

**EASTERN HINDUKUSH IN TRANSITION:
SOCIO-PHYSICAL CHANGES AND THEIR IMPACTS ON
NATURAL RESOURCES IN DIR VALLEY, NORTHERN
PAKISTAN**



FAZLUL HAQ

(PhD)

DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF PESHAWAR

2015

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DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF PESHAWAR

2015

DEDICATED TO

**my honorable parents who offered me unconditional
love and support throughout the course of this research**

APPROVAL SHEET

This research thesis, “EASTERN HINDUKUSH IN TRANSITION: SOCIO-PHYSICAL CHANGES AND THEIR IMPACTS ON NATURAL RESOURCES IN DIR VALLEY, NORTHERN PAKISTAN”, submitted by Mr. Fazlul Haq, under the supervision of Dr. Fazlur-Rahman, Department of Geography, University of Peshawar, Pakistan for the award of degree of Doctor of Philosophy in Geography is hereby approved.

Supervisor
(Dr. Fazlur-Rahman) _____

External Examiner _____

ABSTRACT

Change and transformation in mountainous areas has become a subject of interest for scholars and scientists in the recent past and extensive research has been conducted on this issue around the world. There are three interlinked systems in the context of global change research in mountains i.e. the biophysical system; the socio-cultural system; and the natural resource management system, where any change in one system triggers off changes in the others. The existing literature reveals that in the past few decades a number of changes have occurred in various aspects of environment of the northern mountainous belt of Pakistan. These changes have occurred in a very short period of time driven by various natural and anthropogenic forces, and are still going on.

The present study aims to study the phenomenon and consequences of changes in Dir Valley located in the Hindu Raj off-shoots of the eastern Hindukush Mountains. This region offers a wide potential for research in various sectors of life and environment. However, it is still unexplored and research activities are almost negligible. This research is focused on three broad aspects of change i.e. change in physical conditions; change in social setup; and the consequential impacts of these changes on natural resources and resource management strategies. Different tools and techniques were used for the collection and analysis of data regarding the above mentioned three different sets of variables.

For a detail insight and in-depth study, five villages (sub-valleys) were selected besides an overview of the social and physical conditions of whole Dir valley. Two important variables i.e. availability and distribution of land and forest resources were determined using GIS. A questionnaire survey was carried out in the sample sites asking questions about various aspects of the socio-economic setup. Besides questionnaire survey, interviews and focused group discussions (FGDs) were also conducted in the selected sub-valleys. The interviews and FGDs were focusing on the indigenous resource management strategies adapted by the community and the temporal changes that have occurred in these mechanisms.

Findings of the study reveal that considerable changes have occurred in various aspects of the socio-economic setup of the study area, which have affected the biophysical environment and natural resource base in a number of ways. High population growth is among the most important

aspect of change affecting various other aspects such as housing and household characteristics, agriculture, income generation and consumption, migration and accessibility. Household size has decreased drastically resulting into a significant increase in the number of household. Consequently, land use pattern has changed due to the expansion of residential areas in all directions. Forest cover in particular has been degraded severely, which has necessitated the transformation of natural resource management systems.

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Fazlul Haq

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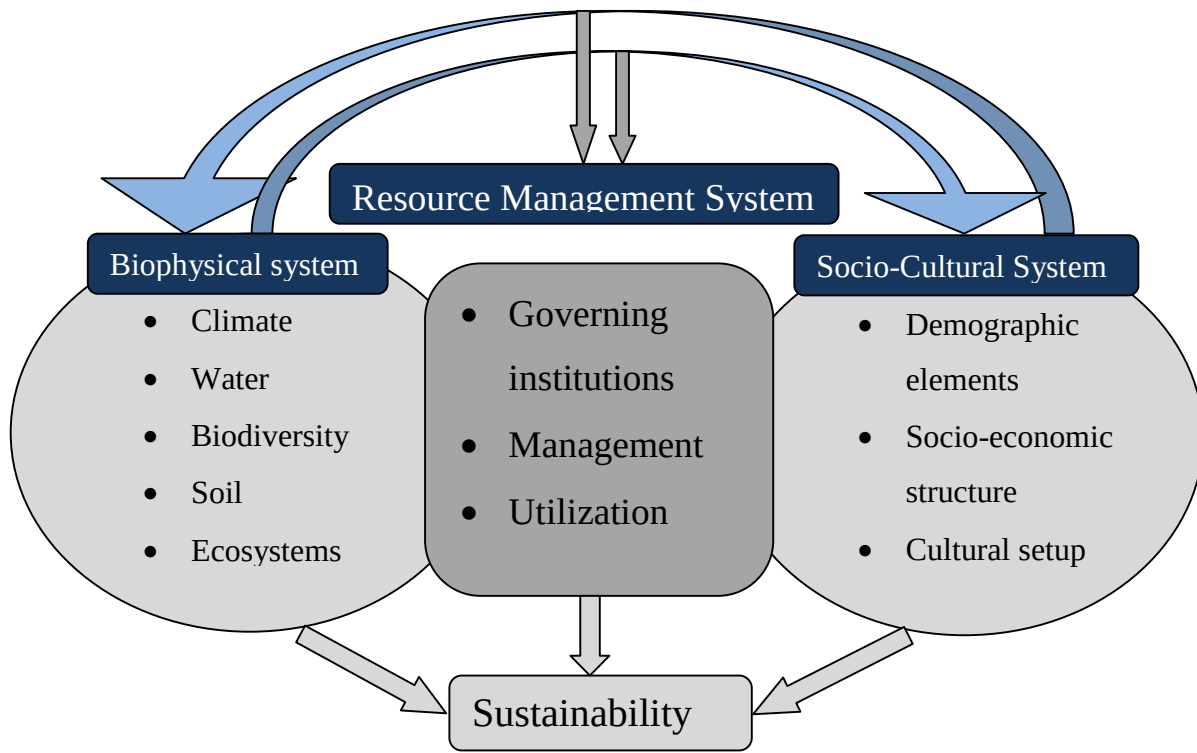
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1.1 Introduction

Change and transformation in mountainous areas has become a subject of interest for scholars and scientists in the recent past and extensive research has been conducted on this issue around the world (Kozak, 2003; Peco et al., 2006; Falcucci et al., 2007; Korner, 2009; Bjornsen, et al., 2012; Price & Weingartner, 2012). There are three interlinked and interdependent core areas or systems in the context of global change research in mountains i.e. the biophysical system; the socio-cultural system; and the natural resource management system, where any change in one system triggers changes in the others (Fig 1.1). Therefore, a holistic approach is needed to study the consequences of changes in mountainous regions. The trend of global change research in mountainous regions is however deviant and more focused on the biophysical or ecological systems (Bjornsen et al., 2012).

Recently, a conference was held on Global Change and the World Mountains in Scotland in 2010 where 450 researchers from around the world highlighted the gaps and emerging themes in mountains research. It was concluded that the mountains researchers and scientists have predominantly and extensively dedicated their efforts to climate change, biodiversity and ecosystems. More emphasis is paid to observing and quantifying the phenomena of changes in ecosystems and other aspects of biophysical environment. The scientists also pointed out a research gap in linking biophysical and socio-cultural changes and integrating them with natural resource management system. “A majority of the abstracts (312 or 72%) dealt with ecological systems, 92 (21%) with social systems, and 34 (8%) with resource use and management. With regard to interactions, 278 abstracts (64%) referred to interactions within ecological systems, 198 (46%) to influences of global environmental drivers on ecological systems, 150 (35%) to decision making and institutions, and 99 (23%) to influences of ecological systems on social systems” (Bjornsen et al., 2012: 549).

Fig 1.1 Conceptual Framework: Interactions among the Systems



In the past three or four decades, a number of changes have occurred in both the biophysical as well as socio-cultural environment of the northern mountainous belt of Pakistan. The major biophysical changes include; decrease in per capita and per unit crop yield, decline in natural resource base and productivity of resources, decrease in irrigation water, overuse of forests and common property resources, land degradation, deforestation and loss of biodiversity, changing patterns of rainfall and temperature, increase in the occurrence and intensity of natural hazards and extreme weather events. These changes have occurred in a very short period of time driven by various natural and anthropogenic forces, and are still going on (Flint, 1994; Schickhoff, 1995; Nüsser & Clemens, 1996; Stellerecht, 1997, 1998; Gautam, et al., 2003; Ali et al., 2005; Ali et al., 2006; Fazlur-Rahman, 2007a, 2007b; Rahman et al., 2008; Rahman et al., 2014).

For the last two decades, changes have been the main topic of research on the mountainous regions of Hindukush, Himalaya and Karakorum. Researchers have attributed these changes to several main driving forces: change in the political set-up, unprecedented population growth, and transformation of the economy due to

improved accessibility. The increased accessibility, in particular, is considered to be a major driving force for changing the whole socio-economic set up and land utilization in the area (Fazlur-Rahman, 2007a: 193).

Nevertheless, the biophysical changes neither occur in isolation nor their impacts remain confined to the same system. Instead these changes also affect the socio-cultural setup and economic conditions of the localities (Jodha et al., 1992; Ali & De Boer, 2007; Fazlur-Rahman, 2007a). Large scale out-migration of mountain inhabitants is a recurrent phenomenon, which is the indicator of insufficient local food supplies, deficit in the cost benefit calculus of mountain agriculture and poor natural resource base (Pilardeaux, 1997, 1998). Other changes in the economic setup are high inputs in agriculture, changes in the types of crops and cropping pattern, high dependency on market for food and fodder, change in the composition of livestock (Ehlers & Kreutzmann, 2000), increasing pressure on forests and rangeland resources etc. (Grotzbach, 1984; Kreutzmann, 1992; Ehlers, 1996, 1997; Stober, 2000). According to Fazlur-Rahman, (2007a, b), the structure of traditional societies throughout the northern mountainous belt of Pakistan has affected by the current changes and transformation.

Collectively these changes result into the transformation of the traditional livelihood strategies and local institutions governing the management of locally available natural resources. The reliance on combined mountains agriculture for livelihood sustenance and food security has declined and partially replaced by off-farm activities like trade, government and private services, seasonal labor migration and remittance from abroad. Fazlur-Rahman, (2007a) also states that a number of changes have occurred in agricultural strategies and cropping patterns such as the disappearance of foxtail millet and different varieties of peas and wheat. Similarly, the barley which was the staple food of people in the past is now replaced by wheat.

The coupling effect of bio-physical and socio-cultural changes results into the transformation of resource management systems on the one hand, and weakening of other social institutions such as reciprocal activities and cooperative maintenance and repair of community infrastructure (Fazlur-Rahman, 2007b; Jodha, 2007). Continuously growing population, demographic and administrative transformations, changes in the economic systems and livelihood strategies result into an increased pressure on the sensitive environment and limited natural resource base of the

mountainous areas¹. This increased pressure resulted from the aforementioned changes and transformations triggers the process of resources degradation and threatens the sustainability of fragile mountain environment. As a result, the traditional and historical resource management systems and institutions are losing their efficacy in the adequate management and conservation of natural resources and are undergoing transformations (Somanathan, 1991; Schmidt, 2005; Jodha, 2007; Haq et al., 2012; Rahman et al., 2014).

Ownership regimes, property rights and indigenous tenure arrangements, rules and regulations governing the utilization and management of resources have undergone several changes. The traditional practices of collective actions in managing and conservation of natural resources and bringing about other community based activities are either abandoned or weakened in many parts of the mountainous regions of Pakistan (Fazlur-Rahman, 2007b). The traditional integrated mountain societies are losing their cohesiveness and going towards more and more individuality. In many cases the common property resources are privatized and the institutions governing the management of CPRs are slowly and gradually going towards abandonment.

1.2 Research Problem, Key Questions and Objectives

In the past few decades, several visible changes have occurred and are still occurring in the physical and social setup of the northern mountainous belt of Pakistan. These changes affect the sustainability of natural resource base and lead to the transformation of natural resource management systems. The key questions which are tried to be answered in this research are about what major transformations have occurred in the socio-economic setup and how are these changes interrelated with changes recorded in the biophysical environment and natural resource base of the study area. The objectives set for this purpose include;

- To explore the major changes occurring in the social and physical conditions of the study area
- To investigate the driving forces of change
- To study the impacts of changes on the natural environment and life of mountains' people

¹ Same observations have been reported from different mountainous regions of the world and the issue has been debated by a number of researchers from different disciplines (cf. Schmidt, 2005; Jian, 2009; Nautiyal & Kaechele, 2009; Rahman et al., 2014).

