elders / seniors advices for adaptation measures related to agriculture but they were also willing to consider recommendation of NGO's working in their valleys. Regarding adaptation to climate change, all were agreed that people are helpless for coping with extreme flooding now a days due to flash floods and glaciers melting water coming in the river. All respondents replied that they support the idea of building houses at safe places and away from river banks but also demanded some sort of financial support from government. Figure 27 shows the bar chart about a higher level of response which shows that local knowledge about climate change has significant value and unless it is not integrated into scientific knowledge before planning for adaptation measures in this area, such adaptation planning will might be not fruitful.

Key finding: Local indigenous knowledge is also a great source of information regarding local climate changes and about people's behavior for climate change adaptation. Thus it can play a vital role in planning for better adaptation measures at local level. Although other sources of information including scientific knowledge about climate change and its future predictions is important but at the same time significance of adaptation practices by communities according to their own traditional knowledge cannot be ignored.

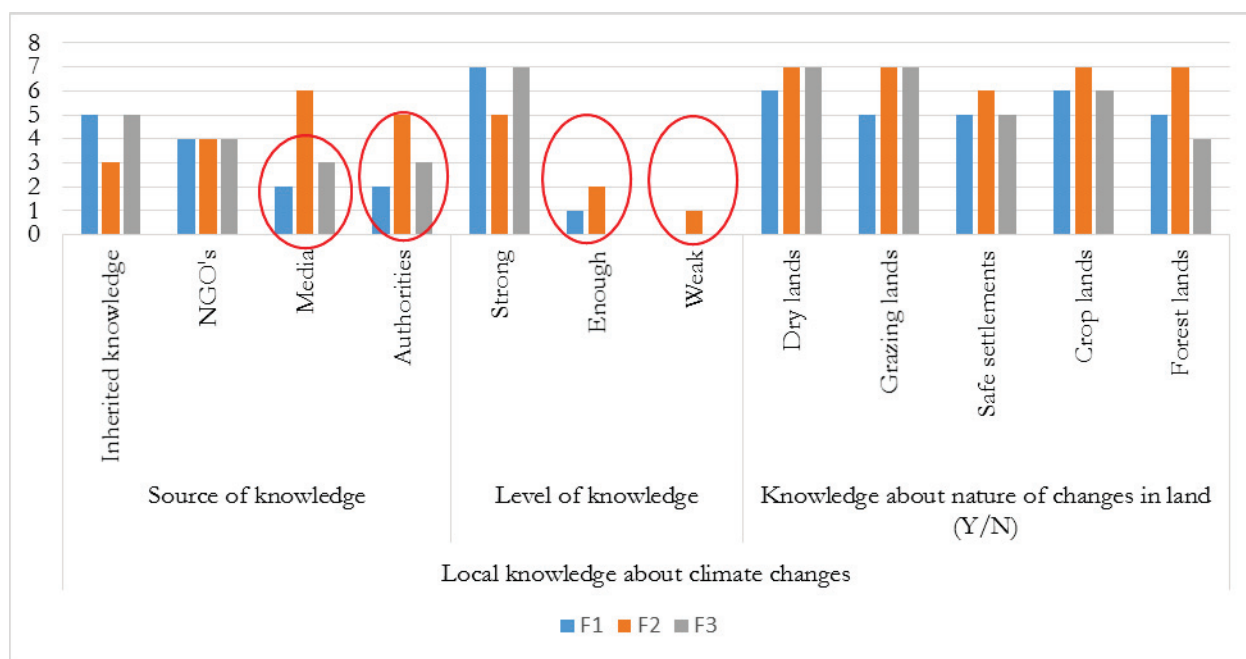


Figure 27: Assessment of value of local traditional and indigenous knowledge about climate change

Theme 4: Status of forest and importance of community forest management

Table 15: Assessment of present status of forest, local tenure rights on forest and role of community in effective management of forests

Theme	Code	Key points from answers	Calash	Booni	Shogore	Pattern of response
			F1	F2	F3	
			Participant = 08	Participant = 08	Participant = 07	
Managing forests at community level	Tenure of Forests	Complex permit rules for wood use	7	7	4	B
		Less financial rewards	8	4	7	B
		Less transparent procedures	8	4	7	B
		Un clear use rights	8	4	7	B
	Status of forests	Forests as govt. property	7	7	7	A
		Weak management and monitoring	8	8	7	A
		Over grazing	4	8	4	B
		illegal harvesting	8	8	7	A
	Adaptation activities	re-plantation	7	6	8	A
		Redefining use rights	8	4	7	B
		More group rights	8	4	7	B
		Cash incentives	8	4	7	B
		Limiting grazing	4	8	7	A
		Creating awareness	7	7	7	A

A: Strong agreement either positive or negative B: Mixed Response C: Disagreement

In focus group discussions, it is highlighted that although there is no distinguish boundary between lower grasslands, village land and top ground forests, but mostly forests are belonged to provincial government. Very few owned forests can be cited on private land by local people who plant walnuts and fruit trees on their farm lands. All the respondents were not satisfied about the present unclear use rights of forests and

the rules of permit for wood use enforced by forest officials. All were agreed for awarding more financial benefits and transparent procedures. They also highlighted overgrazing, illegal harvesting of trees and weak management as the main causes of decline in forest reserves. Additionally, all the respondents suggested to stop grazing of goats and sheep in surrounding areas of town so to protect soil from erosion and weakening of rocks which they also think the major cause of landslides during rainfalls. All the participants during discussions agreed on limiting illegal access of outsider contractors for harvesting trees and by adding more flexible use rights for locals who are willing to play their role in monitoring, protecting and re-plantation of forest trees. A bar chart showing in figure 28 represents high level agreement in bringing clarity on discordant property rights on forests and demand for raising community participation for effective management of forest reserves.

Key finding: Deforestation can be controlled by creating awareness, by reducing and restricting grazing in forest areas. However due to presence of unclear use rights of forests for local community is another hindrance for improving forest reserves and ultimately conservation of carbon stock. Thus, by providing more use rights to local community, and by giving them cash benefits for managing forest management cannot only give economic benefits to poor local people but can also improve carbon sinks and sources.

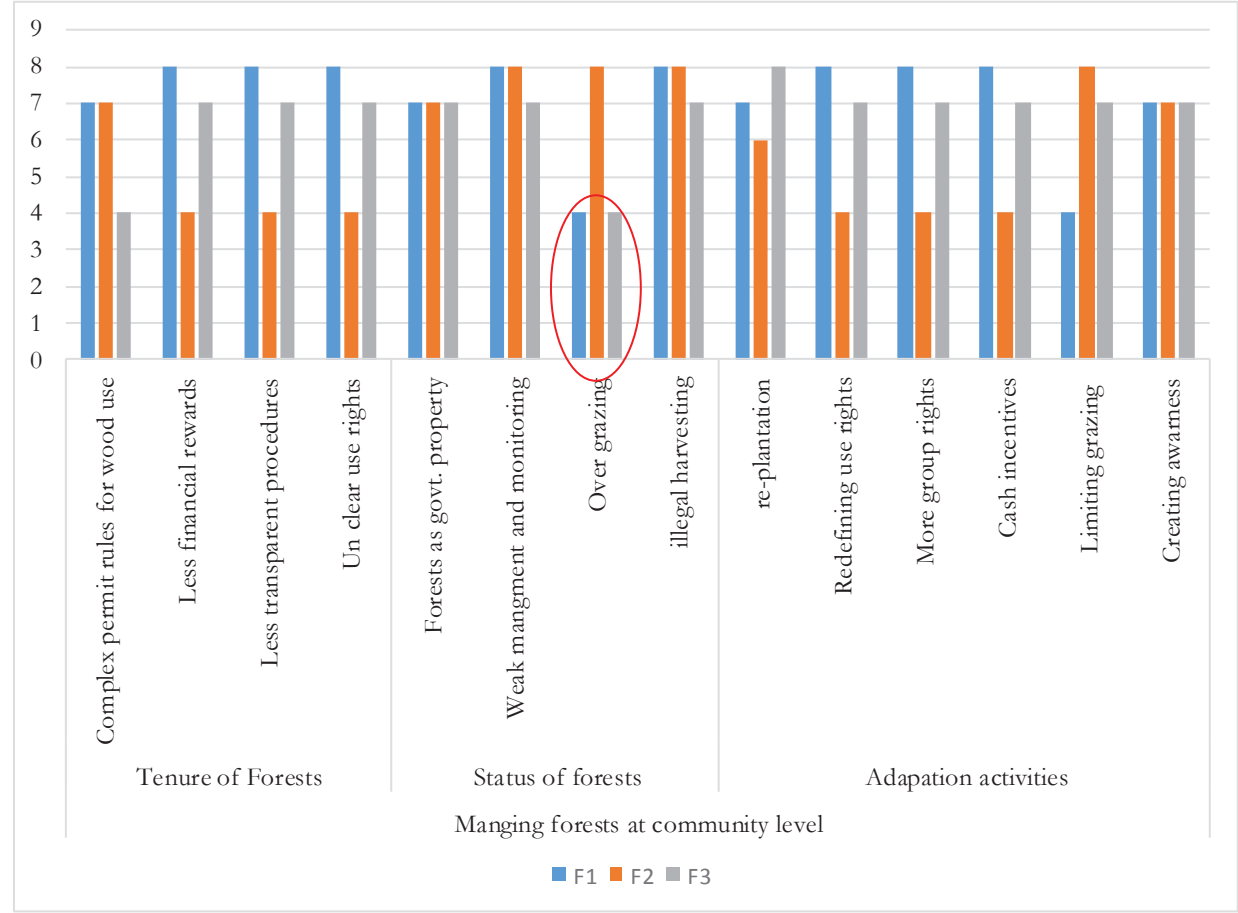


Figure 28: High degree consensus among the respondents from all focus groups about present unclear structure for forest tenure and role of the community forest management.

Theme 5: People view about causes of climate changes and stakeholder's responsibility for adaptation

Table 16: Table showing information about people's view causes of climate change in the study area and to identify who is responsible for making planning for adaptation to climate change

Theme	Code	Key points from answers	Calash	Booni	Shogore	Pattern of response
			F1	F2	F3	
			Participant = 08	Participant = 08	Participant = 07	
Causes of Climate change	Causes	Natural changes	6	3	3	C
		Human Activities	4	8	7	B
		Global warming	3	7	5	B
	Coping with effects of extreme events	Safety walls	6	7	7	A
		Stopping Encroachments	6	8	7	A
		Building Safe houses	8	8	7	A
	Who's responsible	Central government	3	6	6	B
		Provincial government	5	6	6	B
		Local govt.	7	7	7	A
		People	4	8	5	B

A: Strong agreement either positive or negative B: Mixed Response C: Disagreement

Some respondents felt that these changes are from God's will and results from table 16 shows disagreement between focus groups about this belief. Others felt that reason is human activities / intervention to natural environment. Some respondents also claimed that it is due to global warming. Others counted the disasters events like flooding, unpredicted rainfalls and landslide etc. as climate change. However, all of them were able to identify the occurrence of more frequent glacier outbursts and heavy rainfalls in the area and they understand that all these are occurrences are contributed from climate change. Thus people in the study area have quite scientific view about climate change, its causes and its impact on environment on their lives.