- To investigate the interrelationship of changes among the systems and their impacts on natural resource management
- To study the effectiveness of traditional and modern mechanisms in the sustainable management of natural resources

Change in the following variables from each of the three major systems will be studied.

Biophysical System

- Availability and productivity of agriculture land
- Irrigation water
- Natural vegetation

Socio-Cultural System

- Demographic changes
- Economic Transformations
- Changes in livestock population and composition
- Land-use pattern
- Agricultural inputs
- Cropping pattern
- Improvement in accessibility

Natural Resource Management System

- Management and utilization strategies
- Ownership and property rights
- Degradation of natural resources

1.3 Research Methodology

This research is focused on three broad aspects of change i.e. change in physical conditions; change in social setup; and the consequential impacts of these changes on natural resources and

resource management strategies. Different tools and techniques were used for the collection and analysis of data regarding the above mentioned three different sets of variables.

1.3.1 Selection of Study Area

This study is carried out in Dir Valley², located in the Hindukush Mountains, Northern Pakistan. Dir is an intermountain valley structured by a complex system of Hindu Raj Mountains which branch off from the eastern part of the Hindukush Mountain Range (Shams, 2000; Khalid, 2003; Khan, 2006). These mountains reach up to a height of above 5,000 meters in the upper areas (Fig 2.1). The high peaks remain snow covered throughout the year. On the one hand the rough topography has limited the availability of plain area and cultivated lands but on the other hand these steep sloped and high mountains provide several other resources. The flat low lying lands in the valleys and gentle slopes in the foothills are relatively densely populated as compared to the high elevations rugged mountains. The areas situated on the banks of river Panjkora and close to the main road (Dir-Chital Road) are the most favorable sites for the development of settlements. Hence, due to the limited availability of suitable lands for the construction of dwellings in the surrounding hills, concentrated settlements in the form of chunks can be found in these areas.

Up to 1969, Dir was a princely state ruled by various dynasties. It was given the status of a settled district in 1970 and was divided into Lower and Upper Dir districts in 1996. The valley is resided by the people of Sultan Khel, Painsa Khel, Usa Khel, Nasirudin Khel and Roghani tribes with a number of other smaller groups, *Mulian*, *Gujjars* and migrated people. Timergara is the main urban center located in the Lower Dir district. This area has recorded a very fast rate of urban growth in an ill planned and haphazard manner and has developed into a big city in the past few years. Due to unplanned growth, the city is expanding in all directions and has engulfed most of the agricultural lands situated on both banks of river Panjkora. In terms of population density, this city is the most densely populated region in the whole valley and all the activities associated to big cities are carried out here.

² Dir Valley refers to the entire valley formed by River Panjkora covering the Upper and Lower Dir districts.

Besides Timergara, there are a number of small urban units located on the main road including Chikdara, Gulabad, Talash, Khall, Wari, Darora and Dir proper. These are the most accessible and population attracting sites in the valley and hence having concentrated settlements. The sub-valleys located on both sides of River Panjkora such as Jandol and Maidan in the Lower Dir district, Tormang Dara, Karo Dara, Roghani Valley, Niag Dara, Usheraï Dara, Bara Dara, Sheringal and Kohistan etc. in upper Dir district are among the most spectacular mountain valleys with high population densities. Although, most of these valleys are located far from the main road and urban center Timergara, but the availability of suitable land for dwellings and other natural resources have attracted the inhabitants to settle over here. These valleys belong to the people of the above mentioned tribes and they have historically made arrangements for the appropriation of rights of different tribes to different valleys. Now a day, usually each valley is inhabited by the people belonging to the same tribe along with minorities, who are landless locally known as *fakirnama* or *fakiran*.

For a detail insight and in-depth study, one village each was selected from five sub-valleys on purposive basis i.e. from different altitudinal belts (Fig 1.2). These villages include; Khall Bazaar area from Khall sub-valley, Balkore village from Karo Dara, Daskore from Niag Dara, Jabar from Ushiri Dara and Thal from Kohistan. Khall bazaar area was selected from Khall sub-valley which is the most accessible and nearly urban area located at an altitude of about 500 to 1400 meters above sea level and also on the main road. Thal Village was selected from Kohistan sub-valley situated at an altitude of more than 3000 meters. This area is thickly covered with forests and the inhabitants are almost fully dependent on the local resources. The rest of three villages were selected from different altitudes in the intermediate area between Khall and Kohistan. These sub-valleys exhibit diverse characteristics both in terms of socio-cultural and physical setup.

1.3.2 Selection of Time Frame/Data Points

The baseline in the time frame for temporal changes was taken as 1970. At the time of independence (1947), Dir was a state which was merged with Pakistan in 1969 and was declared a settled district in 1970. This was the start of a new era in the history of Dir valley, which brought about drastic changes in the social set up of the area, which consequently affected the natural environment in a number of ways. The last data point for temporal changes is 2014

subject to the availability of data regarding different variables. In this way, the temporal changes occurred in a time period of four decades have been analyzed in this research.

1.3.3 Change Detection Using Remote Sensing Technology

Change detection in various features of the earth surface such land-use pattern and distribution of natural resources, can be carried out in a best way through remote sensing and Geographical Information System (GIS) technologies (Skole & Tucker, 1993; Cohen, et al., 1995; Tekle & Jedlund, 2000; Kadiogullari & Baskent, 2008; Qasim, et al., 2011;). Two important variables i.e. availability and distribution of land and forest resources were determined using GIS. For the baseline data point i.e. 1970, high resolution satellite images are not available. Thus, the land-use survey maps of 1970 were used to analyze the land-use pattern and distribution of agriculture land and forest resources during that time. For this purpose, the maps were scanned and rectified in ArcMap (ArcGIS) package. The rectified raster maps were then processed for the preparation of maps showing the distribution of resources.

1.3.4 Collection of Field Data for Change Detection

Certain variables for the physical and socio-cultural setup and natural resource management were dealt in this step. It helped in quantifying the changes, occurred in physical conditions, socio-economic setup and resource management mechanisms for the selected data points. In this step, both the primary and secondary sources of data were consulted.

1.3.4.1 Secondary Sources of Data

Like the other surrounding districts, cadastral survey has not been carried out in Dir district. Therefore, unlike the settled districts, no systematic documentation of land-use, natural resources and ownership systems was available in Dir districts. However, data for certain variables was collected from several other secondary sources. Secondary sources were used for the collection of data regarding the temporal changes in; crop yield, cropping pattern, livestock population and composition, demographic elements, availability of cultivated land and irrigation facilities etc. The sources, which were consulted for the collection of data for these variables are; Agriculture Department, Irrigation Department, KP Bureau of Statistics, District Census Reports (DCR), Population Census Organization, Gazetteer of Dir State and the existing literature etc.

1.3.4.2 Primary Sources of Data

Different tools were used to collect primary data for a number of socio-economic variables. Primary data was collected only for the sample sites, as it is not possible to do the same for the whole Dir valley. The following primary tools were used in this research.

1.3.4.3 Questionnaire Survey

A questionnaire survey was carried out in the sample sites. The major variables for which data was collected through questionnaire survey are; sources of income and remittances, occupation, livelihood strategies, landholdings, mechanism and modernization of agriculture, sources of water, irrigation facilities, animal husbandry, pattern, destination and purpose of migration and resource management systems etc. The questionnaire was designed for household heads, consisting of both the open and close ended questions. A pilot survey was conducted in order to pretest the questionnaire. The questionnaire survey was conducted in the five sample sites. A total of 500 respondents were interviewed from the sample villages through simple random sampling.

1.3.4.4 Interviews and Focused Group Discussions

Besides questionnaire survey, interviews and focused group discussions (FGDs) were also conducted in the selected sub-valleys. The interviews and FGDs were focused on the indigenous resource management strategies adapted by the community and the temporal changes that have occurred in these mechanisms. Open ended questions were asked in the interviews and FGDs and the responses were recorded in the form of notes. Usually the elders (*Masharan*) of the community – who formulate and implement resource management mechanisms and regulations – possess rich indigenous knowledge about the local environment. Similarly, most of the changes have occurred in their living memories; therefore, they can better explain the causes and factors behind these changes. Thus, mostly the elderly members of the community were consulted for interviews and FGDs.

1.3.5 Data Analysis and Presentation

As mentioned earlier, the temporal changes in land-use, land cover and natural resources distribution etc. are analyzed through maps using GIS. The quantitative data obtained from the

primary and secondary sources, was processed through statistical software like MS Excel and Statistical Package for Social Scientists (SPSS) for analysis. The results are displayed in the form of graphs, tables and charts etc. which were finally organized, interpreted and presented using MS Word software.

1.4 Justification of the Research

In the present scenarios of rapid development and modernization in every sphere of life, the mountains are no more inaccessible or out of range from the process of change and transformation. It is evident from the literature review that the mountainous regions are undergoing unprecedented changes in each and every sector of environment. Mountain environment is very fragile and sensitive to changes mainly because of the inherent characteristics known collectively as mountains' specificities (cf. Jodha 1992). Any development intervention without considering the imperatives of mountains can cause irrecoverable and long term damage to the environment. The ongoing and consistent changes and unplanned development innovations in the mountainous areas of Pakistan (Fazlur-Rahman 2007b), including Dir Valley, are resulting into the weakening and degradation of traditional institutional arrangements for natural resource management. Moreover, the development activities, improvement in accessibility, transformation of economic set up and abandonment of community based activities directly affect natural resource base and result into un-sustainability.

Therefore, prior to any interventions, comprehensive and in-depth understanding is required through scientific studies regarding the sensitivity of the local environment and the functioning of the traditional social institutions. The present study is an attempt in this regard to explore the consequences of the current changes on the local institutional setup and traditional resource management systems. The study is focused on the phenomenon and consequences of changes in Dir Valley located in the Hindu Raj range of the eastern Hindukush. This region offers a wide potential for research in various sectors of life and environment. However, it is still unexplored and research activities are almost negligible. Other valleys located in the northern mountains of Pakistan such as Swat, Chitral and Gilgit-Baltistan regions are extensively studied and exclusive literature is available on every aspect of social as well as physical environment of these regions. Contrary to this, Dir Valley is completely neglected by researchers both in past and present and no such organized and detail studies can be found from any field. Hence, this study may be

stated as the beginning of research in this area and it will open new windows for research and debates on this unexplored mountainous valley.

1.5 Review of the Relevant Literature

Extensive research has been conducted on change and transformation in mountainous areas around the world and this issue has become one of the core areas of interest for geographers and environmental scientists in the recent decades (Kozak, 2003; Peco et al., 2006; Falcucci et al., 2007; Korner, 2009; Bjornsen, et al., 2012; Price & Weingartner, 2012). Mountains environment is fragile, and sensitive to both natural and anthropogenic drivers³ of change (Oldfield & Messerli, 1999; Gret-Regamey & Brunner, 2010). These driving forces range from seismic, volcanic and flooding events to global climate change and loss of soils and vegetation cover (ICIMOD, 2010). Globally, mountain systems are in a state of transition and several ecosystems are shifting due to high rates of coupled physical and socio-economic changes (Oldfield & Messerli, 1999; Gret-Regamey & Brunner, 2010; Messerli, 2012). Among the driving forces, climate change is the most debated issue in the global change research and its impacts on ecosystems and mountainous environment has been widely studied (Thomas, et al., 2008; Amanda, et al., 2013; Nancy, et al., 2013; Ruiz-Labourdette et al., 2013; Creeden et al., 2014).

Besides affecting ecosystems and biodiversity, climate change has a wide range of impacts on every sector of mountains' environment whether it is agriculture, extent and distribution of natural resources, land use and land cover pattern, livelihood and economic setup of inhabitants (Adger et al., 2003; Gentle & Maraseni, 2012; Beniston & Stufel, 2013: 1). The effects are expected to be more severe in the mountainous areas (Gentle & Maraseni, 2012), where people heavily depend on weather-controlled agriculture and natural resource based economy. "The changing climate is an additional burden to the poor people in the mountains who are already living in poverty, are vulnerable and excluded with predictions of additional risks to livelihoods and further inequity in the future. [...] The farmers of all wellbeing groups reported and

³ According to Knight and Rosa.(2011: 367), "the term "driving forces" or "drivers," familiar to several areas of research in the physical sciences such as plate tectonics and statistical thermodynamics, is new to the social sciences. More importantly, it has been universally adopted by natural scientists studying global environmental change to refer to what are presumed to be the most important factors producing environmental change. In the more generic language of science they are independent variables, particularly ones shown to have environmental effects".

presented in the historical timeline that the productions of winter crops (wheat, barley, corn, potato and chino) had also been massively decreased due to lack of winter rain/snowfall.” (Gentle & Maraseni, 2012: 24, 29). Moreover, according to ICIMOD, (2010) the changing climate does not only affect mountain environment directly but it also exacerbates the impacts of other driving forces of change.