Regarding coping with climate change impacts, table 16 shows that majority of participants from all focus groups support the selection of safe areas for building houses and also building of safety walls along river sides to protect nearby lands from damage. Participants of focus group F2 showed their concern about encroachments in nallaas, and streams land and suggested that the deepening of streams by cleaning them from rocks, and by building safety walls /bunds. Respondents from Booni also suggested the construction of more water channels from rivers to divert river water into different places which can also provide the water source for remote areas which have issue of lack of water availability.

Majority of participants felt that government is primarily responsible for making adaptation planning and managing the climate related hazards however all were also agreed about individual and community role to limit human interventions against environment as well as to play their role for protecting themselves against these climate related hazards. The respondents appreciated international donor bodies and their activities in the area. All the participants were unsatisfied with local government plans, however, they also suggested for initiating fund raising activities, however.

Key finding: A part from natural changes and global warming, human activities are also one of the main factor for causing changes in climate and consequently people are the most effected from these changes. Both people and government have their own roles and responsibilities for limiting human interventions causing climate change.

Theme 6: Roles and responsibilities of community and stakeholders for adaptation to climate change

Table 17: Assessment of role of individual people and community and their view point about the efforts of public and private sector for local adaptation to climate change.

Theme	Code	Key points from answers	Calash	Booni	Shogore	Pattern of response
			F1	F2	F3	
			Participant = 08	Participant = 08	Participant= 07	
Roles and responsibilities	People's role	Crop switching	4	4	4	B
		Building safe houses	6	7	6	A
		Building Standards	3	4	3	B
		They need access to information	8	7	7	A
		Awareness	8	8	7	A
	Efforts of public and private institutions	Restoration plans	4	4	4	B
		Development Projects	5	4	5	B
		Water supply Programs	8	7	7	A
		Building safety walls	6	5	6	A
		Awareness programs	5	5	4	B

A: Strong agreement either positive or negative B: Mixed Response C: Disagreement

Table 17 represents the level of response from participants of different focus groups about their understanding of their responsibilities regarding adaptation to climate change. During discussion, some key adaptation measures including crop switching, adapting better seeds, building safe houses and at safe places were identified, but it was also highlighted that people don't know about these building standards set by government in case if they exist. Thus they agreed upon need of awareness programs as well as fair access to information about future climate change projections.

For discussion about the efforts being made by public and private institutions regarding building capacity of people and providing relief against climate risks, respondents from focus group F2 emphasized that local administration is responsible for adaptation planning but it is not active so far might be due to its limited capacity and limited financial resources. However, they appreciated the efforts of Mr. Mohy-ud-din (Public Representative for restoration of basic services damaged due to recent floods).

Biyer local support organization (BLSO), Aga Khan rural support program (AKRSP), Sarhad rural support program (SRSP) are more active in this area for creating awareness as well as for restoration of utility services, road and bridges re-building and construction of river bunds. SRSP, BLSO, AKRSP and many international donor agencies have made efforts to improve water channels health services and micro-hydroelectricity power plantation. All the respondents appreciated the efforts made by these NGO's regarding their help against the risks related to climate change. All the respondents were agreed on community role. They were willing to provide support like cheap labour / volunteer in case of projects related to manage disaster risks.

Key finding: All have their individual responsibilities so they should realize. Local authorities should impose restriction on construction of houses close to river and should make concrete walls on shaky river banks. It is the responsibility of local government that it should introduce some rules and restrictions to stop environment unfriendly activities. Thus all stakeholders have their individual and own responsibilities that they should aware off. Federal, provincial government including NDMA should assess vulnerability for future due to outburst of glaciers in river basin in the area and should start projects accordingly for building capacity of institutions as well as communities. On the same time, community has also its responsibility to involve and participate effectively in adaptation activities.

Annex-F: Analysis of data from meetings

Private institutions like international and local NGO's are actively participating in rural developmental programs for the mountain community of HKH region including Chitral, Pakistan. These organizations mainly have focus on rural development, schemes for supply of drinking water, building capacity to cope with disasters like floods and on many other resilience programs for livelihood development of people living in this area. Therefore, it is important to collect their opinion about the nature of climate changes and its impact on people, their experience about land policies and their present activities about improving adaptation to climate change.

In this regard, two most prominent organizations, "The International Centre for Integrated Mountain Development (ICIMOD)" and "Aga Khan Rural Support Programme (AKRSP)" were chosen as both these have vast international and local experience and a lot of projects specifically related to climate change are at their credit. One meeting was conducted with chairman ICIMOD who is country representative in Pakistan and has a diverse background about running different projects in Chitral. Other meeting was arranged with representative from AKRSP. During the meeting various issues were discussed like issues related to climate change and its adaptation, capacity building, land related issues, issues with land policies and coordination of stakeholders for information sharing related to current situation of climate related disasters etc.

A comparison analysis is given below in the form of tables and charts showing degree of agreement and disagreement against different arguments highlighted during the meetings. In analysis of these tables, a difference in opinions of both organisations is described and key findings are also summarized at the end of each theme.

Theme 1: Climate change, related extreme events and their impacts on land

Table 18: Causes of climate change, climate related extreme events and their impact on land sector

Questions / Themes	Code	Key points from answers	ICIMOD	AKRSP	Level of Agreement
Climate change, related extreme events and their impacts on land	Weather changes	Too much dry in winter	A	B	Both Agree
		Heavy rains in spring	A	A	Both Agree
	Extreme events	Frequency	A	A	Both Agree
		Intensity	A	A	Both Agree
		Floods in rivers and Nallas	A	A	Both Agree
		Earthquakes	B	B	Both Agree
		Landslides	A	B	Both Agree
		Dry winter season	B	C	Difference
	Effects / Impacts on land	Damage to livestock	C	B	Difference
		Damage to houses	C	A	Difference
		Effect on cultivated land	A	A	Both Agree
		Damage to land near river banks	B	A	Both Agree
		Effect on land holdings	A	A	Both Agree
		Changes in land use	A	A	Both Agree
		Changes in land value	A	B	Both Agree
		Changes in land rights	C	C	Both disagree
		Damage to Informal settlements	C	A	Both Agree

A: Strongly Agree,

B: Agree,

C: Don't Agree,

D: Strongly disagree

Table 18 shows that respondents from both organisations were agreed on majority of key arguments made during answering the questions. According to the both, the area is facing too much dry winter seasons and heavy rain falls during the spring season, which are more prominent weather changes due to climate change. Due to these changes in weather, frequency and intensity of extreme events like floods, landslide and earthquakes is increased as compared to past decades. However, about the intensity of droughts, there was difference in opinion among the both. ICIMOD claimed that droughts in winter is also a major issue in almost whole area where as AKRSP personnel was in opinion that it's intensity differ in different areas and only few parts are facing this issue. But analysis of both agreements show that dry winter season is there in the area at some places apart from majority of the area is facing frequent floods.

Regarding impacts of climate change on land sector, both were agreed that climate change have countable impacts on land sector including agriculture, forests and other land use like settlements. The land degradation is also prominent due to landslide which effect the land holdings as well changes in land value. However, there was complete disagreement about the argument about changes in land tenure and there unable to link changes in tenure and climate change which actually shows the lack of information access about the land records from land officials. Figure 29 shows the overall response which leads to 76% agreement on key points, 18% contributes towards different view point and only 6% of the key points where both were disagreed with each other.

Key finding: There is significant change in land use due to climate change. Increasing frequency floods and landslides have affected the existing cultivated areas, forests and land holdings particularly near to nallaas. Informal settlers particularly afghan refugees are mostly effected for their houses and livestock. All the issues highlighted in above table 7 under the title “effects/impacts on land” are land related issues.

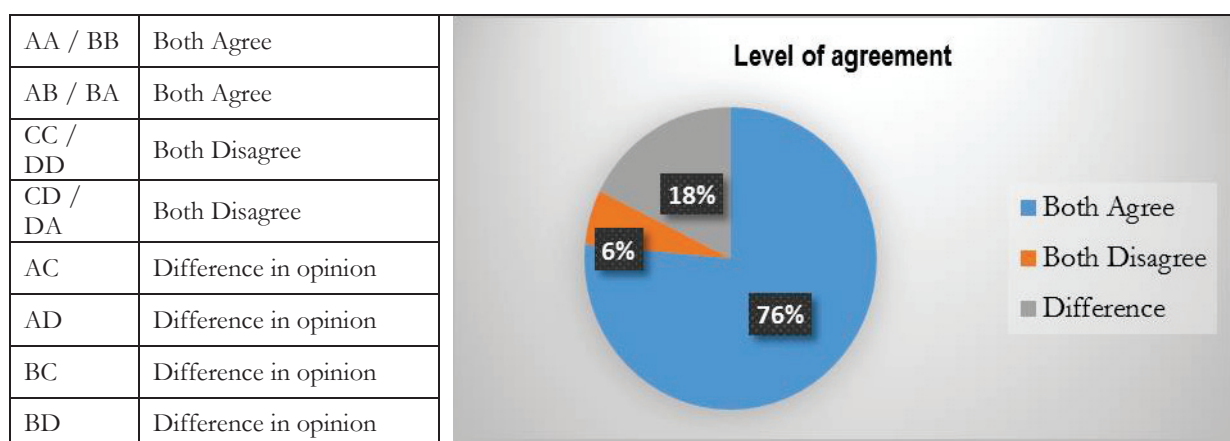


Figure 29: Showing the level of agreement between the two about identifying land related issues in context of climate change

Theme 2: Impact of climate change on forests and managing forests at community level

Table 8 summarise the key points highlighted during the meetings about forest status, present structure of use rights of forests and adaptation activities that can be practised with the help of community for effective management of forests and improvement of forest reserves. Both have highlighted the similar issues related with forest tenure like unclear use rights on forests, complex permit rules for wood use for locals and lack of transparent procedures for allowing benefits to local's quantity for harvesting trees. Both were agreed on decline of forests due to weather changes related with climate change apart from other issues like timber mafia. Illegal cutting of trees for fire wood and over grazing which shows poor management and weak monitoring from forest authorities. In continuation of further discussion, both were agreed for active participation of community in adaptation activities to reduce forest degradation and to improve forest reserves in the area.

Table 19: Assessment of present status of forests, its tenure and community role in effective management of forests

Questions / Themes	Code	Key points from answers	ICIMOD	AKRSP	Level of Agreement
Managing forests at community level	Tenure of Forests	Complex permit rules for wood use	A	A	Both Agree
		Less financial rewards	A	A	Both Agree
		Less transparent procedures	B	A	Both Agree
		Un clear use rights	B	B	Both Agree
	Status of forests	Forests as govt. property	A	A	Both Agree
		Decline in forest due to climate change	B	B	Both Agree
		Decline in Forests due to human activities	B	A	Both Agree
		Timber Mafia	A	A	Both Agree
		Weak management and monitoring	A	B	Both Agree
		Over grazing	B	B	Both Agree
		illegal harvesting	B	B	Both Agree
	Adaptation activities for Effective Forest management	Community participation	A	A	Both Agree
		Territorial rights	B	A	Both Agree
		re-plantation	A	A	Both Agree
		Redefining use rights	C	A	Difference
		More group rights	B	A	Both Agree
		Cash incentives	A	A	Both Agree
		Limiting grazing	B	D	Difference
		Creating awareness	A	A	Both Agree

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

The adaptation activities include re-plantation of forest trees, effective monitoring of illegal harvesting and protection of forest trees from environmental changes. In this regard, community role is important for which both were agreed on the actions to be taken like redefining use rights, introducing group rights at community level as well as offering cash benefits to people for offering their participation in management of forests. Figure 30 shows the high level of agreement on key viewpoints.

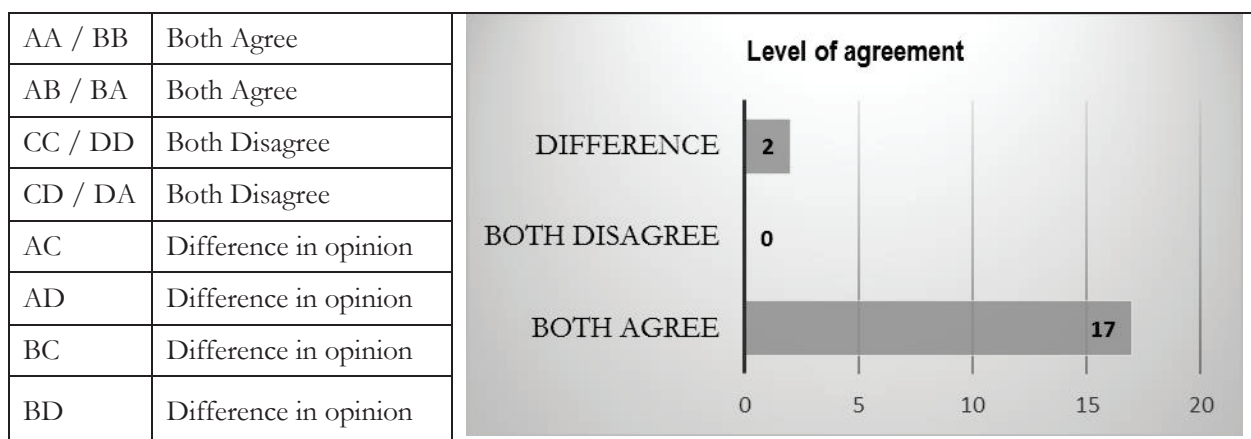


Figure 30: Showing the level of agreement between the two regarding community forest management

Key finding: Present status of forest in the study area is a big concern. Forests are declining due to many reasons including climate changes, human activities and poor management. Unclear use rights are also responsible for promoting illegal harvesting of trees thus causing decline in forest areas. Community participation is really important in adaptation activities like re-plantation of forest trees, effective

monitoring of illegal harvesting and protection of forest trees from environmental changes. This can be achieved only when some actions will be taken from authorities like redefining use rights, introducing group rights at community level as well as offering cash benefits to people for offering their participation in management of forests.

Theme 3: Local knowledge about climate changes

Table 20 shows some of the key viewpoints of respondents about the sources and level of local knowledge that people have about climate change and nature of climate related impacts related to land. This information can help to understand the role of people in effective adaptation to climate change as well as realigning the policies so that people at community level can respond better for adaption planning initiated by different institutions.

Table 20: Assessment of value of local indigenous knowledge about climate change

Questions / Themes	Code	Key points from answers	ICIMOD	AKRSP	Level of Agreement
Local knowledge about climate changes	Source of knowledge	Inherited knowledge	B	A	Both Agree
		NGO's	A	A	Both Agree
		Media	A	A	Both Agree
		Authorities	A	A	Both Agree
	Level of knowledge	Strong	C	B	Difference
		Enough	C	B	Difference
		Weak	D	D	Both disagree
	Knowledge about nature of changes in land (Y/N)	Dry lands	B	B	Both Agree
		Grazing lands	C	B	Difference
		Safe settlements	C	C	Both disagree
		Crop lands	C	C	Both disagree
		Forest lands	D	B	Difference

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Table 20 shows that both were agreed that people have strong inherited knowledge about climate changes occurring in the area where as they also gain knowledge from other sources like social media, public authorities and private institutions like NGO's. People in the community already know about the different kind of lands as well as they know about the nature of lands that can help them for better improvements in agriculture. However, at the same time, both disagree for their level of knowledge about the fertility of crop lands and identification of safe settlements. The reason is that nature of soil is continuously changing due to frequent floods and debris flow causing draining the soil from rock and making it weak so making steep slopes unsafe for building houses.

Key finding: Although local indigenous knowledge is important for understanding the role of community participation and people's responsibilities for their capacity building and improving adaptation to climate change but they need more access to information held with different institutions in order to learn more about the nature of changes in land occurring due to climate so that they can better identify the safe places for building houses as well as can adapt measures for better production from their cultivations.

Theme 4: Roles and responsibilities in adaptation to climate change

Classification of key points extracted from meeting notes showing in table 21 provides information about some key efforts made by public and private institutions for capacity building of people as well as give an understanding about the role of community to cope with climate changes. Further, issue of lack of coordination among all these stakeholders including community is also highlighted during the meetings.

Overall they were agreed upon that people at community level should have access to information so that they can better respond for activities like crop switching and selection of better seed to cope with climate change effects on agriculture, and building their houses at safe places. Thus creating awareness is very important to improve knowledge of local community about climate change and how they can better respond accordingly to minimize its impacts on their livelihood.

Table 21: Understanding the roles and responsibilities of community and other stakeholders regarding adaptation to climate change

Questions / Themes	Code	Key points from answers	ICIMOD	AKRSP	Level of Agreement
Roles and responsibilities	Community's role	Crop selection and switching	A	A	Both Agree
		Building safe houses	A	A	Both Agree
		Building Standards	A	B	Both Agree
		Access to information	A	A	Both Agree
		Awareness	A	A	Both Agree
		Public safety	A	A	Both Agree
	Efforts of public and private institutions	Restoration plans	A	A	Both Agree
		Development Projects	A	A	Both Agree
		Water supply Programs	B	A	Both Agree
		Building safety walls	A	A	Both Agree
		Awareness programs	A	A	Both Agree
	Coordination among stakeholders	Exists	C	D	Both disagree
		Don't Exist	B	A	Both Agree
		Data sharing	A	B	Both Agree
		Access to information	C	C	Both disagree

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: It is clear that agriculture and people livelihood is strongly effected due to climate changes in the study area. No any adaptation program can get success unless community is not involved in these adaptation programmes. People have limited scientific knowledge about the recent climatic impacts on land, thus they should have access to information about future projected climate changes as well as government priorities regarding climate change adaptation. This is only possible if there is present enough mechanism of exchange of information between all stakeholders including individual and community.

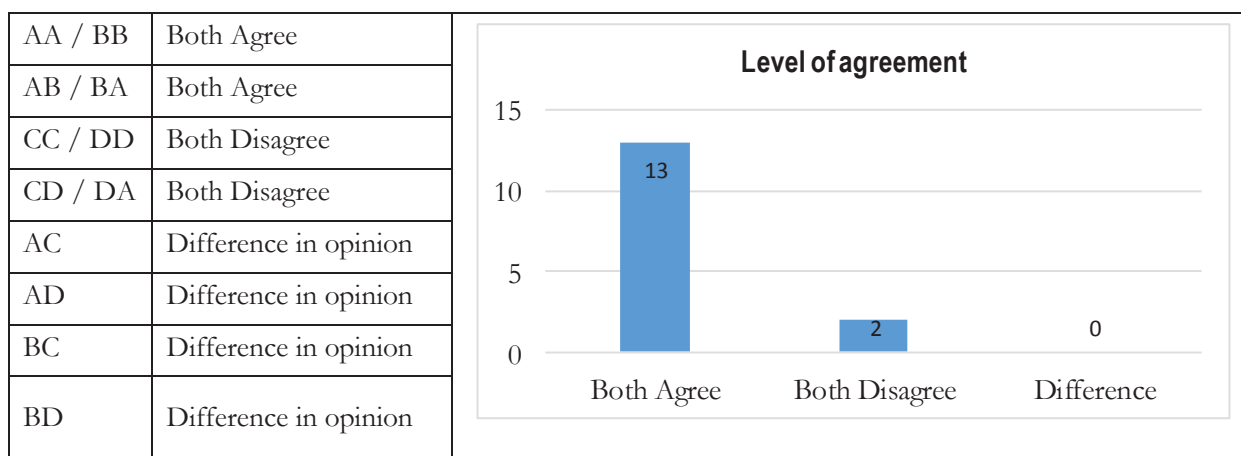


Figure 31: Shows high level of agreement about recognising role of community

Theme 5: Information about land policies and integration of land issues related to climate change

Table 22 shows the degree of opinion of personals from both ICIMOD and AKRSP when they were asked about the present status of land policies and possible integration of land related issues into climate change adaptation strategies. Both claimed that as such there is no any concrete policy exist at national and local level. According to their knowledge, they argued that some documents are available which can be classified as a set of national land policies but there is no clear cut policy which can address the issue of conservation of carbon stock and reduction of GHG emissions as well as can provide guideline for structuring adaptation strategies and implementing them at local level. Additionally they highlighted the disaster relief programs of National Disaster Management Authority (NDMA) but also claimed that due to absence of coordination among NDMA and private organisations and due to lack of concrete policies, efforts being made for risk management, relief and adaptation programmes are not fruitful till to date.

Table 22: Assessment of views about present status of land policies and policies about climate change adaptation

Questions / Themes	Code	Key points from answers	ICIMOD	AKRSP	Level of Agreement
Policy issues	Policies about climate change adaptation	Policy Exists	B	D	Difference
		Don't exist	C	A	Difference
		Adaptation Plans by NDMA	A	B	Both Agree
		NGO's Plans	A	A	Both Agree
		Policies about carbon emission reduction	C	C	Both disagree
		International developmental programs	B	B	Both Agree

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: Land policies exist or not, this is a separate question that might be answered correctly by relevant government institutions, but it is clear that integration of land related issues due to climate changes into land policies is an emergent need. This integration can help to improve adaptive capacity of institutions as well as can bring a one single platform or interface which can provide enough source of knowledge about climate change issues and adaptation as well as can help in sharing experiences of all organisations involved in the developmental programs related to adaptation.

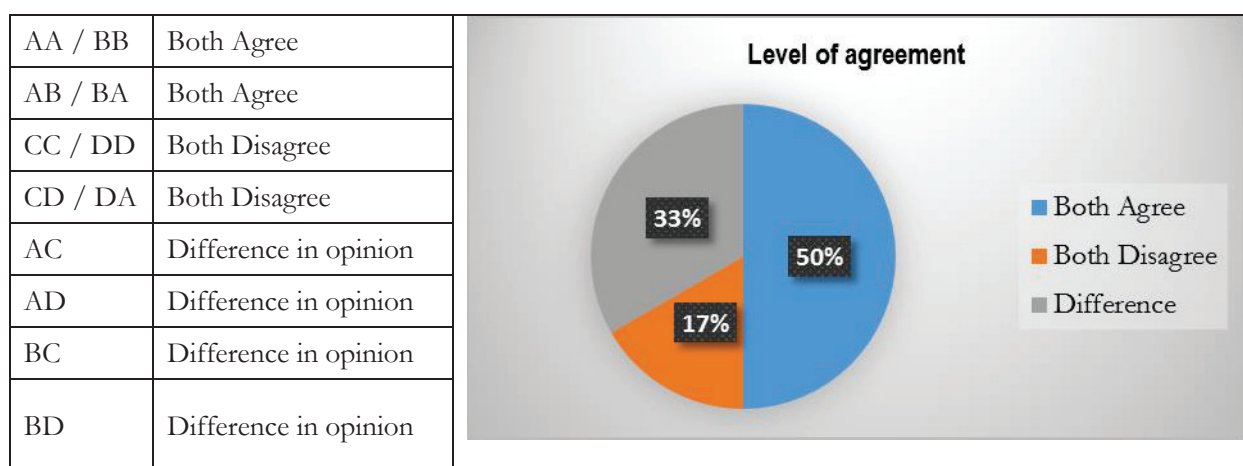


Figure 32: A mix level of response for information about present status of land policies

Theme 6: The possibly approaches for sharing information among stakeholders and diffusion of this information to public.