However, changing climate is not the only factor behind ongoing environmental changes in the mountainous areas. Various, anthropogenic factors also play an equally important role in transforming the mountain environment (Chowdhury, 2006 a, b; Mottet et al., 2006; Bradshaw et al., 2009; Wyman & Stein, 2010; Newman et al., 2014; Nyssen et al., 2014). The major anthropogenic drivers of change in mountains include rapid population growth, improvement in accessibility, transformation of the traditional economic setup and introduction of non-farm sources of income, migration – both educational and for generating income – weakening of local institutions for natural resources utilization, modernization of agriculture and reliance on exogenous food supplies etc. (Butchart et al., 2010; Defries et al., 2010; Weinzettel et al., 2013; Bucala, 2014: 6).

Population growth and the associated household dynamics lead to considerable changes in every sector of natural and socio-economic setup. The effects of population growth are enormous and have been studied extensively worldwide (United Nations, 1973; Repetto, 1986; Harrison, 1992; World Bank, 1992; FAO, 1994; Templeton & Scherr, 1997; Horizon, 2009; Sati, 2009; Gracheva et al., 2012; Boserup, 1965; Simon, 1981; 1990; 1996; Hyden et al., 1993). Household dynamics is mainly driven by population growth accompanied by modernization. The impacts of household changes on natural environment can simply be illustrated in the form of increased pressure on natural resources. Knight and Rosa (2012) studied the effects of household dynamics on natural resource consumption. The study concluded that population growth is the key driver behind changing household characteristics, which in turn effect physical environment in a number of ways. According to this study, the consumption of energy increases manifold as a result of household dynamics and hence, the forest resources are under threat because of high rate of fuel wood extraction. Similarly, Liu et al., (2003) studied the effects of household dynamics on biodiversity.

Improved accessibility is another driver of changes in mountainous areas. Ali et al., (2005) studied the impacts of modernization and improved accessibility on the natural environment in the Hindukush-Himalayan Region. This study concluded that most of debates on environmental changes in the mountainous regions are focused on Nepal and India; however, the history of environmental changes is same in Pakistan and India because of the similar colonial origin of environmental management policies. This study also argued that about 50% of the forest cover has been removed during the last three decades, while the process is still going on with an alarming pace. Describing the drivers of deforestation, it concluded that the development of road network and easy access towards the forest cover areas accompanied by mismanagement of Forest Department has resulted into severe degradation of forest cover and natural habitats.

As a result of changing socio-economic setup, land use land cover change has become a burning issue around the world which has gained considerable attention of the researchers and policy makers in the recent times. Land use and land cover change has a number of consequences and effect the functioning of socio-economic and biophysical environmental systems with important outcomes for sustainability of natural resource base, livelihood security, biological diversity and the vulnerability of people and ecosystems to the impacts of recurrent global environmental changes. Scholars throughout the world claim that rapid rates of land use and cover change are becoming a major global environmental challenge (Lesschen et al., 2005; Niisser, 2000; Acevedo et al., 2008; Baskent & Kadiogullari, 2007; Houghton, 1994; Lambin et al., 2001; Ojima, Galvin, & Turner, 1994; Dewan & Yamaguchi, 2009; Dongol et al., 2002; Chen et al., 2001; Crews-Meyer, 2004; Serneels & Lambin, 2001; Baskent & Kadiogullari, 2007; Pan et al., 1999; Liu & Cai, 2012). These studies reflect the importance of land use land cover changes on the environment and the associated communities.

As a general perception, mountainous areas have a diversified but limited natural resource base highly sensitive to both the natural changes as well as anthropogenic drivers of change (Stocking, 2005; Ehlers, 1995, 2008; Rahman et al., 2014; Ehlers & Kreutzmann, 2000). Natural resources are central to all the other sectors of economy in most of the mountainous regions of northern Pakistan and the inhabitants withdraw a number of basic livelihood items from the locally available natural resources (Jodha, 2007; Ehiagbanare, 2007; Sharma et al., 2009). Due to topographic and climatic constraints, the productivity and regenerative capacity of natural

resources is insufficient to keep pace with the continuously growing population resulting into issues of un-sustainability. Keeping in view these constraints and the local environmental conditions, the available natural resources are managed and utilized quite carefully. For this purpose the local inhabitants have established institutional arrangements (Jodha, 2007). Different resources are kept under different ownership regimes such as private property, common property and open access, on de jure basis.

Usually, everything belongs to the inhabitants whether it is benefit from the resources or the decision making and planning regarding the management of natural resource. The locally introduced management and utilization mechanisms are formulated in such a way to insure equity in both the benefits from the resources and the associated duties and responsibilities. These centuries' old mechanisms are designed by the local experts who possess rich traditional environmental knowledge and understand the local conditions in a better way than the professional experts (Haagsma, 1995; Pestalozzi, 2000; Fazlur-Rahman, 2007b; Jodha, 2007). Usually the resource management and utilization mechanisms are orally formulated and pass from generation to generation with necessary modifications and adaptations from time to time. However, the locally introduced tradition resource management strategies have considerably changed during the recent past, mainly due to population growth and other socio-economic and bio-physical changes.

According to Jodha, (2007: 126),

The key drivers behind this change were population growth (directly or indirectly induced by integration) inducing land hunger; enhanced role of market forces encouraging privatization of common property resources (CPR); public interventions (administrative, fiscal and technological measures) with little sensitivity to CPRs in fragile areas and disregard of traditional institutional and folk-agronomic measures to manage fragile lands. The most effective combined effect of all these developments has been the decline of culture and practice of collective action and autonomy of community arrangements relating to local resource management.

1.6 Organization of Thesis

The thesis is divided into six sections. In section 1 the problem is outlined in the light of existing literature, while a detail overview of the physical and anthropogenic characteristics of the study region is given in section 2. Third section deals with the transformations occurred and still occurring in the socio-economic setup of the study area. Changes occurring in biophysical conditions of the study area are discussed in section 4, while the consequences of changes in these two sets and the resultant adaptations in natural resource management system are described in section 5. The findings of the study are summarized and the theses are concluded in the last section.

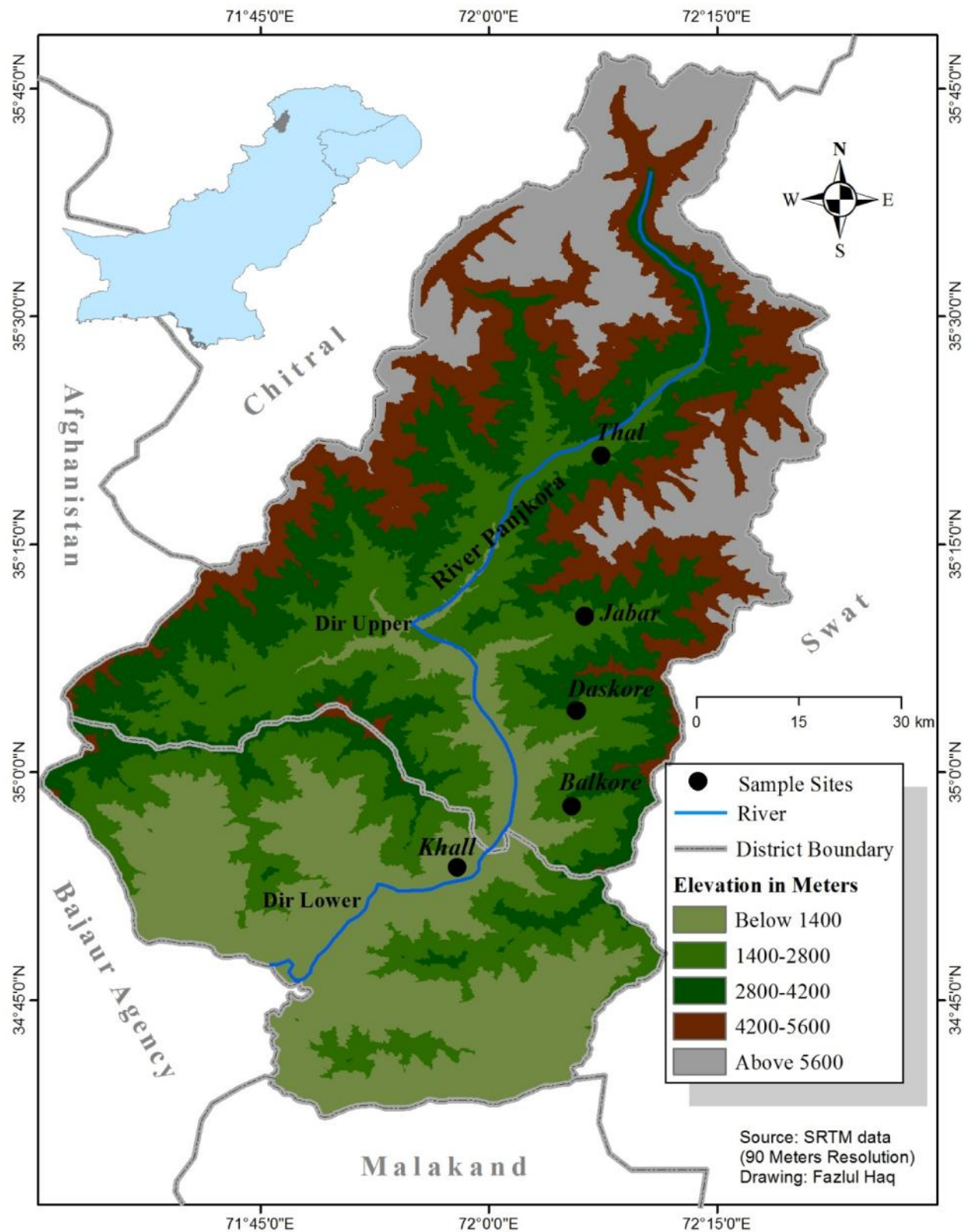
2.1 Physical Characteristics**2.1.1 Location and Physiography**

Dir valley is located on the western frontier of the Khyber Pakhtunkhwa Province formerly known as North West Frontier Province (NWFP) of Pakistan between 34°45' N to 35°45' N latitude and 71°30' E to 72°30' E longitude . It has common borders with settled districts, Federally Administered Tribal Areas and Afghanistan. The valley is bounded by Chitral district in the North and North West, Swat district in the East, Afghanistan in the West, Bajaur Agency in the South West and Malakand district in the South (Fig 2.1).

Physiographically, Dir Valley is situated in the Hindu Raj off-shoots of Hindukush Mountains, Northern Pakistan. Hindu Raj range branch off from the south-eastern Hindukush Mountain Ranges and are arranged in the form of semi-parallel spurs running in a north south direction. The main spurs include the Dir-Chitral Divide separating the valleys of Chitral and Dir, the Dir-Swat Divide located between the Dir valley and Swat valley and the Swat-Kohistan Divide, which separates the districts of Swat and Kohistan. The altitude of the valley ranges from 1400 meters in the foothills and floodplain of River Panjkora to above 5,000 meters in the northern and north western parts (Fig 2.1). The main Panjkora River takes its origin in Kohistan region of Dir valley; however, it is not in the form of a single stream. Several small streams originate from these mountains most of which are fed by lakes formed in the snow covered mountains.

The name Panjkora is a combination of two words, 'panj' and 'khar' which means five streams. This name is given to the river because it has five major tributaries namely, Kohistan River, Gwaldai River, Sheringal River, Dir River and Barawal River (Fig 2.1). The main Kohistan River originates from the Hindu Raj Mountains of Dir-Kohistan in Shandur and flows in a south-west direction.

Fig 2.1 Study Area: Location, Drainage Pattern and Physiography



After passing through Barikot and Biar, it receives Gwaldai River in Patrak. In Sheringal it receives its next major tributary i.e. the Sheringal Stream from Dok Dara region. From the west two other streams drain into it, Dir River which comes from the Lawari Top area and Barawal River coming from Barawal and joins the main Panjkora River in Chukiatan in the south of Dir proper. In Chukiatan it takes a turn towards the east and flows in a south east direction. Besides these five main tributaries, river Panjkora also receives a number of streams and torrents in Lower Dir District. The important ones among these tributaries are the Kunai Stream which drains the Maidan area and joins Panjkora near Timergara and Roud Stream coming from the Jandul areas.

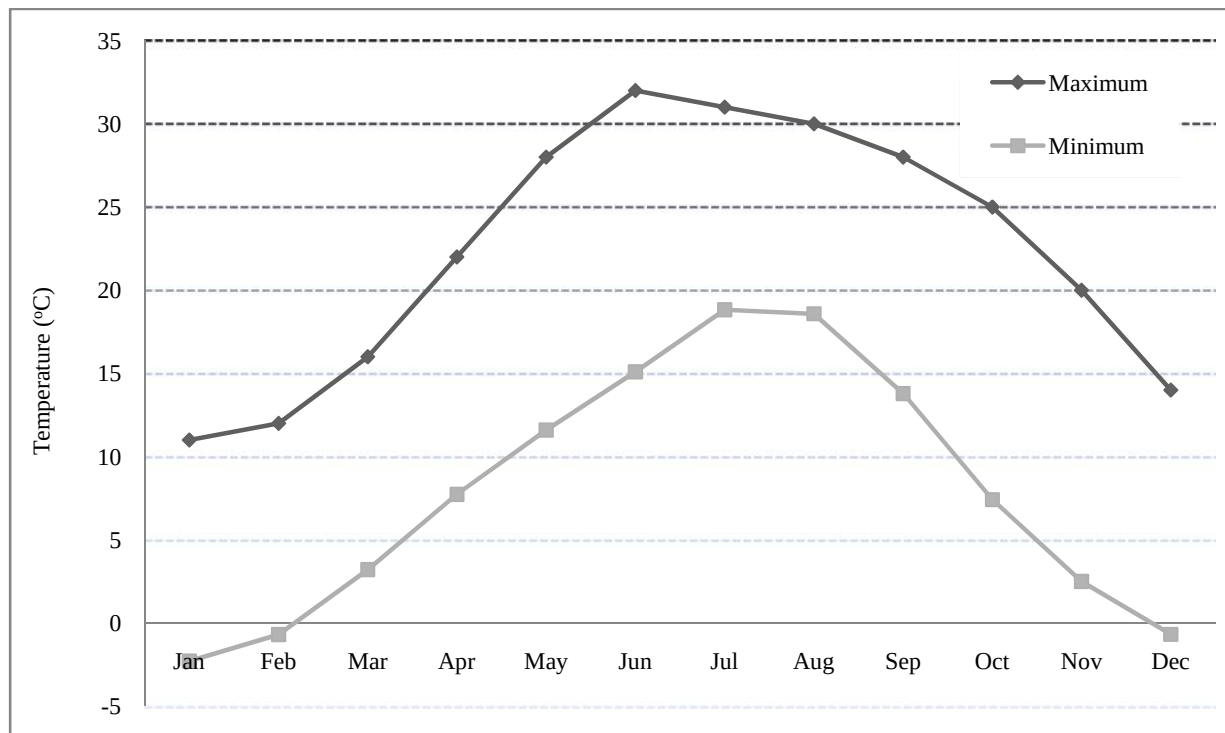
The physiography of Dir valley is structured into a series of deeply cut valleys by the Panjkora River system. A complex drainage system is developed draining into the main Panjkora River from both the right and left hand sides. The valleys are deep and narrow in the upper stages of the streams and become wider in the lower areas where small floodplains and alluvial fans are formed on both the sides of the river. The tributaries of Panjkora River receive heavy volume of water fed by snow melt particularly in the summer months. This often results into the occurrence of flash floods in the tributaries and high intensity floods in the main Panjkora River in the lower part of the valley (Tabassum et al., 2012). The valleys formed by Panjkora River and its tributaries provide relatively flat land for the construction of dwellings and transportation network. Agricultural activities are also concentrated in the floodplains and in the command areas of this river system.

Dir is underlain by metamorphic and igneous rocks comprising four main rock types i.e. quartz, feldspar, biotite, schist with inter-layers of metamorphosed limestone, amphibolite rocks of diorite group and a series of dykes cutting these two types of rocks. The amphibolite is well foliated and has quartzite and gneissic inter-layers and inclusions of granitic rocks (GoP, 2000). Soils are poorly developed due to the rough mountainous terrain throughout the valley. Wherever, flat surfaces are available, the soils are comparatively well developed having rich composition of fine particles and humus. Usually, thin residual soil cover with poorly developed soil profile is found in the mountains underlain by solid bed rocks of both the sedimentary and metamorphic natures. The terrace fields on the gentle slopes of the hills are dominated by coarser materials and pebbles.

2.1.2 Climatic Characteristics

Climatically, Dir valley is situated in the sub-tropical continental highland type of climate (Khan, 2006). This type of climate is characterized by prolonged and severely cold winters and short pleasant summer. Small scale regional variations can be observed in the prevailing climatic conditions within the valley. These variations are basically due to the sharp variations in altitude which ranges from below 500 meters in the foothills up to above 5,000 meters in the north and north eastern parts. Temperature often drops below freezing point in winter months i.e. from December to February (Fig 2.2).

Fig 2.2 Monthly Mean Maximum and Mean Minimum Temperature (1967-2010)

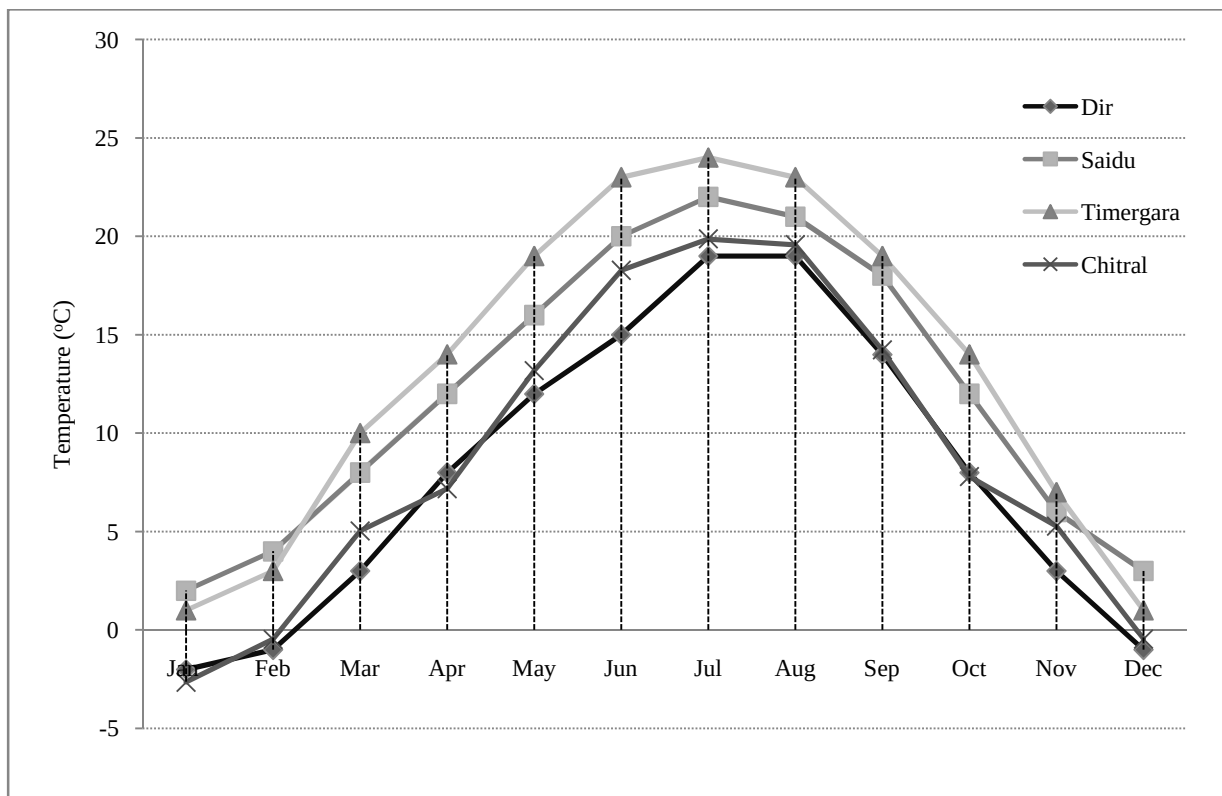


(Pakistan Meteorological Department Peshawar 2014)

While comparing mean minimum temperatures of Dir with the surrounding met-stations, it can be observed that in the lower parts of the area i.e. Timergara and adjacent low lying areas, temperature does not drop below freezing point. The mean minimum temperature of Dir coincides with Chitral i.e. the northern bordering district while lower than Saidu (Swat) i.e. its eastern neighboring district (Fig 2.3). Timergara City is the hottest place in Dir Valley and the mean minimum temperature always remain above freezing point.

Contrary to the prolonged and severe winters, the summer season is relatively short and pleasant in most parts of the valley. The duration of summer season varies from short and mild in the north and north eastern high mountains to comparatively long and hot in the lower areas. Summer temperature remains higher in the low lying areas located in the valley, while low temperature is experienced in the mountainous areas. June and July are the hottest months and temperature often remains above 30°C (Fig 2.2).

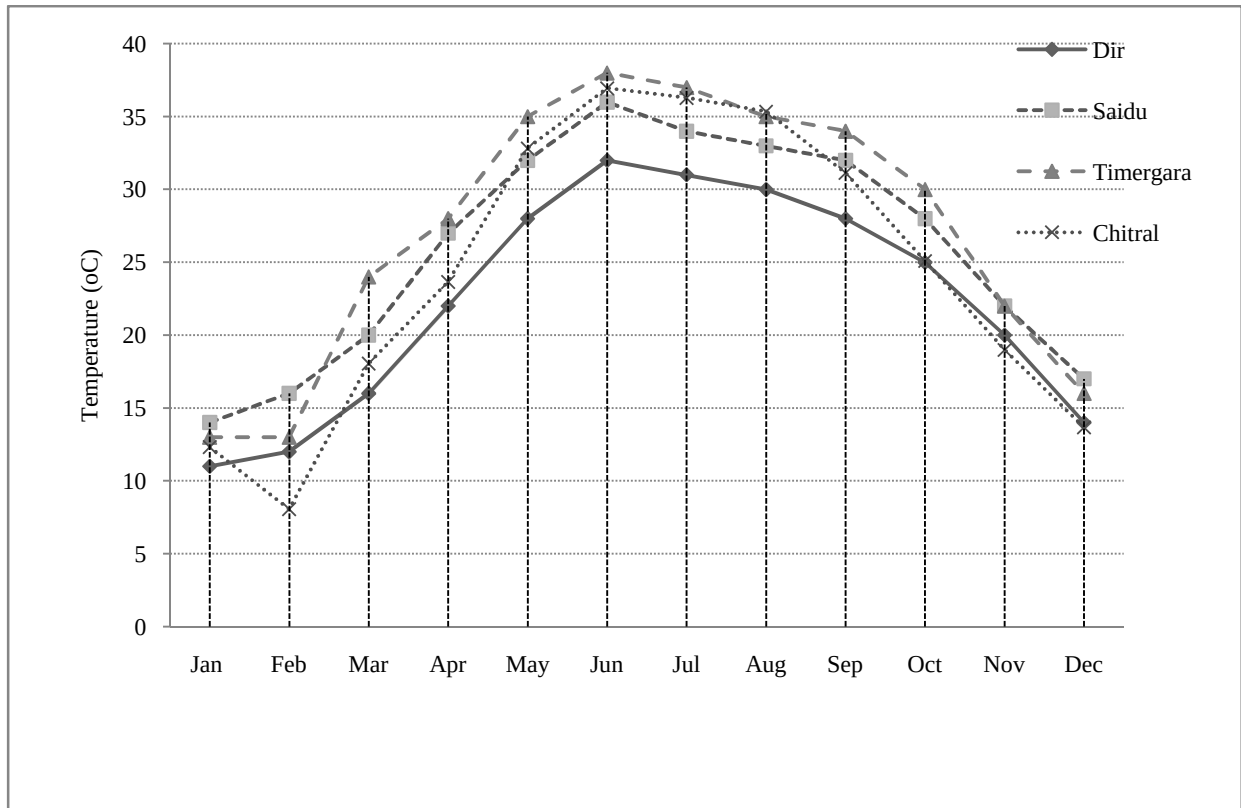
Fig 2.3 Mean Minimum Temperature of Dir and the Surrounding Met-Stations (1967-2010)



(Pakistan Meteorological Department Peshawar, 2014)

The comparison reveals considerable local variations in mean maximum temperature between upper and lower parts of the area. Summer temperature rises almost up to 40°C in the lower areas i.e. Timergara while remains around 30°C in the upper areas i.e. Dir Proper (Fig 2.4). Besides these local variations, the mean maximum temperature of neighboring districts i.e. Swat and Chitral also remains quite high as compared to the study area.