Table 23 shows the summary of agreement and disagreement regarding existing situation of coordination among public and private organisations. Both were agreed that the major issue in this area is the lack of

coordination among all the stakeholders particularly very poor coordination of public organizations with private organizations. ICIMOD declared that they are sharing data about projects and climate related information with NDMA who is the pioneer and leading organisation for disaster management in Pakistan. But AKRSP claimed that there is no proper coordination present among private and public organisations and usually it is very difficult to approach concerned government organisations for requesting information / data related to climate change. ICIMOD also claimed that ICIMOD and its partner NGO's are the only one who are managing data about the climate changes in the area and then this data is shared with NDMA. For forecasting, ICIMOD has also working relationship with metrological department. This argument made by ICIMOD is also supported by its publication. Both highlighted some mechanisms of information sharing like through media, public announcements, warning systems and publications which seems irrelevant to the subject querying for standard ways of mutual communication among stakeholders.

Table 23: Assessment of existing coordination among stakeholders for information sharing and its accessibility

Questions / Themes	Code	Key points from answers	ICIMOD	AKRSP	Level of Agreement
Access to information	Coordination among stakeholders	Exists	B	D	Difference
		Data sharing	C	A	Difference
		Exchange of information	A	B	Both Agree
		Information about development programs	A	A	Both Agree
	Information sharing	Media campaign	C	C	Both disagree
		Public Announcements	B	B	Both Agree
		Early Warning system	B	A	Both Agree
		Publications	A	A	Both Agree

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: It is clear that poor coordination exist between all public and private stakeholders regarding data sharing which highlights the weak structure of policies as well as a barrier for access the information to people and community who are directly going to response for the adaptation activities. Another important thing is, at present only ICIMOD is the main custodian of climatic data, so while planning strategies to cope with climate change, relevant authorities should consider the recommendations and data provided by ICIMOD.

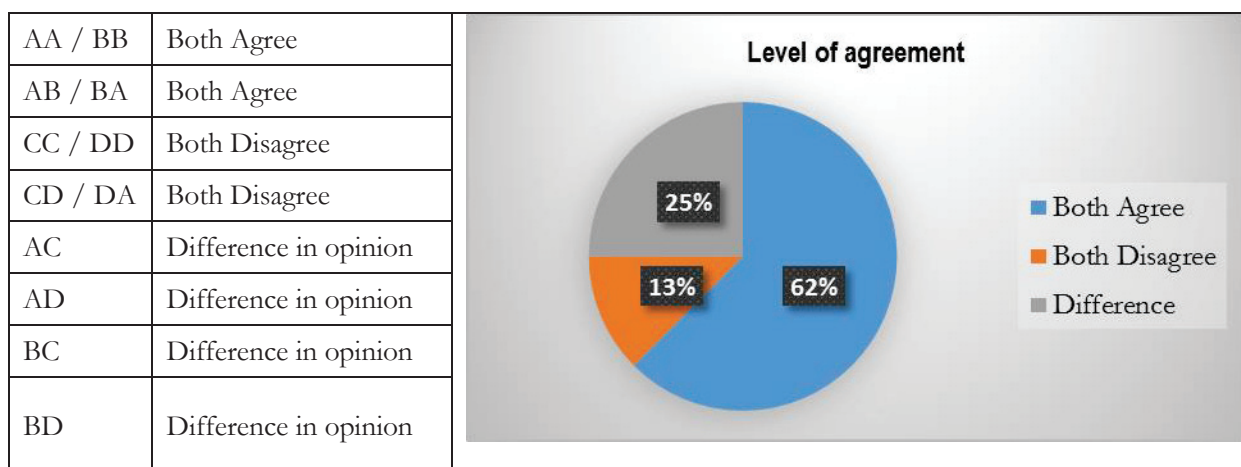


Figure 33: A mix level of agreement about key arguments regarding information sharing and coordination among stakeholders.

Annex-G: Analysis of data from Interviews with forest officials

Forest department in Pakistan is administrated under provincial governments. Forests of Chitral being one of the district of Khyber Pakhtunkhwa (KPK) province are therefore currently under the administrative control of KPK. Forestry in Pakistan involves the management of all public and protected forest areas. Central federal government issue its policy guidelines for management and development of forest resources, while provincial governments in implementation of those recommendations, and make provincial level policies. Present KPK forest policy approved in 1990 a stated at official website of KPK.

In order to collect information about present status of forest, and relevant key policies for its management, two individual semi structured interviews were conducted with the two senior officials of local forest office of Chitral and Booni respectively. Similar questions were asked to both officials. Both officials shared enough information about the present status of forest tenure and the present status of forest reserves in the area, however both were reluctant to provide information about policy issues related to forest management linked with climate change. The reason is also might be their lack of information as during the desk study of National Climate Policy, it is clear that provincial governments have their own responsibility in framing the policies in a way so as to address the issues related to climate change.

An analysis of data collected through interviews with forest officials is summarized below in the form of tables and charts. Data classified in each table is described separately and results in the form of key findings are also given immediately after the description of each table.

Theme 1: Status of forest reserves and it management

Officials informed that mostly forests are government property mainly classified as Forest Reserves, Protected Forests and Private forests. For local people, legal rights include use rights of timber for non-commercial use, fodder and fuelling. Forests decline is mainly due to poor forest management and monitoring and discarded land tenure. They also reported that presently 4000 ha area has been declined in past 15 years.

They accepted the argument that the present system of permits for harvesting trees is being misused while local community is being exploited not having their fair share for getting wood for their non-commercial use. So by soliciting participation of local communities in sustainable management of forests, encouraging them for planting trees in their nearby areas of residence and exploiting regeneration of auto production of Oak trees can help to increase the population of trees in forest land. They also suggested that people can also promote agroforestry on farm lands to reduce pressure on forest for firewood as well as by cultivating fodder crops on farmland to reduce over-grazing. Table 24 summarizes the key findings about forest tenure types and key suggestions made by these officials for effective management of forests.

Table 24: An assessment of nature of forest reserves, forest tenure and effective management of forests

Code	Key points from answers	Response
Nature of forest reserves	Forests as govt. property	A
	Protected forests	B
	Private forests	B
Forest use rights for locals	use rights for timber for non-commercial use	A
	Fodder and fuelling	A
	Permit for wood used for construction of houses	A
Causes of deforestation	Weather changes	A
	Poor management and monitoring	C
	Discarded tenure	B
	illegal harvesting of trees	B

	Misuse of permit of cutting trees by contractors	C
Effective Forest management	Involving local village people for production of trees	B
	Limiting grazing	B
	Planting trees nearby residential areas	A
	Protection of illegal cutting of trees	A
	Abolishing system of contractors	C
	Creating awareness	A

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: Although majority of the forests are government property and government is solely responsible for management of forest reserves. But in the present situation where the forest are quickly declining due to various issues likely climate changes as well as due to weak management of forestry department, local community should be involved or sustainable management of forests. They should share ownership rights of nearby forests as well as a mechanism of incentives should be devised to encourage them for planting trees in their nearby areas of residence to increase the population of trees in forest land.

Theme 2: Policies at provincial and local level

A summary of analysis about existing status of policies is summarised in table 25. Both officials claimed that forest policy exists at provincial level including some ordinances addressing issues of deforestation related to climate change. Other policies include energy conservation, renewable resource policy etc. But they also accepted the weak level of implementation at local district level. They were strongly agreed about that these policies needs to be integrated to cope with environmental challenges.

Table 25: Information about current status of policies regarding preservation of carbon stocks and other adaptation measures

Code	Key points from answers	Response
Policy about preserving carbon stock	At National level	A
	At provincial level	A
	Local level implementation	B
	International obligations	B
Other policies	Energy policy for energy sector emission of carbon	B
	Transport policy	B
	Small Hydro power plants	A

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: Policies do exists at both national and provincial level. However their implementation at local level for making strategies for adaptation to climate change is absent which ultimately show the weakness in policy structure at higher level. There should be an integrated framework of policies that can address all the issues related to land sector including land tenure issues for effective management of forest which is essential for both preserving carbon stock and reduction of GHG emission as well as for better adaptation measures to improve the production of forest trees and natural grasslands.

Theme 3: Tenure of forest and role of community in preserving carbon stock

In table 26, some of the key tenure issues related with forests are highlighted. Officials of forest department were agreed about the present discordant structure of property rights on forests. They accepted that quantity restrictions for cutting trees for non-commercial use of local people is being applied so local people are enforced to use illegal ways for getting wood for building their houses. Also, due to

lack of mutual confidence, and weak governance, non-efficient monitoring, timber mafia, even some corrupt government officials are also involved in illegal harvesting of trees. Further, they highlighted that, at present, local community have no much influential rights of use on forests. System of permit for harvesting trees and e-plantation need to be improved.

Table 26: Tenure issues particularly for forest areas and assessment of community role in bringing reforms in forest tenure

Code	Key points from answers	Response
Tenure issues	Restrictions for cutting trees by local	C
	Discordant structure of property rights	B
	Unclear system of contractors	B
	Unclear use rights	B
Community's role	By introducing influential rights of locals	A
	Revising system of contractors and permits	B
	Introducing cash incentives for re-plantation	B
	Benefits for protecting forests by locals	B
	Promoting farming to reduce pressure on grasslands	A
	Promoting private forest farming	A

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: Government authorities alone cannot effectively manage the huge forest reserves. Limited use rights and unclear structure of ownership rights on forest and grass lands is another barrier which is further boosting decline in forests. Thus, by adding more group use rights and sharing ownership rights of forest with local community is vital for controlling present decline in forests as well as for the success of adaptation plans for densifying the present forests by re-plantation and taking care of existing species to protect them from climatic hazards.

Theme 4: Access to information and sharing data among stakeholders.

Table 27 shows the summary of key notes regarding existing situation of coordination among forest department and other public and private organisations. They claimed that enough coordination exists among all the stakeholders particularly among public organizations. They further declared that information about the development plans for natural resources relate with forests is shared among all institutions and also any sort of information can be accessed through requests at any time. They also highlighted that some sort of information with the aim of creating awareness among people is also flowed via social media, workshops and public announcements.

Key finding: All is reported good about the present level of mutual coordination among stakeholders for access and sharing of information, but there is need to quantify the data that forest department have in context of carbon stock as well as quality estimation of above and below ground biomass in the form of geo-spatial data so that clear picture can be available in context of climate scenario. This kind of data is hardly available with forest department.