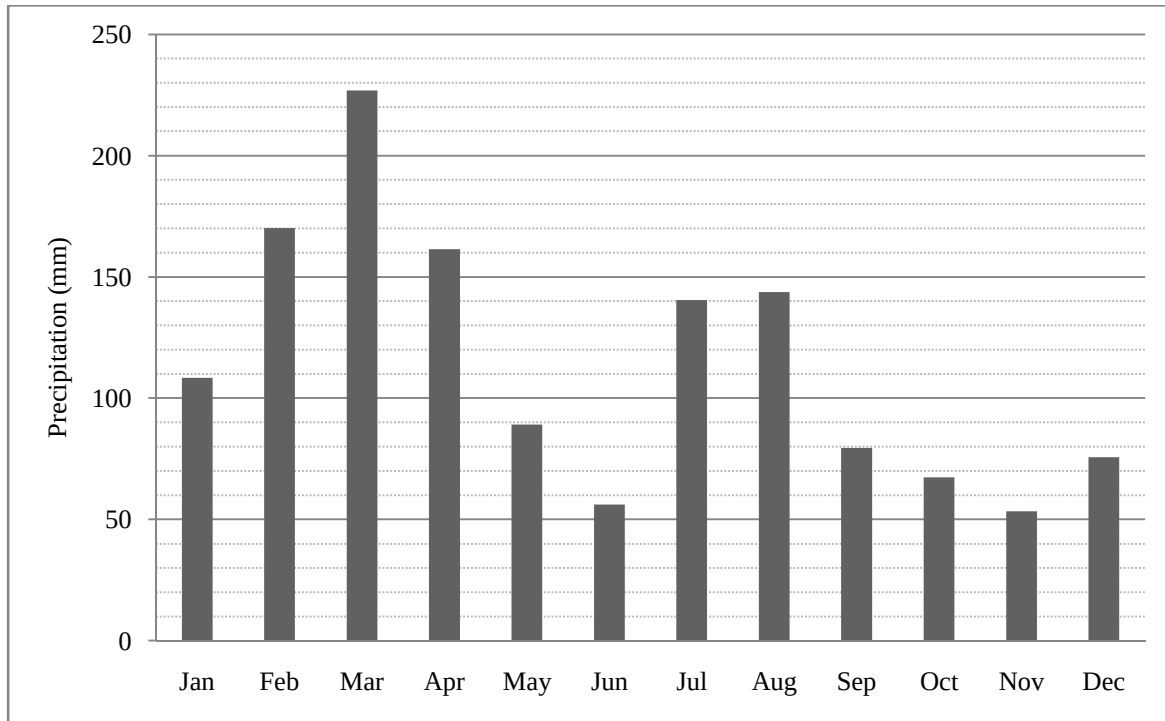
Fig 2.4 Mean Maximum Temperature of Dir and the Surrounding Met-Stations (1967-2010)



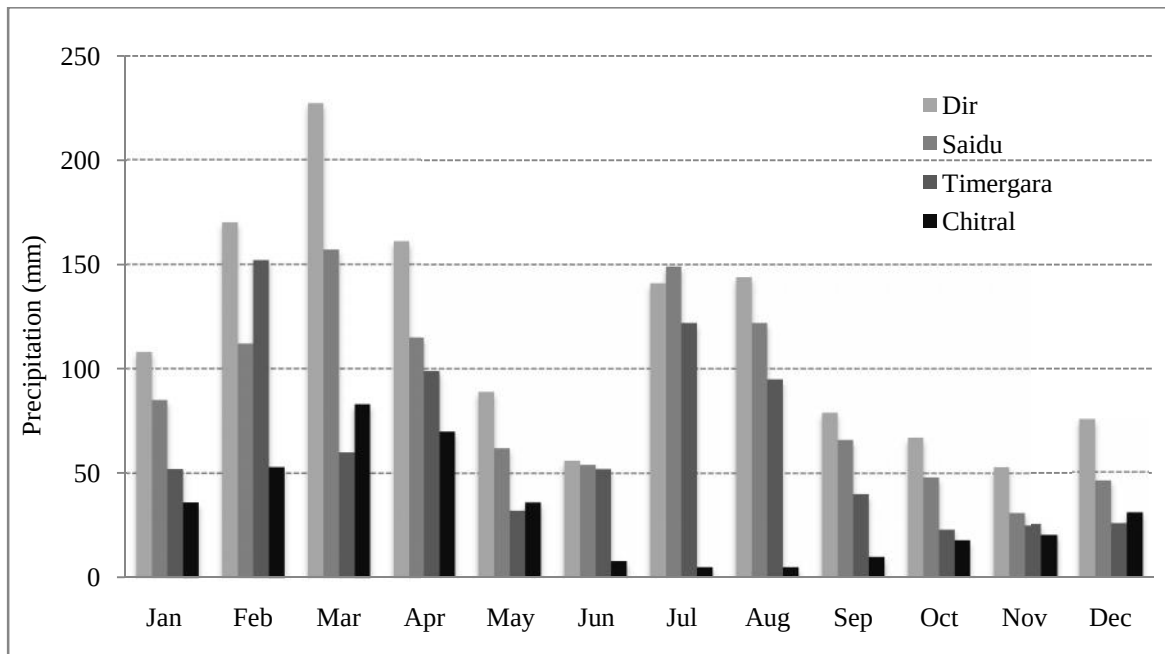
(Pakistan Meteorological Department Peshawar, 2014)

Rainfall is received both in the summer and winter seasons; however, most of it is received during winter (Fig 2.5). Heavy snowfall is received usually from November to February while the period prolongs up to March in the higher altitude areas. The mountains in the north and north eastern portion of the valley remain snow covered round the year. Summer rainfall is mostly received from monsoon system. North eastern parts of the valley receive torrential rainfall caused by the tail end of monsoon winds in the months of July and August (Fig 2.5).

Comparative figures of mean monthly precipitation reveals that the upper areas of Dir Valley receives more precipitation than the lower parts as well as neighboring districts almost throughout the year. The differences are considerable in winter season i.e. December to February and the intervening period of March and April (Fig 2.6).

Fig 2.5 Dir Upper: Mean Monthly Precipitation (1967-2010)

(Pakistan Meteorological Department Peshawar, 2014)

Fig 2.6 Mean Monthly Precipitation of Dir compared with other Met-Stations (1967-2010)

(Pakistan Meteorological Department Peshawar, 2014)

2.1.3 Natural Resource base and its Distribution

The above mentioned topographic and climatic variations determine the uneven distribution of natural resources. Land, water and forests are the major resources found in the valley and providing basic livelihood support to the inhabitants. These resources are unevenly distributed over the entire valley. The mountains receive sufficient amount of precipitation to support vegetation growth, hence thick cover of alpine forests can be found at higher elevations. Such thick forests are not available at low lying areas; however, dispersed trees and scrub covers can be found almost everywhere.

The availability of agriculture land and water resources also varies widely throughout the valley. Narrow tracks of agriculture land are found in the floodplains of river Panjkora and its major tributaries. In the hilly areas, agricultural land can only be found in the form of terrace fields wherever the gentle slopes can be modified. Agricultural land is limited and available in small patches in the upper part of the valley. Usually Rain-fed agriculture is practiced in these small patches as water is a scarce resource in the hilly areas. However, in some areas springs and small perennial streams provide irrigation facilities for the cultivable land. Moreover, in highlands only a single crop in a year can reach maturity due to long and cold winters. Whereas, the low lands enjoy two main cropping seasons i.e. *Rabi* and *Kharif*. Two major crops can be grown in these two seasons along with a number of minor crops, vegetables and fruits

2.2 Anthropogenic Characteristics

2.2.1 History of Dir Valley

Contrary to the neighboring areas of Dir valley such as Chitral, Gilgit region and Swat, little written material is available on Dir valley though it has been the center of various spiritual and religious personalities and has a rich history (Rehman, 2013). The main factor behind the lack of colonial literature on Dir is perhaps the restrictions on movements through the valley in the past and its isolation from external influences. Most of the books and other written records about the history of Chitral and Swat valleys and arrival of Pashtun civilization belong to the British writers and expeditors who traveled and stayed here. The British government officials and agents

have exclusively traveled through the other parts of this mountainous belt and have written their experiences in the form of books, biographies and reports.

Dir being an easy route connecting Chitral and other parts of northern Pakistan to the plains of Peshawar Vale could have been an area of interest for the explorers and expeditors of the British era; however, the unfriendly nature of the inhabitants restricted the movements of British Officials through this route and thus keeping it hidden from the writers and historians. One of the British agents Durand, (2001: 112, 182) has written his views about travel through Dir valley as,

...we got no sport here, but I got orders to return to India by Kashmir, and not to attempt the Dir road. The proposed return to India via Dir and Bajaur was discussed with care, and the general opinion was that I could go down in safety if Umara Khan invited me. Both the Khan of Dir and the Khan of Aladand, the last man through whose bonds I should have pass, were said to be most anxious to arrange my passage, but all depended on the Napoleon of Bajaur.

Due to its location bordering Afghanistan, tribal areas and the then princely states of Swat and Bajaur, Dir valley has remained an important route and has a rich history of chronological dynasties. However, due to poor research activities, the history of the area – as well as other socio-economic and biophysical aspects – is not properly documented.

Besides two available colonial sources (Mahon & Ramsay, 1897; General Staff of India, 1901), recently a book is published in Urdu Language by (Shahid, 2005) attempting to document the history of Dir. Moreover, Dir has been mentioned and short descriptions have been given in various other books (Robertson, 1896; Barth, 1956; Caroe, 1958; Spain, 1973). The history documented in this thesis is based on information taken from these sources.

2.2.1.1 History of the Name ‘DIR’

There are a number of opinions and contradictions regarding the name ‘DIR’ among the elders and those who have written about it. Dir has remained the center of various religious orthodoxies and spiritualism and several civilizations have developed and passed through this region. As a result the valley has been known by different names as well as its present name ‘Dir’ has been used in different meanings according to the prevailing situation.

According to the elders Dir has been known in the ancient history by various names such as Goraïy, Yaghistan, Biloristan and Masaga. The name Dir was first used in the time of Buddhist Civilization in Panjkora valley (Shahid, 2005). In Arabic Language the word ‘Dir’ means monastery and it was used to describe the Buddhist Monasteries were constructed on both banks of River Panjkora. Another ancient name of Dir was Kafiristan which means the land of Kafirs (Non-Muslims). This name was given to it after the dynasty of Kafirs living in the Kohistan region of Dir valley. These Kafirs ruled over the area from 10th to 15th century AD. After 15th century AD, the Pashtuns of Yosafazai Tribe conquered the area and named it as Dir. It is said that Dir was derived from the Persian word ‘dair’ which meant ‘far off’ and ‘hard to reach’. This name was used for the area because of its inaccessibility and remoteness.

2.2.1.2 Ancient History (1500 BC to 1500 AD)

The history of Dir valley is very old and can be traced back to the Stone Age, Dravidians and Arian civilizations. A town in the present day Upper Dir district known as Darora is believed to had been named after Dravidians Civilization (Shahid, 2005). After the arrival of Arians, the whole Gandhara Region including Dir, Swat and Taxila etc. remained under the influence of Persian Empire in 522 BC (Spain, 1963). The remains of the Fire Temples along the banks of River Panjkora in the lower parts of the valley are the evidences of Achaemenian Civilization in the area (Spain, 1963; Dani, 1986). Dir and Swat valleys have always remained either under direct control of big empires or partially under their influence due to the availability of natural resources. In 327 BC, this area was conquered by Greeks under the command of Alexander the Great who entered into Dir Valley from Jalalabad, Afghanistan through Bajaur Agency. During that time Dir and Swat valleys were part of the Masaga State, stretching from Lawari (the boundary between Dir and Chitral) up to Attock covering the present day Bunir district, Malakand and Bajaur Agencies and the surrounding mountainous areas. Dir remained under Greeks’ influence for the next two centuries (Spain, 1963; Ahmad, 1976; Nichols, 2008).