Table 27: Coordination among stakeholders and sharing of information

Code	Key points from answers	Response
Coordination among stakeholders	Exists	A
	Data sharing	A
	Exchange of information	A
	Information about development programs	B

Information sharing	Media campaign	B
	Public Announcements	B
	Early Warning system	C
	Publications	B

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Figure 34 shows the level of agreement in opinions from both officials which shows that their answers mostly fall in the area of agreement showing no any prominent difference about any key information provided by one after the other.

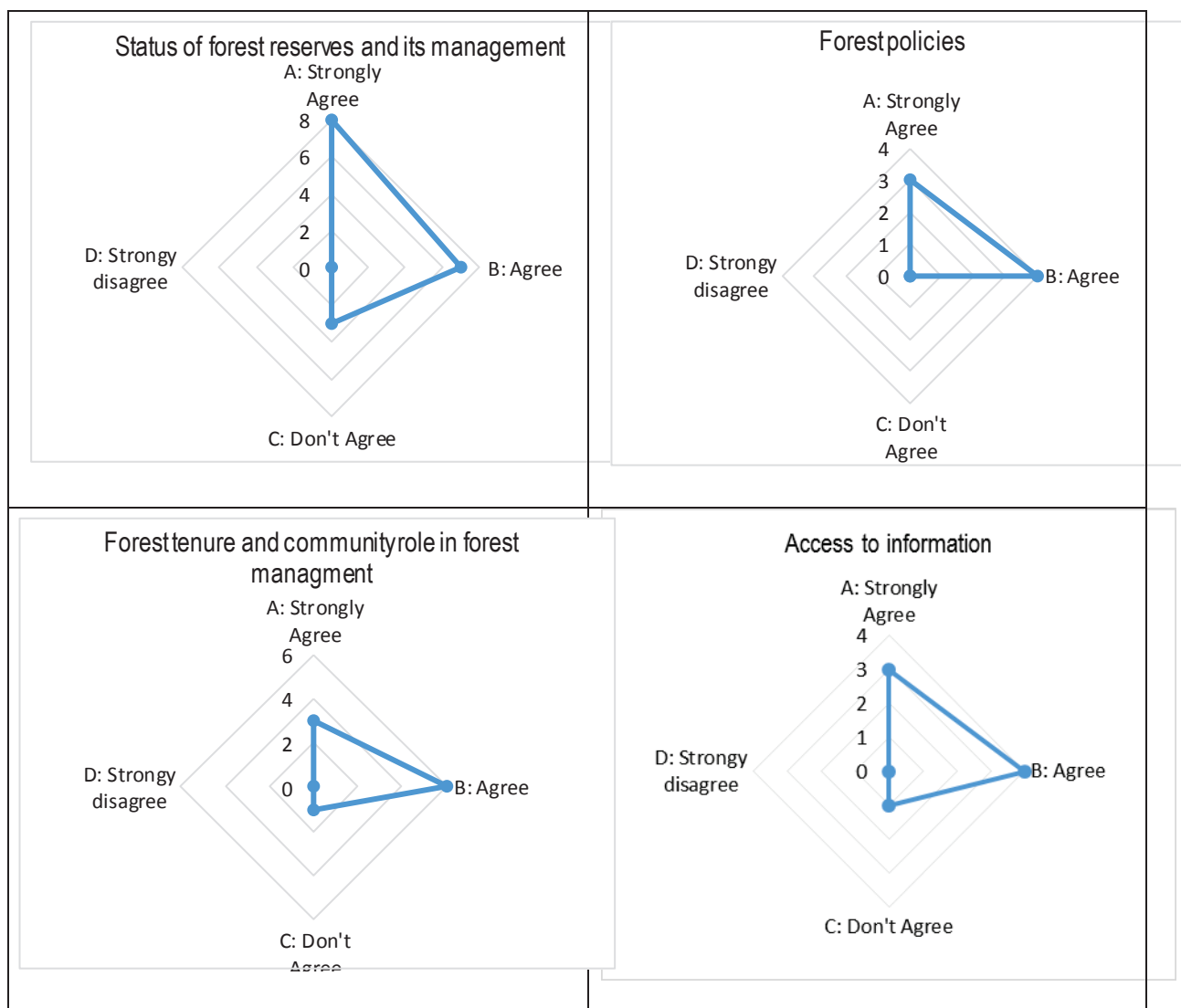


Figure 34: Level of agreement for four major concepts

Annex-H: Analysis of data from Interviews with agriculture officials

Agriculture department is also under the control of provincial government. Presently no independent office is established at district level. However one sub section of district government is entitled with agriculture section and supervised by an Assistant Director from agriculture department. A semi structure interview was conducted with the two officials from agriculture section of the Chitral district office as no any official is appointed in Booni. Although information from both of these officials is almost homogenous with some level of disagreement in opinion on some key points. All the information gathered through interview with agriculture officials is summarised in the following tables and charts and describe in further as below.

Theme 1: Impacts of climate change on agriculture land including its fertility and issues related to soil degradation

Due to change in weather, no significant changes occurred, however, planting and harvesting dates have been changed. In this regard they claimed that office of the agriculture department based on recommendation of agricultural research council, proceed the information to farmers regarding cropping dated and they are adapting accordingly. Further they also informed that aluminium and urea fertilizers are most suitable for the area due to present condition of the land. They highlighted the other issues with agriculture land like limited growth in cultivated land due to its terrain nature and further it is declining due to presence of farm lands closed to river beds being damaged by floods and its conversion into urban land due to population pressure and unplanned housing schemes.

Regarding soil condition of the study area, they informed that deforestation due to climate change and cutting shrubs for firewood weakens the soil among rocks which is the major cause of soil erosion. Watersheds are also responsible for soil erosion. Flash floods are also causing soil erosion in this area. Soil of district is slightly acidic to slight alkaline while increasing intensity of flood water flow also effect soil PH. In table 28, all the major impacts on agriculture land related with weather changes and other climatic extreme events are classified.

Table 28: Impacts of climate change on agriculture land

Code	Key points from answers	Response
Weather changes impacts on fertility	No significant change	B
	Slightly acidic due to change in PH value	B
	Ammonium and urea fertilizers are suitable	B
	changes in planting and harvesting dates	A
Other impacts on agriculture land	Limited growth in agriculture land due to terrain nature	A
	Land conversion due to population	A
	Declining cultivation area in river beds due to floods	A
	Effect on land holdings	C
	Changes in land use	B
	Changes in land value	B
	Changes in land rights	D
Soil erosion	Water shed	A
	Cutting shrubs for firewood weaken the soil among rocks	A
	Floods	B

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Figure 35 shows the level of agreement in both of the officials. Both have shown strong agreement on most of the key information with only two key points about change in land holding and in land rights. Although they were aware with the fact that agriculture land is being effected by floods and other climate related extreme events including landslides, and changes in weather patterns, but they were unable to quantify about the level of direct damage to ownership rights of farmer who own the land particularly near to streams and rivers.

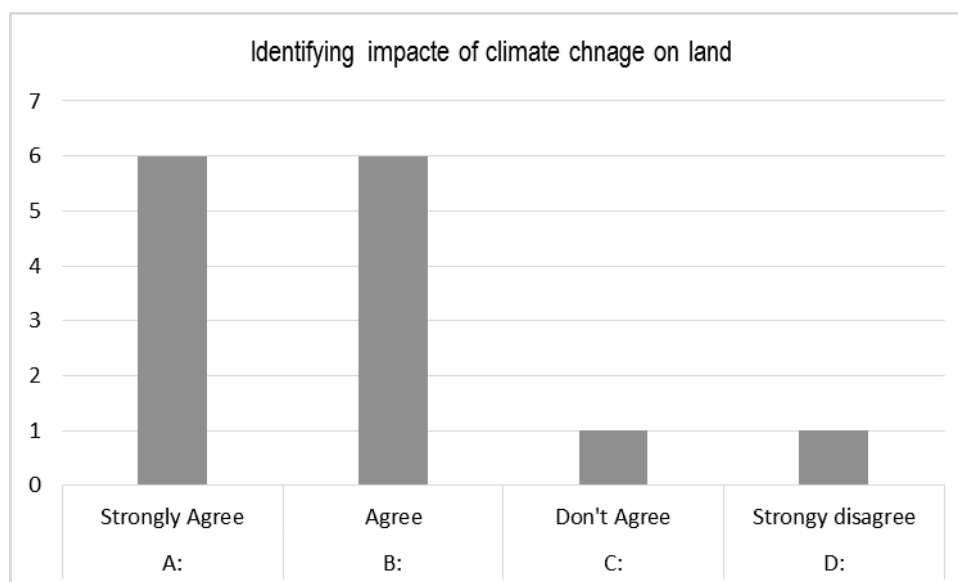


Figure 35: Level of response for each key point coded in interviews notes.

Key finding: Climate change have also its significant impacts on agriculture land in terms of its fertility, soil erosion and changes in planting and harvesting seasons. As mostly cultivated land is situated near the rivers and streams, so due to frequent floods cultivated land is also being damaged besides its conversion into urban land due to population pressure and unplanned housing schemes. Thus overall impact of climate change on agriculture is very high and is the major source of vulnerability of people who highly depend on agriculture for their livelihood.

Theme 2: Issue related to water resources and its accessibility

While discussing about the water resources in the area, both officials highlighted that water channels also called perineal pipes are the major ways of irrigation adapted from historical times. It is the old and successful way, because farm lands usually are at higher level from river and streams. Mainly glaciers melting, snow fall fed while in some area monsoon and unpredicted winter rainfalls are the major sources of water in river and streams. Table 29 summarises the climatic issues related with water resources and it accessibility. They also highlighted the issue of shortage of water in winters as mostly winters are dry. SO they also suggested that structure of water channels needs to be improved. More channels needs to be constructed by government. They should informed that department has identified source sites which will not only reduce the pressure of floods but also will possible to give water access to more cultivable land.

Table 29: Sources of water and its accessibility

Code	Key points from answers	Response
Sources of water	Perineal Pipes	A
	Rivers	A
	Springs	B
	Rainfalls	B
	Glaciers	B

	Monsoon	B
Issues	Floods	A
	Abrupt Rainfalls	A
	Dry season	A
	Glacier melting	B
Accessibility	Shortage	C
	Excess	B
Barriers	Limited water channels	A
	Perineal pipes as major source for irrigation	A
	Less water for Agricultural which are farm lands are at higher level from rivers and streams	A
		A

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Figure 36 shows that for majority of key points, both were seemed to be agree with each other making the quality of information suitable for further analysis.