After the decline of Greeks Empire, it came under the rule of different dynasties such as Buddhists, Huns, and Hindus etc. till 998 AD when the area was conquered by Muslims. Although Islam reached to the sub-continent in 712 when Muhammad Bin Qasim came here through Karachi – the then Debal – however, Muslim Civilization in Dir started in 998 AD after the arrival of Mahmood Ghaznavi who defeated the Hindus and established Muslim rule in the

area. According to Shahid, (2005) Dir Valley has also remained under the rule of the great Mughul emperor ‘Timur’ when he stayed here in 1369 AD. According to him, Timur during his expeditions, stayed in a town Timergara on the bank of River Panjkora which was named Timurgarh after his name in that time. Later on Timurgarh changed into Timergara, which is presently the largest town and urban center of Dir Valley. The ancient history of Dir reveals that this area has remained under the influence of more than fifteen different civilizations from 1500 BC to 1500 AD. The arrival of Pashtun Civilization in 1519 AD, when Yousafzai Tribe occupied the area, was the beginning of a new era in the history of Dir. This civilization is going to complete its 5th century and is still persisting.

2.2.2 The Arrival of Pashtuns (1519 AD to the Present)

Yousafzai⁴ was one of the four major clans of Khashi Tribe living in Afghanistan. After getting prosperity in Kabul, the Yousafzai openly defied the then ruler Sultan Ulugh Bag, who was the grandson of Turk King Taimur and the uncle of Babur. Ulugh Bag tried to suppress the tribe but he failed, and therefore, he staged a bloody massacre and killed all the leaders of Yousafzai. A very few members of the tribe survived in this massacre with two renowned persons i.e. Malik Shah Mansur and his nephew Malik Ahmad. Later on, the young Malik Ahmad played the key role in the rehabilitation and reunion of the Yousafzai Tribe. Those who survived migrated from Afghanistan and entered into Pakistan through Khyber Pass. Slowly and gradually, the people of Yousafzai occupied the areas from Peshawar up to Swat, Dir and Buner after a number of battles with the local tribes and the then Sultan of Swat⁵.

⁴ The history of changes in the socio-physical environment and natural resource management systems began after the occupation and permanent inhabitation of Pashtun Tribe in Dir valley. Due to frequent political changes before the arrival of Pashtuns, no records of resource ownership and revenue system can be found here. The available literature reveals that proper resource ownership and management system was formally introduced by the Yousafzai Tribe after settling over in this area (General Staff of India, 1901; Mahon and Ramsay, 1981).

⁵ This was the time of Mughul King Zaher-ud-Din Babur’s expeditions whose troops were fighting with the tribes of Bajaur. Keeping in mind the bravery of Yousafzai people, Babur established diplomatic relations with them and married a Yousafzai daughter in order to keep them in order and get their support in the time of need (cf. Spain, 1963, 1973, 1995; Ahmad, 1976; Nichols, 2001).

Malak Ahmad, Shekh Mali and Shah Mansor were among the major commanders and leaders of Yousafzai Tribe. Malak Ahmad was a great warrior and played the key role in several battles fought with other tribes particularly the Dalazak Tribe. In 1523 AD he commanded the Yousafzai troops in the last battle against Dalazak Tribe. After this fight, Yousafzai Tribe lived in peace and prosperity and devoted themselves to agriculture activities and economic development. Shekh Mali was a great leader, scholar and expert of the Islamic Law and Jurisprudence. Besides his considerable contributions in the battle field, he was a great policy maker and always led his tribe in every sphere of the social affairs. He was respected by his followers and his decisions were accepted by everyone. His greatest contribution was the introduction of land ownership system and the formulation of rules and regulations for the appropriation of land and resources among various clans of Yousafzai Tribe and their allies in 1523. This system of land tenure was termed as *wesh*, which became one of the most important institutions in Pashtun society. The importance of this system is evident from the colonial literature (Mahon and Ramsay, 1897; Government of the Punjab, 1898; General Staff of India, 1901; Barth, 1956; Caroe, 1958; Spain, 1963, 1973) as well as the present day studies (Nichols, 2001; Sultan-i-Rome, 2005, 2007, 2008; Nafees et al., 2009; Rahman et al., 2014; Haq et al., 2012).

The main purpose behind the introduction of *wesh* system was the equitable distribution of land and resources among the inhabitants of Yousafzai Territory, the present day Khyber Pakhtunkhwa Province. This territory includes both the plain areas of Peshawar Vale (*sama*) and the mountainous terrain (*gharaiza*) of Dir and Swat etc. The distribution of natural resources is determined by the wide altitudinal and topographical variations among the plains and the mountains. The plain areas were more fertile and productive with irrigation arrangements as compared to the rain fed and relatively less fertile lands of mountains. The uneven distribution of natural resources accompanied by accessibility factor among the plains and mountains were not favoring the permanent distribution of *sama* and *gharaiza* among the tribes and the co-owners.

Therefore, Shekh Mali introduced the temporal and circulatory appropriation of areas and resources for different time intervals under the *wesh* system. The plain and mountainous areas and the fertile and infertile lands were allotted to the co-owners through a drawing lot system (*khasanry*) for a period of five or six years. After the expiry of that time period, the process of

allotment was revised and the rights of owners were circulated. The inhabitants of mountainous areas were shifted to the plain and those of the fertile land to the infertile one and vice versa. The rules and regulations for the functioning of *wesh* system were formulated in the form of law, which was termed as *daftar*. This law not only covered the land ownership system, but also defined several other acts and rules for the integration and successful functioning of Pashtun society. According to this law, the murderer's house should be burnt, he should be exiled from the village and his share in the land should be handed over to the victimized family. The term *daftar* was also used for the territory and resources belonging to a particular tribe or owner and presently it is used in this context only. This system of periodical distribution and re-distribution and the law of *daftar* were very successful and remained in vogue for centuries. Later on certain weaknesses and changes in the socio-economic and political setup resulted into the abandonment of this system from the plain as well as most parts of the mountainous areas. Nevertheless, the system is still practiced on local level in several small valleys of Dir, Swat and Kohistan etc. with some modifications and transformations.

2.2.3 Feudalism in Dir: The Arrival of Khans and Nawabs

2.2.3.1 Khanism in Dir

Khanism started in Dir valley in 1626 AD by a spiritual leader of Maly Zai Tribe named Akhund Ilyas Baba. He was a religious scholar used to preach Islamic education and resolve the tribal disputes and conflicts through the Muslims' Law and Jurisprudence and also had deep knowledge on local social systems. Slowly and gradually he became popular, effective and respected person in the Maly Zai area. The people began to honor his sayings and soon he established his rule in Dir Village and became the first Khan. His successors managed to extend the territorial limits of their rule giving birth to an autonomous political entity, which later on became the princely state of Dir. After his death in 1676 AD his son Mulla Ismail succeeded to the throne (*Gaddi*) and remained Khan until 1752. He was also educated in Muslims' Law and ruled the state in a good manner following his father footsteps. Khan Ghulam Khan became the successor of Mulla Ismail in 1752 and remained in rule till 1804. Unlike his father and grandfather, Ghulam Khan was more interested in ruling the people and living a royal life style

instead following the way of his forefathers. Khan Zafar Khan succeeded Ghulam Khan in 1804 and ruled the state till 1814. He established a formal and paid military force and started to extend his rule to the surrounding areas. His major achievement was the invasion on the Kohistani Kafirs when he defeated them in a battle and conquered the area. The next successor in the Khanizm was Khan Qasim Khan Shahid who ruled Dir state from 1814 to 1822. He was assassinated by his sons in 1822.

The golden period, in the three centuries Khanizm, was the rule of Khan Ghazan Khan who ruled the state for 46 years from 1822 to 1868. He re-organized his military force and started to recover the areas which were lost by his predecessors. This was the time of several internal and external threats because of the freedom movement of 1857. However, he overcome the challenges through his wisdom and didn't lose control of his state. He died in 1870 and his son Khan Rahmatullah Khan took charge of the Gaddi of Dir who was a great warrior and a judicious ruler. Rahmatullah Khan on the one hand was facing the opposition of his brothers who were not ready to accept his rule, while on the other hand he was threatened by his son Khan Sharif Khan. With the help of Umara Khan of Jandol, Khan Sharif Khan attacked his father's state. However, the commanding skills and wisdom of his father always defeated him.

During that time Jandool principality was under the rule of Umara Khan who was known by the British as Napoleon of the East due to his expeditions. Umara Khan after fighting with his brothers succeeded to the throne of Jandool in 1880 and started invading the neighboring localities of Dir state. Umara Khan made several attacks on Dir and until 1884, more than half of the Dir state came under his rule. After the death of Khan Rahmatullah Khan in 1884, his son Sharif Khan succeeded as the new Khan of Dir. The continuous pressure from his brothers enforced Sharif Khan to recover the areas conquered by Umara Khan. Until 1890, these two forces remained in a state of continuous aggression against each other and several battles were fought. This was the sixth attack of Umara Khan on the territory of Dir, when he finally succeeded in occupying the whole state. By the autumn 1890 the whole of Dir state was under the control of Umara Khan and Sharif Khan was exiled to Swat. He appointed his brother Muhammad Shah Khan as the Governor of the state who started collecting revenue from the people of the area and also took the timber trade of Panjkora into his hands.

2.2.3.2 The Arrival of Nawabism in Dir

After the merger of Dir into Jandool, Umara Khan continued his expeditions and started invasions on the other surrounding principalities such as Nawagai, Nikabi Khel and Ranizai. His power expanded up to Dargai Skhakot in the south of Malakand and up to Chitral state in the north. Umara Khan was at the top of his power in the year 1894, having completely recovered all his previous possessions and now began to actively intrigue in Chitral. The advancement of Umara Khan and Sher Afzal⁶ into the Chitral territory resulted into a series of incidents which ultimately led to Chitral Siege on March 3rd. The incidence of Chitral Siege brought a new turn in the history of Dir, Chitral and other principalities. Due to increasing powers of Umara Khan in Chitral, the British agents in Gilgit directly came into the play and confronted the *lashkar* of Umara Khan. This confrontation converted into a long lasting bloody war between the British army and Umara Khan. The British advised Umara Khan again and again to withdraw his forces and interference from Chitral but he paid no heed to their warnings.

In this situation, the dispatch of Chitral Relief Force became necessary for the British government in order to settle the Chitral dispute. However, the Chitral Relief Force had to pass through the Dir route where there was no passage for the British army. This was the time for the involvement of the exiled Khan of Dir, the Khan Sharif Khan. The British Officials knowing about the past conflicts between the Khan of Dir and Umara Khan used this opportunity and invited the former to dialogues on the issue. A deal was signed between the British forces and the ex Khan of Dir. The Khan was offered the throne of Dir and possession of the lost areas in return for his assistance in providing safe passage through the Dir route and support against the Khan of Jandool. Khan Muhammad Sharif Khan, who up to now had been a refugee in Swat was too glad to accept that offer. He with the help of the tribes in his support conquered the forts on the banks of River Panjkora and made the passage clear for the Chitral Relief Force. In this way the British forces reached Chitral and the powers of Umara Khan came to an end.

After the Chitral dispute was resolved, the Khan of Dir Muhammad Sharif Khan was rewarded the throne of Dir and he came into power as per agreement with the British officers. He was declared as the first Nawab of Dir in 1895 and his rule was formally recognized by the British

⁶ For details about Sher Afzal's advancement and Chitral Siege, see Robertson, (1895).

government. The succession of Sharif Khan to the *Gaddi* of Dir as the first Nawab was accompanied by substantial changes in the political and social setup of Dir principality. Sharif Khan remained Nawab till 1904 and ruled the state for nine years. However, during his rule, the state didn't progress properly because of financial, political and social constraints faced by this embryonic state and its new ruler. Besides these unfavorable conditions, the Movement of Sartor Fakir (a rebellion against the British rule) during 1897 resulted into a long lasting conflict between British forces and the religious elements of Dir state. Due to these upheavals, no development activities were undertaken in the state during the rule of first Nawab.