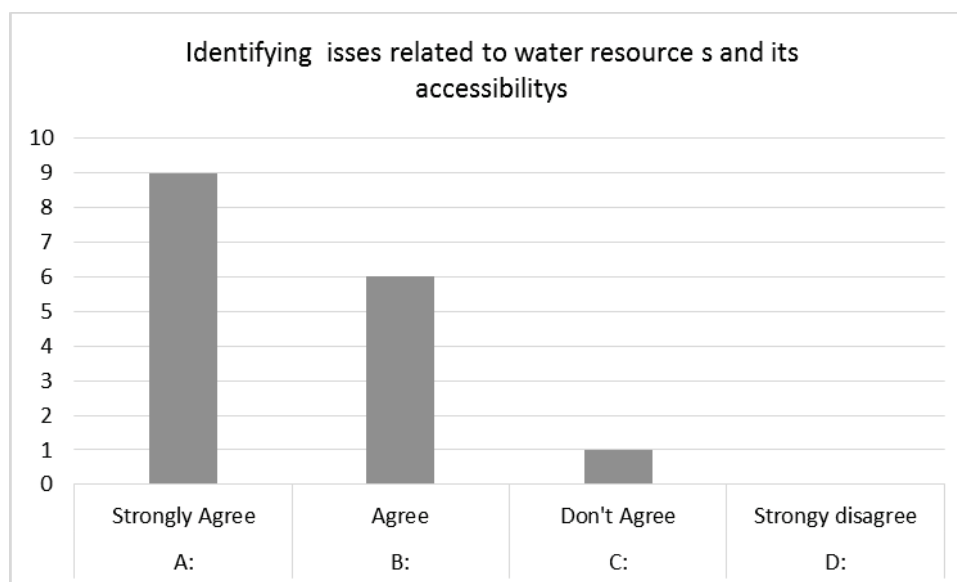


Figure 36: Level of agreement between agriculture officials during interviews.

Key finding: As glaciers melting and rainfalls are the main sources of water tributaries of the study area, therefore changes in glaciers melting and rainfalls due to present changes in climate conditions have strongly effected water resources as well as its associated beneficiaries like agricultural land and people. Further present structure of water channels is another barrier and its capacity need to be improved in the light of future projected climate changes and its related impact on water resources so that enough water would be available for drinking as well as to meet the demanded supply for irrigation.

Theme 3: Access to information

Regarding information sharing about the latest quickly changing climate conditions for agriculture sector, and its timely access to farmers is a major issue. Both officials were well aware about this issue, however they emphasized that they have registration schemes for all farmers to be registered with agriculture department, so that they can send information updates about seeds, plantation dates and suggestions for crop switching. Further they also highlighted that coordination with other departments like forest, water management board and district government. A lot of research is being made by research council which is

actively involved in inventing re-engineering of better seeds that can better adapt climate changes. They claimed that the new kinds of species are readily available to registered farmers at discount rates. Figure 37 shows not a strong but an overall agreement between the two officials about their answers provided by them.

Table 30: Access to information

Code	Key points from answers	Response
Coordination among stakeholders	Exists	A
	Data sharing	B
	Exchange of information	B
	Information about development programs	C
Information sharing	Media campaign	B
	Public Announcements	B
	Early Warning system	A
	Publications	A

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: Information related to climate changes, forecast about upcoming rains and droughts, and their possible impacts on crops needed to be passed to famers well on time. Timely access to information for farmers is a major issue. Thus quick information updates about seeds, plantation and harvesting dates and suggestions for crop switching and other coping strategies are needed to be shared with farmers as well as to other institutions which is again only possible when there is present a single platform for exchange of information is established at local level where all kind of information would be readily available altogether.

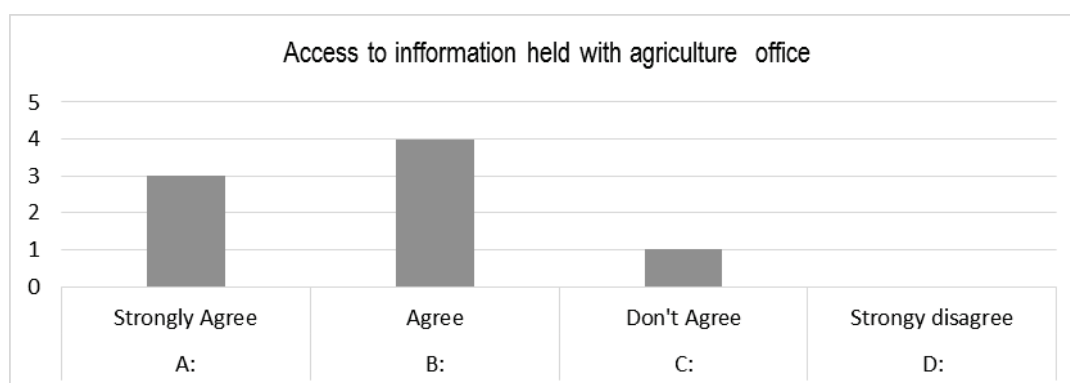


Figure 37: level of information held with agriculture department to share with other stakeholders

Annex-J: Analysis of data from Interviews with land administration officials

Land administration system in Pakistan is based on land registers and cadastral maps (Ali & Nasir, 2010). Assistant commissioner and deputy commissioner are senior level officials who are responsible for managing land records at district level including a junior officer called “Patwari” appointed at village and council level who is responsible for maintaining the land records. The present land administration system only maintains land records for the purpose of collecting revenue from rural agriculture land. This department also provides land records to local councils and municipalities for tax collection on non-agriculture and urban lands. Like Agriculture and forestry departments, district land record and revenue office is also under the administrative control of provincial governments.

In order to collect data for in depth understanding of the institutional capacity, structure of land rights, present status of land policies and present status of spatial data and land register, interviews were conducted with the assistant commissioners of both Chitral and Booni (Chitral has only two tehsils namely Chitral and Booni). Efforts were also made to interview Patwari who looks after the whole land administration system at grass root level, but remained unsuccessful to catch these officials due to two reasons. They were not willing to meet for interviews pretending to be very busy, but the other main reason was their bad reputation among the society due to which they were reluctant to meet for exposing their real character. However, senior officials were quite cooperative and friendly to provide all the information they have. All the information gathered through these interviews is grouped under five key themes and shown in the following tables and charts.

Theme 1: Present status of Land policies, rules and regulation about land right, and policies about climate change

According to the both land officials, policies related to land includes legislations and laws for defining tenure types and managing system of transfer ship of ownerships as well as rules and regulations for running official matters. In response to query about present status of land policies, they claimed that there is law forced by federal government and adopted by Khyber Pakhtunkhwa (KPK) government which is also applicable at district level. So same is applicable in this area after its merging into KPK province as district in 1960. Further both were agreed on the statement that no particular separate aspect in land policy related to climate change is present in land administration system. They denied about the existence of such policies related to climate change regarding land use change, safe lands for housing or about new emerging use rights / restrictions related to climate change. Additionally they think that it is the responsibility of union council or local district government who should made adaptation policies that also include restrictions for use rights, rules for buffer zoning around the river beds and building standards for housing. A summary of key points highlighted during interviews are summarized in table 31.

In analysis of the responses against the queries about land policies and policies related to climate change, apart from having their less knowledge about existing land policies, both officials seemed confused about the jurisdiction of different institutions. They were reluctant to recognise the role of land administration in present scenario of climate changes in the area and the responsibilities that this department must own for combined efforts for adaptation to climate change as well as to control over the human interventions that are causing climate changes.

Key finding: There is no policy at present. Land policies for land tenure and management of land should be transparent and must integrate the policies to address climate changes and adaption practices in the study area.

Figure 38 shows a mix response against different key points regarding policies which depicts the overall weakness of the existing structure land administration system and also show the lack of recognition of roles and responsibilities that land administration can play for effective management of land use, land use change in context of climate change.

Table 31: Question / theme: Land Policies

Code	Key points from answers	Response
Policy defined	Set of documents	A
	Laws and legislation	A
	Rules and Procedures	A
Status of land policy	Federal law adopted by provincial government	A
	Historical law before merging into province in 1960 from old rulers	B
Rules about land tenure	Federal tenancy act	A
	Inheritance laws	B
	Islamic laws	C
Policy about climate change	Buffer zoning along river beds	C
	Safe areas for settlements	C
	use rights restrictions	C
	Engineering and building standards	D
	No policy about monitoring encroachments in river beds	C

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

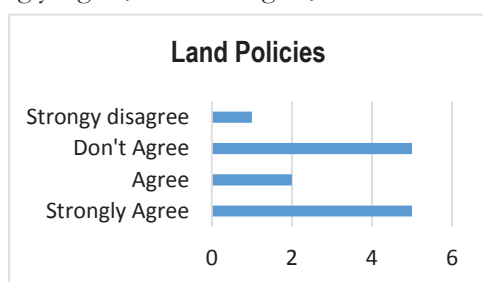


Figure 38: A mix response against different key points regarding policies

Theme 2: Spatial data and cadastral maps

Regarding status of land records and spatial data, cadastral maps are in paper format along with some old maps and sketches that show demarcated boundaries and limits of rivers, lakes and streams but there are no any marked safe zones on these maps. They were also aware of the fact that informal settler have mostly illegal encroachments on land inside the river beds. But as such no actions are being made by either local district government or the land authorities. Further, they admit the fact that due to some tempering in records by junior officials (Patwari), some land disputes are reported which shows the lack of transparency, and a high level of corruption in the institution. Land department only updates the land records based on the owner's request after the occurrence of disaster events, Tehsildar and local Patwari visits the area for re-measurement and acquisition of land according. They both stated that on Deh (Village) maps, Patwari marks the boundaries related to forest lands, pavements and village boundaries etc. but for only revenue purpose.

Table 32: Status of Cadastral maps and spatial data in the study area

Code	Key points from answers	Response
Status of Cadastral Maps	Only sketch maps	B
	No digital maps	B
	complete record of land holdings	A
	Tempering in old records before from the time of private ruler Mehter	B
	Records are only updated upon the request of land holders	B
Spatial Information	Information about flood and other disaster prone areas	D
	Information about use right types and restrictions	D
	Marked boundaries of forest reserves and rangelands	A
	Up-to date information on maps	B

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: No such spatial information related to marked prone areas for floods and disasters is prepared or managed at district office level thus re-measurement of all land holdings closed to river banks should be taken. Paper format of maps is outdated now, thus digital spatial information provide support to all public and private organisations who are actively involved in planning developmental projects for improving adaptation capacity of people and institutions, so digital cadastral map should also be prepared.

Theme 3: Impacts of climate change on land

Questions were also asked to the land officials regarding their view point about climate change and its impacts on land. Both were agreed that due to climate changes in the area, weather is being changed and thus causing expansion in river beds, degradation of forest lands, and changes in agriculture area. They claimed that due to large area of rural agriculture land now being kept as uncultivated and also is effecting the land revenues obtained through agriculture lands. They were also agreed about the changes in land use by people in response to climate changes. A summary of key findings during from notes is shown in table 33, while a level of response from both officials is shown in figure 39 which shows that both have provided similar kind of information.

Table 33: View of land officials about impact of climate change on land

Code	Key points from answers	Response
Weather changes impacts on land	Significant change in land conversion	B
	Expansion in river beds	B
	Changes in forest reserves	B
	Changes in agriculture land area	A
Other impacts on land value	Land conversion due to population	A
	Declining cultivation area in river beds due to floods	A
	Effect on land holdings	A
	Changes in land use	C
	Changes in land value	B
	Changes in land rights	B
Monitoring	Work with NDMA in resilience programs	A
	Estimates the property losses during disasters	A
	Monitoring after disaster relief activities with NDMA	A

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: There are significant changes in land use, land use change, land tenure in response to changing climatic conditions of the area. Land administration department should recognise new emerging role in the present climatic changes in the region. Land administration can play its role in providing up to date spatial information in shape of hazards maps, as well as up to date land records and cadastre maps can help the relevant institutions to assess the vulnerability of agriculture, water and people.

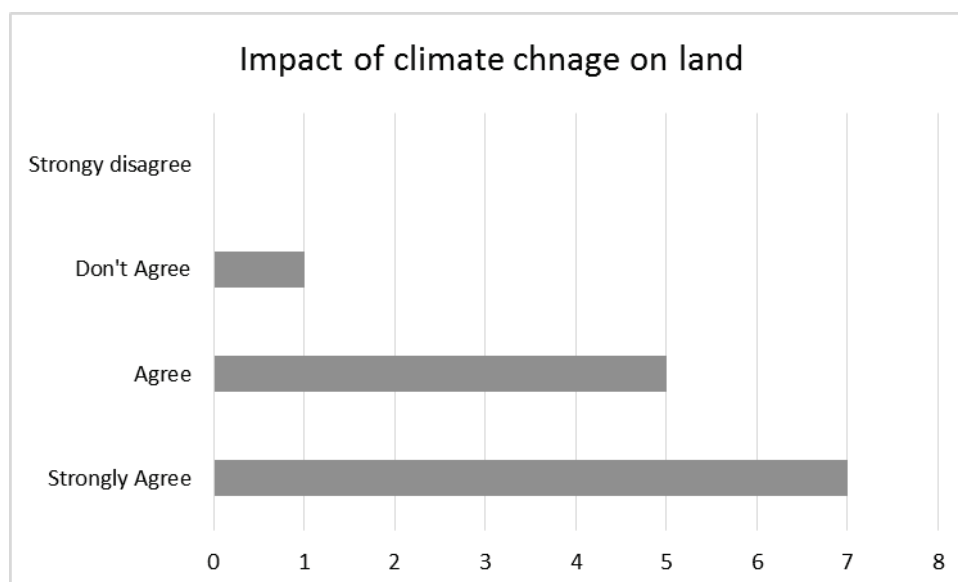


Figure 39: Shows that majority of the response from both officials for queries is similar to each other.

Theme 4: Access to information held with land department

Table 34 summarise the key points while officials were answering the questions about the mutual coordination among stakeholders that possibly exist or not. They claimed that it exists, however on the same time they told that there are restrictions to access the data but some sort of information exchange is allowed. But overall they were not able to clarify their stand point whether they claim that land revenue department is fully open for access to information or not. They also informed that this office provide land records as wells take part in front line with NDMA during the monitoring and rehabilitation work after floods or disasters events. It means they are preparing the record of damages to land, property and life but how these statistics are accessible to other public and private organisations is questionable and unclear.

Table 34: Information sharing and coordination with other stakeholders

Code	Key points from answers	Response
Coordination among stakeholders	Exists	B
	Data sharing	C
	Exchange of information	B
	Information about development programs	D
Information sharing	Information about land records	A
	Information about damaged property after disasters	B
	Information about life losses and damages to property	B
	Information about rural agricultural land and it's revenues	B

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: Geo spatial and non-spatial Information needed for vulnerability assessment is available with land officials up to some extent, but due to present limited accessibility and reliability of this information, it cannot help effectively in the context of climate change. Data collected during disaster relief activities should be readily available to all public and private organisations who make plans for adaptation activities as well as for future risk management. Land revenue office need to be more open for information access and the mutual coordination among stakeholders need to be improved.

Annex-K: Analysis of data from Interviews with district government officials

Local administrations including local governments, union councils and municipalities are the first line of defence in responding to challenges related to climatic changes (Ingram & Hong, 2011). The local administrations set the rules for land use planning including urban and rural settlements and their expansions at suitable places, management of recreational and green areas and building safe design for service infrastructure. Local administrations also respond at very first for any disasters occurring in their jurisdiction. They need to improve infrastructure in order to provide public utility services in all kind of circumstances and climatic conditions as well as they are also responsible for public safety which is under constant threats of climatic changes. Thus, they need to adapt.

Interviews were also conducted with the officials of district government Chitral and tehsil administration of Booni in order to understand the role of local governments in adaptation planning, land policies related to climate change and implementation of these adaptation policies at local level. Presently local administration units are under the control of District officer and Tehsil officer who are appointed by provincial government. Interviewees from both offices were senior officials so a lot of information was provided by them which can help further in understanding the new emerging responsibilities of local governments in context of local climate change adaptation planning. Although information from both of these officials is almost homogenous with some level of disagreement in opinion on some key points. All the information gathered through interview with them is summarised in the following tables and charts and describe in further as below.

Theme 1: Impacts of climate change on land

Table 35 represents the analysis of information from key notes of responses while querying about nature of climate changes and their impacts on land. The response is very similar to other interviews as they also highlighted the significant changes in weather as compared to the past decades and declared the climate change and global warming as one of the main factor for these weather changes. They also agreed upon the fact that climate change have a significant impact on land including changes in land value, land losses due to climate related hazards like floods and dry winter seasons. They also explained about the accountable manages to land, livestock, individual land holding and public infrastructure due to frequent floods in the area.

Table 35: Questions / theme: Impacts of climate change on land

Code	Key points from answers	Response
Weather changes	Too much dry in winter	A
	Heavy rains in spring	A
Extreme events	Floods in rivers and Nallas	A
	Earthquakes	C
	Landslides	B
	Dry winter season	B
Effects / Impacts	Damage to livestock	A
	Damage to houses	A
	Damage to drinking water sources	A

	Damage to utility services	B
	Damage to land near river banks	B
	Changes in land use	B
	Changes in land value	B
	Changes in land rights	C

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

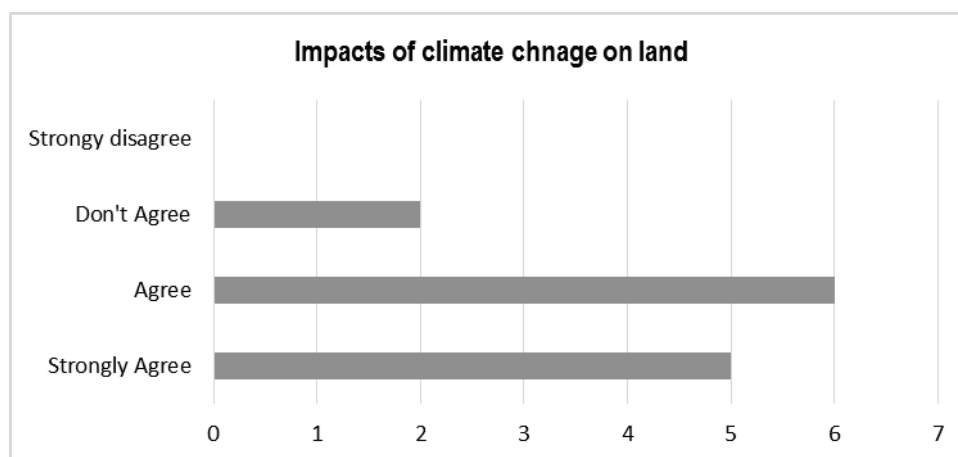


Figure 40: Both officials were agreed on majority of key arguments during queries related to climate change impacts

Key finding: Climate change is real and nature of extreme events like floods, landslides, earthquakes, and droughts are being intensified due to recent climate changes. Consequently these events have a significant impact on land sector including agriculture, water, infrastructure, land holdings and livelihoods of people.

Theme 2: Role and responsibilities of local government for adaptation to climate change

As stated earlier, local administrations like union councils and district administrations are primarily responsible for public safety and providing immediate relief response during occurrence of any disaster event in the area. Thus both officials were asked some questions about their responsibilities in responding to the challenges of climate changes and related hazards. They claimed the federal and provincial governments are initially responsible for planning and financing the adaptation and risk management projects however they accepted that local governments are first line of defence against climate related hazards and they are responsible for public safety as well as adaptation to the changing environment. Table 36 summarise the assessment of some key responsibilities mandated by local governments however they also highlighted the issue of lack of funds released by provincial governments for local developmental programmes.

Table 36: Assessment of roles and responsibilities of local administration for taking adaptation measures

Code	Key points from answers	Response
Who is responsible	Federal govt. is responsible for planning	B
	Provincial govt. is also responsible for funding	B
	Local govt. as first line of defence	A
	Local govt. for public safety	A
	Local govt. for implementation of adaptation plans	B
responsibilities of local govt.	Restoration plans	B
	Development Projects	B

	Water supply Programs	B
	Building safety walls	A
	Access to information	A
	Awareness programs	B

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Figure 41 shows that 100 % similar information provided by both officials with no any points of disagreement or contradiction in source of information from them.

Key finding: It is clear that local administrations understand their role and responsibilities regarding responding against the challenges of climate changes in the areas. They already making plans and developmental programs as part of adaptation plans, building capacity of local people and improvement of infrastructure to cope better with changing climate conditions but budget constraints are one of the main barrier for local authorities to make these plans successful. In partnership with donor agencies and NGO's they can better implement their adaptation strategies and plans for improving the adaptation capacities of local community.

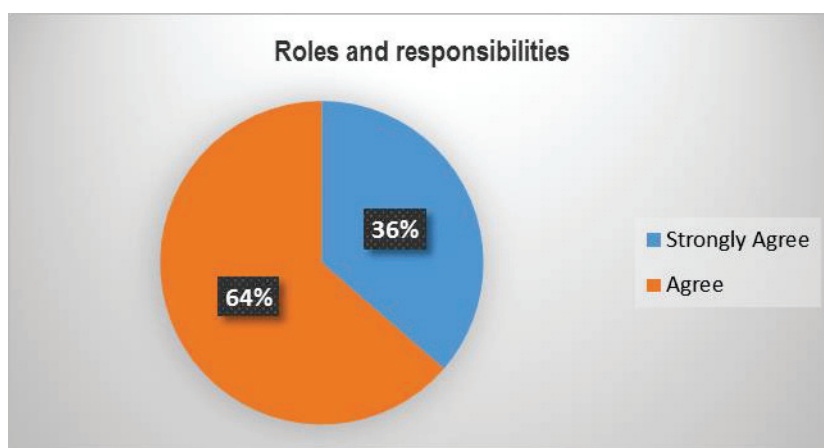


Figure 41: Level of agreement in response from local government officials

Theme 3: Adaptation policies

Regarding queries about policies for preserving carbon stock and priority policies, both of them stated that policies about climate change adaptation are available both at national and provincial level. In addition to national developmental plans, local government also have programs in implementation of these guidelines that can improve carbon reserves in the study areas. Further they also indicated that they were planning at local for providing the better basic services like health, safe evacuation, river bunds, efficient water drainage system, early warning systems etc. They also informed about the efforts made by private sector organizations in setting up environment friendly energy sources like small hydroelectric power plants that are not only providing cheaper electricity but also reducing the pressure on forests for energy. In example they also highlighted that micro hydroelectric power plants are now more common in village areas which is the most environment friendly energy resource. Further it was also learnt that government in partnership with private investors is making check dams to upper watershed for further planning for identifying more sites. In response to query about linking carbon taxing with revenue system, both denied about applying such kind of taxes. Table 26 represents a summary of key points that were highlighted by these officials while talking in details about the present policies and their status at local level.