Sharif Khan died in 1904 and his son Muhammad Awrangzeb Khan known by *Chara* Nawab⁷ (dumb) succeeded as the second Nawab of Dir. According to the elders, *Chara* Nawab was a spiritual person and a judicious leader. However, he was handed over the throne of Dir with a countless number of internal and external threats limiting his capacity to lead the state towards prosperity, peace and development. He remained Nawab for 20 years. This whole time was spent in a situation of insecurity and aggressions from the Swat and Jandool states on account of boundaries demarcation. It is said that a total of 45 battles were fought with the forces of Swat and Jandool during the rule of *Chara* Nawab. The continuous uprisings between Dir and Swat were creating security threats for the British movements through the Dir-Chitral Highway. Therefore, they planned to settle the issue between these two principalities by demarcating the boundary permanently. Finally, it was 1923 when an agreement was signed by the Wali of Swat and the Nawab of Dir and the boundary issue between the two states was resolved. After this agreement, *Chara* Nawab got rid of the conflicts and insurgency from Swat state but the issues of Jandool rebellions persisted.

After his death, *Chara* Nawab was succeeded by his son Muhammad Shah Jehan Khan in 1924. Shah Jehan Khan was a disobedient son not complying with the teachings of his father contrary to his younger brother Alamzeb Khan. Therefore, he lived most of his life out of his father's rule away from his family. According to the elders, the officers and ministers of Awrangzeb Khan were very corrupt and were trying to take the powers of state into their hands during the illness of Nawab. Moreover, a number of the officers were not in favor of Shah Jehan Khan and used to

⁷ *Chara* Nawab lost his power of speech in the childhood due to some incident and hence named as *chara* or dumb which later on became his pet name.

support the succession of his younger brother Alamzeb Khan. However, Shah Jehan was very clever and planned to get the favor of all the resourceful persons. Initially he settled the matter with his younger brother through a Jirga and immediately reached to India in order to get the title of Nawab from the British Viceroy. In this way Shah Jehan Khan succeeded to the throne and became the third Nawab of Dir. Soon after coming into power, he gathered the corrupt officers of the preceding rule and punished them with death in a very violent and wild manner.

Shah Jehan Khan established good ties with the British representatives and Political Agent of Malakand in order to get their full support. Nevertheless, he was never in favor of the British presence and interference in his rule. Moreover, he never wanted the free and unrestricted movement of British officers in Dir state. However, he didn't opt for any direct confrontation with British authorities as it would have weakened his power in ruling the people and protecting the state from any outside aggression.

The period of Shah Jehan's rule was undoubtedly the darkest stage in the history of Dir state and the negative impacts of his miserable and shortsighted governance can still be observed in every sector of the society even after passing of more than five decades. During his rule, there was a complete ban on education and the construction of health centers. Pursuing education in the jurisdiction of the state was considered as a serious offense and those who tried to get education were punished and exiled from the state. There were very few people who were able to afford education outside Dir. Majority of common people remained in the darkness of illiteracy and deprived of basic health facilities. This act of ignorance made the state one of the most undeveloped areas of the country.

The construction of big houses was seriously restricted and those who constructed such buildings were jailed and their dwellings were demolished. Moreover, there was a ban on the execution of any development project or construction of infrastructure in the limits of the state. There were only one major route connecting Chikdara (Lower Dir) with Proper Dir, which was the capital of the state. People were not allowed to keep private vehicles and were compelled to travel in the state buses, which were very few in number and in very pathetic conditions. His revenue system was also biased and was not based on equal collection of tax from every part of the state jurisdiction. He appointed his men in every village and used to collect grains in each cropping season known as *Nawab's Ushar*. The people belonging to the royal tribe were exempted from

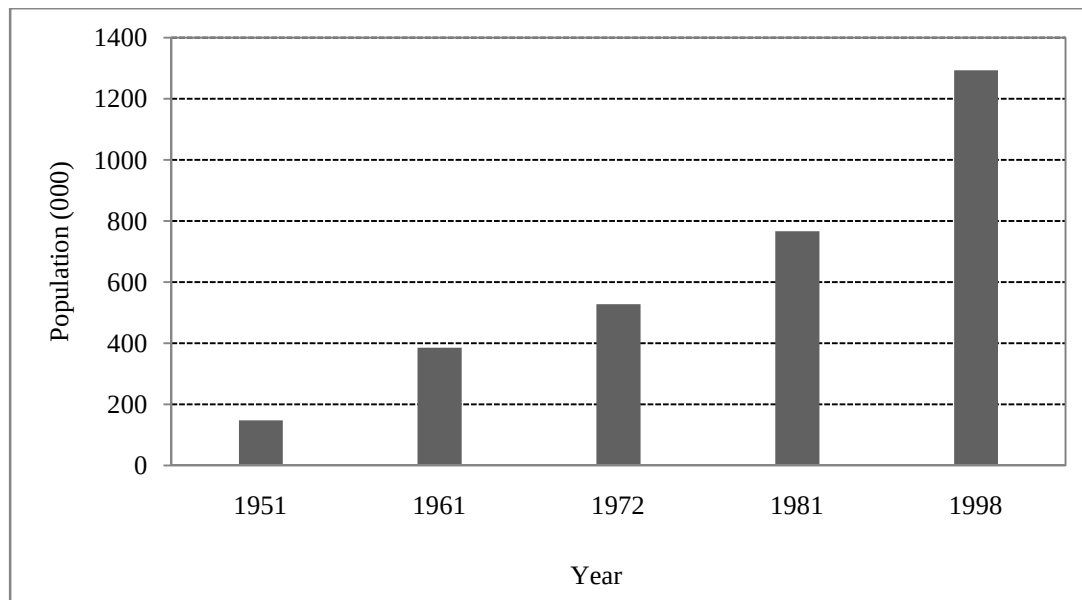
revenue collection and the others were compelled to pay all the duties. Certain tribes were to feed his horses and dogs and others were to provide a fix number of hunted birds on monthly basis.

In short, the period of Nawab's rule was full of inhuman acts and darkness for the inhabitants of the valley. Everything belonged to the people who run the state, while the public was treated in a very unlawful and cruel manner. The state remained in backwardness and couldn't progress in any sector until the end of Nawabism and arrival of formal governance. This darkest age of Dir Valley came to an end in 1969 when Shah Jehan was arrested and took away by the Government of Pakistan. Dir was declared as a settled district of Pakistan in 1970 and since then the area started to develop. Education and health facilities were established and development projects were initiated. Hence, it can be said that development started in Dir after 1960.

2.2.4 Population Growth

Population statistics of the study area reveal a continuous and rapid growth since 1951 to 1998 (Fig 2.7). It can be observed that the population is increased from about 150 thousand in 1951 to about 1300 thousand in 1998 which reveals an increase of about 9 times.

Fig 2.7 Study Area: Population Growth, 1951 to 1998



(GoP 1961, 1972, 1981, 2000)

Crude population density has also recorded an increase of about nine times from 28 persons per square kilometer in 1951 to 245 persons per square kilometer in 1998. Moreover, the physiological density has considerably increased from 160 persons per square kilometer in 1951 to 1390 persons per square kilometer in 1998. The annual growth rate was very high in 1961 which was 10.1 and decreased sharply to 2.7 in 1972 but again increased gradually to 4.5 in 1981 while dropped to 3.4 in 1998 (Table 2.1).

Table 2.1 Study Area: Dynamics of Population from 1951 to 1998

Census Year	1951	1961	1972	1981	1998
Population (000)	148	385	528	767	1293
Annual growth	..	10.1	2.7	4.5	3.42
Inter-censal increase	..	159.1	37.2	45.2	77.2
Population density	28	73	252	145	245
Physiological density	160	414	568	825	1390

(GoP 1961, 1972, 1981, 2000)

2.2.5 Distribution of Population

The population is mostly concentrated in the valleys and foothills of the Hindu Raj Mountains due to the availability of comparatively flat surface for the construction of dwellings, arable land, irrigation water and other resources. High mountains with steep slopes, thick forest cover and hostile climatic conditions are not inhabited by population. Permanent human settlements are found on gentler slopes, alluvial fans and terraces up to an altitude of 3,000 m in the mountains. Contrarily, only summer houses and animal huts can be found in the highlands lying above 3,000 meters. The summer houses are constructed for the purpose of shifting livestock to the high altitude pastures in summer.

The present day Dir Valley is inhabited by the descendants of Maly Baba known as Maly Zai on both the sides of River Panjkora. Maly Zai is divided into four tribes namely Painsa Khel, Sultan

Khel, Usa Khel and Nasradin Khel named after the four sons of Maly Baba⁸. The descendents of Usa Khel own the areas north from Talash up to Ashari Gat i.e. the main Timergara city and the surrounding villages. The major localities of Usa Khel *daftar* (property) include Peto Dara, Timergara, Balambat and Khazana etc. The areas north from Ashari Gat up to Shamardin are owned by the descendents of Nasradin Khel. The important villages of this *daftar* include Siyar Dara, Rabat Dara, Munjahai, Barun and Maidan.

Sultan Khel and Painda Khel tribes inhabit the upper part of Dir valley i.e. the present day Upper Dir district. North from Shamardin up to Akhagram including the sub-valleys in the mountains on both the sides of River Panjkora, are owned by Sultan Khel. Tormang Dara, Karo Dara part of Usherai Dara and Khall are the important localities of this *daftar*. The descendent of Painda Khel own the areas north of Akhagram including Kair Dara, Pataw Dara, Niag Dara and part of Usherai Dara.

2.2.5 Education and Literacy

As mentioned earlier, the impacts of the last stage in the history of Dir Valley i.e. Nawabism persist in every sector of the society of the area. Due to restrictions posed by the last Nawab of Dir, there were no education facilities in the area. Therefore, the number of institutions and the enrolment rate was equal to none resulting into very low literacy ratio i.e. 5.8% around 1970. The number of primary schools was 285 in 1972 which increased to 1662 in 1998 along with increase in the number of higher education institutions. The enrolment rate was only 3% in 1972 which increased to 21% in 1998 and the literacy ratio was also increased to 25% (Table 2.2). Education sector started developing after the declaration of area as a settled administrative district of Pakistan. Presently, education institutions can be found throughout the area even in the very remote mountainous villages up to the extent where human dwellings are constructed. The people pursue higher education for which they migrate to the plain areas particularly the districts of Mardan and Peshawar as well as outside the province and the country.

⁸ Under Shekh Mali's *wesh*, the areas north of Malakand hills including the valleys of Swat and Dir came under the ownership of Ako Baba who was one of the five sons of Yousaf Baba (five descendents of Yousafzai Tribe). Maly Baba was the son of Ako Baba, and was given the area of Dir.

Table 2.2 Education Institutions and Literacy in Dir Valley (1972-1998)

Year	1972	1981	1998
Literacy ratio (%)	5.8	6.8	25.2
Enrollment (%)	3	6	21.2
Primary schools number	285	400	1662
Middle schools number	30	51	94
High schools number	31	39	135
Colleges number	1	1	4

(GoP, 2000)

2.2.6 Agricultural Activities

Historically, agriculture has remained as the primary means of livelihood subsistence in the valley. Although the rough topography of the valley restricts the availability of plain land for agriculture activities; however, wherever the slopes can be modified into terraced fields, cultivation is practiced. Both rain-fed and irrigated agriculture is carried out in the area. Mostly, agricultural activities are concentrated in the foothills and valleys formed by the Panjkora River system and the seasonal torrents. The floodplains along the river and all its tributaries are fertile and intensive agriculture is practiced in these plains.

It can be observed that the total reported area of the Upper Dir District is two times greater than that of the Lower Dir District which is 167068 and 80364 hectares respectively (Table 2.3). However, due to its mountainous terrain, the total area under cultivation in Upper Dir is smaller than in the Lower one. Area not available for cultivation in the upper part is 5158 hectares compared to 2599 hectares in the lower part, while the area under forest cover is three times larger in the upper one (Table 2.3).

The floodplains of the major tributaries of Panjkora River such as Kunaai Stream in Maidan, Tormang Stream, Ushera Stream and Kohistan Stream are particularly very productive and a number of crops are grown here. Usually, these plains are irrigated through canals and water courses taken off from Panjkora River system. The water is diverted from the main streams in the form of minor canals. These canals are drawn in such a way that they run along the same contour line (altitudinal level) in order to take more areas under command. Nevertheless, most of

these floodplains are partially flooded almost every year and may completely be washed away in severe cases such as the floods of July, 2010. However, the people reclaim and repair the lands on regular basis and ensure cultivation twice a year.