Table 37: Assessment of nature of existing adaptation policies at local level

Code	Key points from answers	Response
Policy about	At National level	B

preserving carbon stock	At provincial level	B
	Local level implementation	C
Other policies and priorities of local govt.	Energy policy for energy sector emission of carbon	C
	Transport policy	C
	Small Hydro power plants	B
	Provision of basic services in disasters	B
	Efficient drainage system	B
	Safe evacuation	B
	Setting up early warning systems	A
	Check dams for water conservation	B
Policies about carbon emission reduction	No any active plan at local level	A
	Linking carbon taxing with revenue system	C
	Environmental friendly energy sources like hydro power	B
	Identification of active sites for small hydro power plants	B

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Following figure 42 summarize the response and level of agreement between the both officials. Both were agreed on majority of key points but only disagreement was shown when querying about the local level implementation, and while talking about energy policy for reducing carbon emission. The reason behind the disagreement was that official from Chitral government claimed about the weak implementation of energy policy at local level, while the other argued against supported with examples about the efforts made by local NGO AKRSP in setting up small hydroelectric power plants.

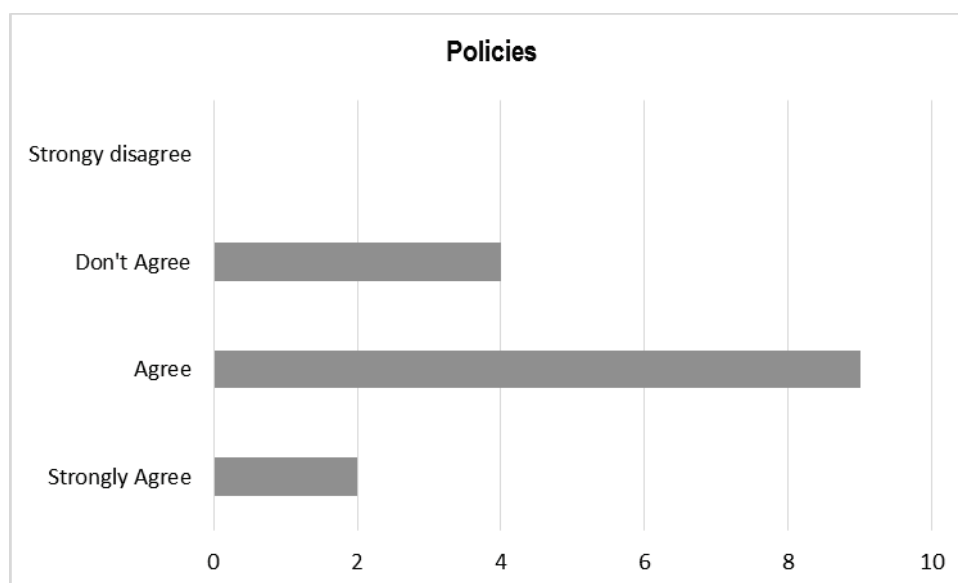


Figure 42: The mix response and level of agreement between the both officials about local adaptation policies

Key finding: Policies about dealing with climate changes and planning for adaptation are present. In the guidelines of these policies, local adaptation program are also being made, however these programs have not practical success because of limited budget resources of these local authorities. Thus, public and private partnership can help to manage this issue of lack of funds and effective adaptation activities can be practised in the area.

Theme 4: Local climate change adaptation and related issues

Issue of limited budget resources for local authorities is already highlighted in previous, under this theme, more questions were asked to understand the issues related about vulnerability of local rural and semi urban population for climate related disasters. Some issues are summarise in Table 38 given below. The officials indicated that families living on river banks are in constant danger but they are not ready to leave the place because they are poor and they don't have enough resources to resettle at the safe places. Cultural attachment is another reason for being not ready to leave their indigenous places. They also accepted that presently neither any restrictions are present that can stop the people to build their houses on their private lands, nor any set of rules regarding standard design to build stronger houses in context of present climatic related extreme events. Government has planned at various places to construct safety walls. Government is helping to re-build their houses with the cooperation of local and international funding bodies.

In response to query about adaptation planning at local level, both of them indicated about plans for building disaster proof infrastructure, protection of people and their properties nearby river banks, improving irrigation water channels and support for rebuilding houses damaged by the floods etc. During interview, one of the official stated that we are trying to invest more in building strong bridges, roads, safe from landslides. In Chitral city infrastructure is quite satisfactory but situation in Booni tehsil is not up to the mark. Further in village areas people usually make their houses in traditional way, but they need to adopt technological advances as well. Figure 43 shows that most of the time both officials responded in the same way and provided similar information with no any point of difference in opinion between them.

Table 38: Question / key theme: Adaptation to climate change

Code	Key points from answers	Response
Issues of resettlement at safe places	People not ready to leave their places	A
	Houses near river banks	A
	Informal settlements	B
	Encroachments in Nallas and streams	A
Other Issues	Planning is there, yet implementation is difficult due to limited budget	A
	lack of residential land	B
	Un clear property rights	B
	No restrictions in land use change	A
	No building standards	A
	No use restriction on private land	A
Adaptation planning at local level	Building disaster proof infrastructure	A
	Improvements in infrastructure	B
	Protection of people lives and their property	B
	Improving irrigation channels	B
	Protection of green parks	B
	Construction of safety walls	A
	Assistance in re-building houses	B

A: Strongly Agree,

B: Agree,

C: Don't Agree,

D: Strongly disagree

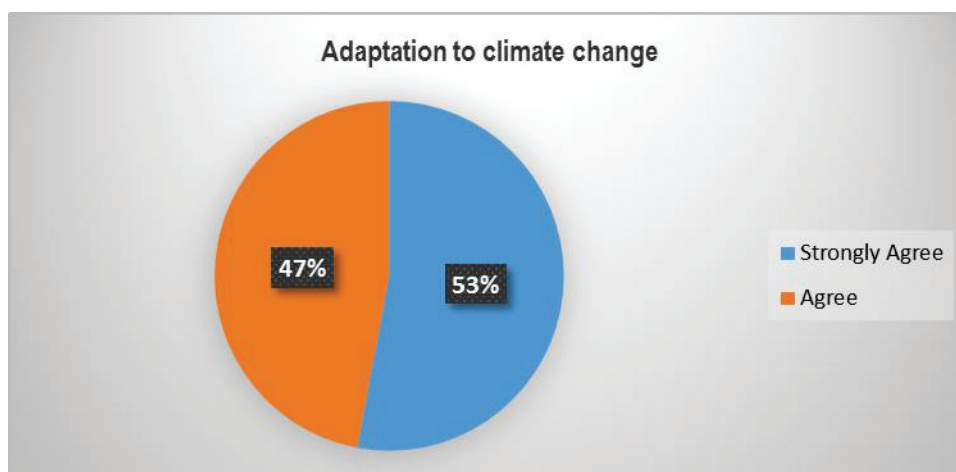


Figure 43: No difference in opinion, responses from both were agreed or strongly agreed with each other

Key finding: Local authorities are well aware about the issues related to climatic challenges and their responsibilities to adapt. The local authorities have sound planning for adaptation to climate change however financial implications are there for their successful implementation.

Theme 5: Access to information

Similar questions were also asked to these officials to get their view point about coordination, collaboration among public and private organisations, and about exchange of information and data sharing. In response, they said that district government is maintaining the record about forecasting the floods and rainfalls while in the directions issued from NDMA, they also initiate the warnings on media and other public forums before flooding expected. Further they claimed that district and tehsil administrations share all the information with agriculture, municipalities and union councils, wildlife department, forestry department, health authorities, police and irrigation department etc. However assistant commissioner Booni was not agreed about the access of all information to people and private organisations particular information about developmental programs initiated by local governments. Analysis shows that both officials were agreed despite disagreement on only one key point that was about the sharing of information for developmental programs to people and private NGPO's working in the area.

Table 39: Access to information about climate change and government priorities for adaptation to climate change

Code	Key points from answers	Response
Coordination among stakeholders	Exists	A
	Data sharing	B
	Exchange of information	B
	Information about development programs	C
Information sharing	Media campaign	B
	Public Announcements	B
	Early Warning system	A
	Publications	A

A: Strongly Agree, B: Agree, C: Don't Agree, D: Strongly disagree

Key finding: There should be a proper mechanism to communicate between all the government and private organizations with each other. Analysis shows that some sort of collaboration among public and private organisations, and about exchange of information and data sharing is present but it needs to be improved. So that both public and private organisation can work together in reducing disaster risks in this area.

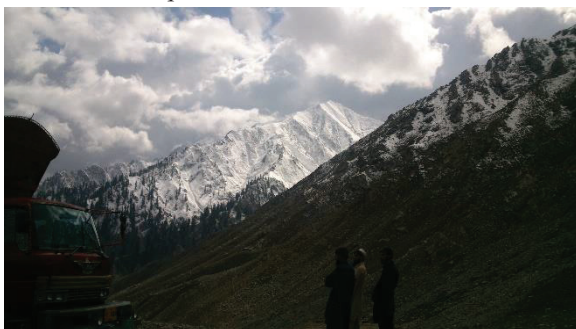
Annex-L: Some Photographs depicting clear identification of climate change issues in study area



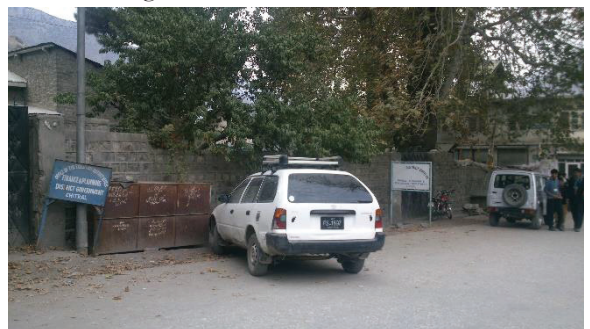
Poor Infrastructure of roads are always under the risk of frequent floods



Main reason for low carbon stock is also poor forest management



Unexpected snowfall in October (Abrupt changes in weather due to climate change)



Poor Infrastructure of Local District government office itself



Dry stream due to droughts in remote area of Chitral in upcoming winter season



High rate of degradation of oak and walnut trees is also due to land sliding



Degradation is also due to soil erosion and drought in the calash valleys



Houses nearby Chitral River in the city are under constant threats of river bank collapses



My host for organizing group discussion in “Annesh” Village (Calash)



Maize fields near Charun Village (Upper Chitral)



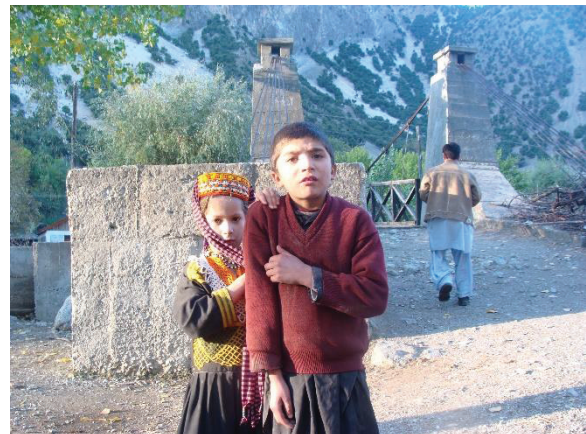
Replantation of oak trees in sloppy mountains can help in increasing carbon stock



SRSP and ICIMOD’s active participation in Shogore



Drinking water scheme by local NGO



Majority of people are poor, so cash incentive based participation for forest management can also help them for their economic growth.



Rangelands / Graze lands are declining due to changes in weather conditions effecting livestock



Traditional houses made with wood, mud and stone



People living here are poor but hard worker



Natural beauty but remotely isolated community needs help in fighting against risks of climate change