Table 2.3 District-wise Land Use Pattern of Dir Valley (in hectares)

Land Use	Upper Dir	Lower Dir
Total area reported	167068	80364
Cultivated area	41740	51305
Net sown area	35791	41866
Current fallow	5949	9439
Total cropped area	-	65440
Cropped more than once	14983	23574
Uncultivated area	85328	29059
Area under forest	79520	25360
Culturable waste	650	1100
Not available for cultivation	5158	2599

(GoP, 2000)

Besides irrigated agriculture, cultivation activities are practiced in the rain-fed areas as well. Rain-fed agriculture is most common in the hilly areas located above the main irrigation sources. In the mountainous areas, the gentle slopes of the hills around the residential areas are modified into terraced fields and a number of crops are grown in these fields. The slopes are modified through constructing retaining walls using the locally available stones without any concreting materials (Fig 2.8). A series of such walls are constructed along the contours in order to modify the whole slope into fields. These walls are repaired and the detached parts are reconstructed on regular basis when the crops are harvested.

Fig 2.8 Terrace Fields in the Study Area

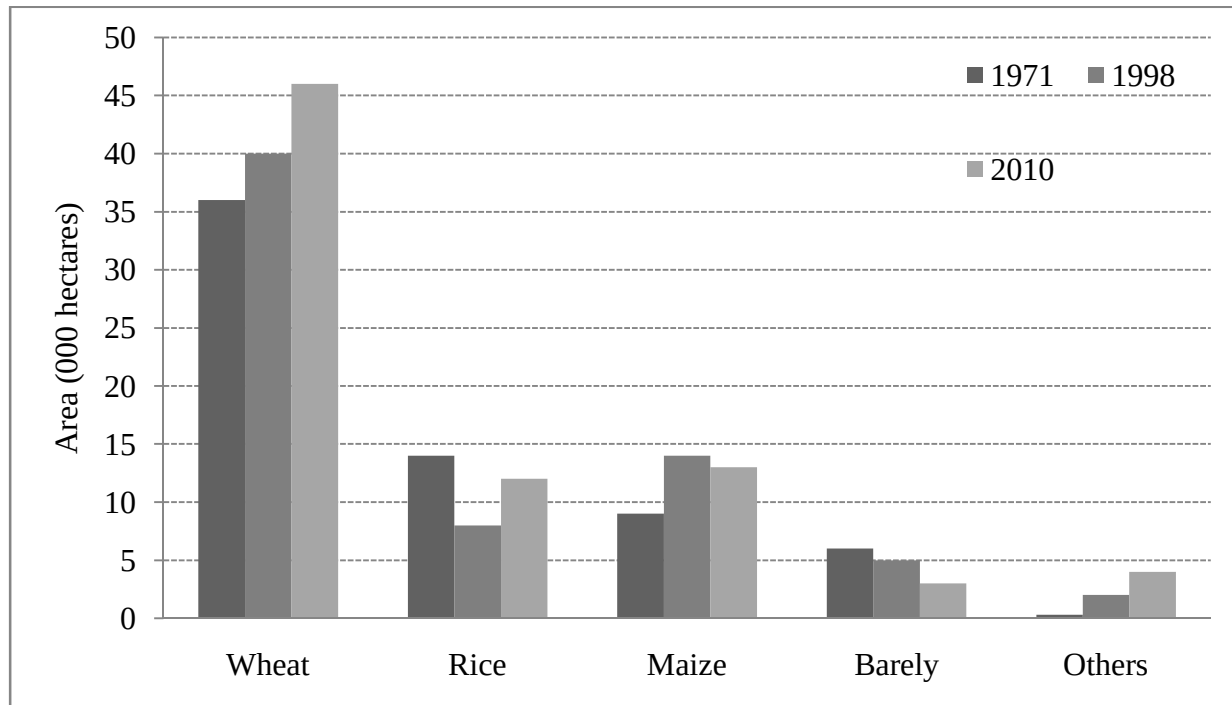


The productivity of such lands depends on the amount of precipitation and the crops give considerable yield during the years when enough and timely rainfall is received. Contrary to this, the yield may be very low in the years with low amount or untimely precipitation. In certain areas, small scale irrigation facilities are provided to the lands by springs and seasonal torrents. The water from springs is stored in small ponds and released to the fields lying in the command areas. In such cases, the water is managed through locally formulated management systems in order to utilize the scarce water resources in an appropriate manner (Haq, 2012; Haq et al., 2012).

Looking at the temporal statistics of agriculture in Dir Valley, it can be observed that the area under major crop i.e. wheat has increased gradually from 1971 to 2010 while that of rice has decreased (Fig 2.9). Similarly, the area under barley cultivation has also decreased to almost half in 2010. Barley is a drought resistant crop and it gives more yield as compared to wheat in the same soil and moisture conditions. In the past, barley was used as a staple food and due to its

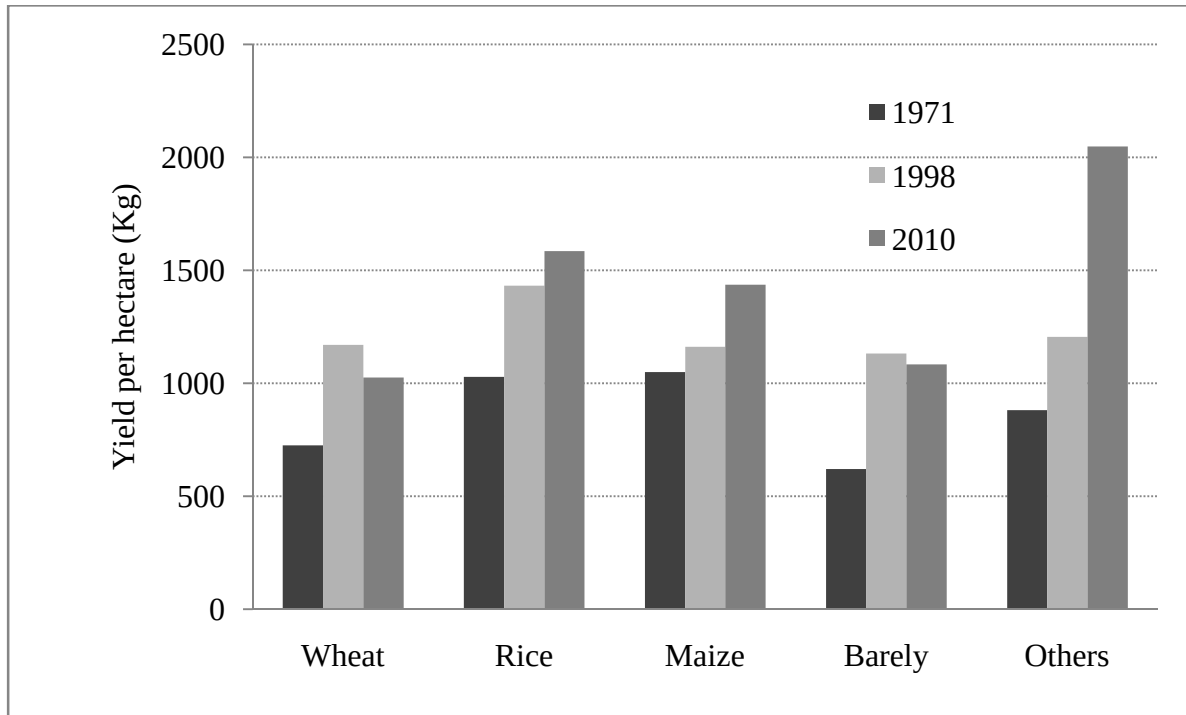
high drought resistance capacity it was given preference over wheat. However, with the passage of time, barley was replaced by wheat and it is no more used as a staple food.

Fig 2.9 Area under Various Crops in Dir Valley (1971-2010)



(GoP 1972, 2000; GoKPK, 2012a)

The yield per hectare of almost all the crops has increased from 1971 to 2010. The yield of wheat and barley has increased from 1971 to 1998 while it has slightly dropped down from 1998 to 2010 (Fig 2.10). Both of these crops are predominantly cultivated in the hilly rain-fed areas and their productivity is determined by the availability of moisture. The decrease in per hectare yield of these crops may be due to the periodic drought spells between these two data points. Contrary to this, we can observe considerable increase in the production of rice and maize during the last four decades (Fig 2.10). Rice and maize are cultivated in the irrigated areas, particularly in the floodplains of Panjkora River system while maize is also grown in the rain-fed areas. The increase in per hectare yield may be attributed to the improvements in agricultural methods, high yielding seed varieties and improved irrigation systems.

Fig 2.7 Crops' Yield in Dir Valley (1971-2010)

(GoP 1972, 2000; GoKPK, 2012a)

2.3 Conclusion

Dir valley is located on the western frontier of the Khyber Pakhtunkhwa Province formerly known as North West Frontier Province (NWFP) of Pakistan bordering with settled districts, Federally Administered Tribal Areas and Afghanistan. Physiographically, the valley is dominated by hills and mountains drained by River Panjkora and its tributaries. Due to rugged terrain, the availability of agricultural land and surface for the construction of houses is limited. Human settlements are mostly concentrated in the foothills and valleys formed by the streams. The small floodplains of river Panjkora with irrigation facilities are intensively cultivated and a number of crops are harvested. In the hilly areas, irrigation water is usually limited and rain-fed agriculture is practiced.

Due to its geographical location bordering Afghanistan, tribal areas and the former princely states of Swat, Chitral and Bajaur, Dir valley has remained an important route and has a rich chronological history. The ancient history of Dir valley is traced back to the Stone Age, Dravidians and Arian civilizations (Shahid, 2005). The area has remained under the influence of

Persian Empire in 522 BC, while the remains of Fire Temples along the banks of River Panjkora are the evidence of Achaemenian Civilization. During the time of Alexander the Great (327 BC), Dir and Swat valleys were part of the Masaga State, and remained under Greeks influence for the next two centuries. After Greeks Rule, it came under the influence of Buddhists, Huns, and Hindus and after the arrival of Mahmood Ghaznavi in 998 AD the area became under Muslims' rule.

History reveals that, Dir has remained under the rule of more than fifteen different dynasties from 1500 BC to 1500 AD. Pashtun Civilization started in the area in 1519 AD, when Yosafzai Tribe migrated from Afghanistan and occupied the area. Feudalism started in the area in 1626 when a spiritual leader named Akhund Ilyas Baba became the first *Khan* of Dir. A number of feudal rulers i.e. *Khans* and *Nawabs* ruled the state till 1969 when the last *Nawab* was arrested by the Government of Pakistan. In 1969, the state of Dir was declared as a settled district which later on was divided into two districts i.e. Upper Dir and Lower Dir in 2005.

3 CHANGES IN THE TRADITIONAL SOCIO-ECONOMIC SET UP

Similar to other mountainous areas,⁹ the long practiced and indigenously developed socio-economic conditions of the study area is under the process of change. One of the major driving forces having multitude impacts on the society and economic organization is changes in population characteristics. Continuous population growth and associated demographic changes increased the demands for food, space for house construction and building material. The locally available natural resources are quite limited and not enough to fulfill the increasing needs and demands of growing population and this usually lead to the diversification of economic activities (cf. Al-Jalay & Nazeer, 1992; ICIMOD, 2010). The southern spurs of Eastern Hindukush Mountains i.e. Hindu Raj Mountains, which cover the study area, are one of the fine examples of rapidly transforming mountainous environment. Here, the traditional livelihood strategies are replaced by a modern way of living which multiplies the demands and gives way to the introduction of off-farm and market based economic organization.

The emphasis on the production of local food items and utilization of farm resources is shifting towards cash income generation and non-local food supplies. The important outcome of this change is the gradual abandonment of mixed mountain agriculture causing the outmigration of people as an alternative strategy for fulfilling economic and livelihood needs¹⁰. Both elements of mixed mountains agriculture – animal husbandry and farming – are slowly and gradually losing importance in the household economic organization in the relatively accessible areas, whereas in the remote localities the traditional way of life is still visible. Moreover, in the low lying and comparatively more accessible areas the situation has totally changed and agriculture and livestock keeping has become an activity of secondary nature.

In the past four decades, outmigration – both local and abroad – has become the backbone of economic structure and an important feature of communities inhabiting the Hindu Raj Mountains similar to most parts of the Hindukush-Himalaya region (Hoermann & Kollmair, 2009) as well as

⁹ (cf. Preston et al., 2005; Nogues-Bravo et al., 2006; Sati, 2009; ICIMOD, 2010)

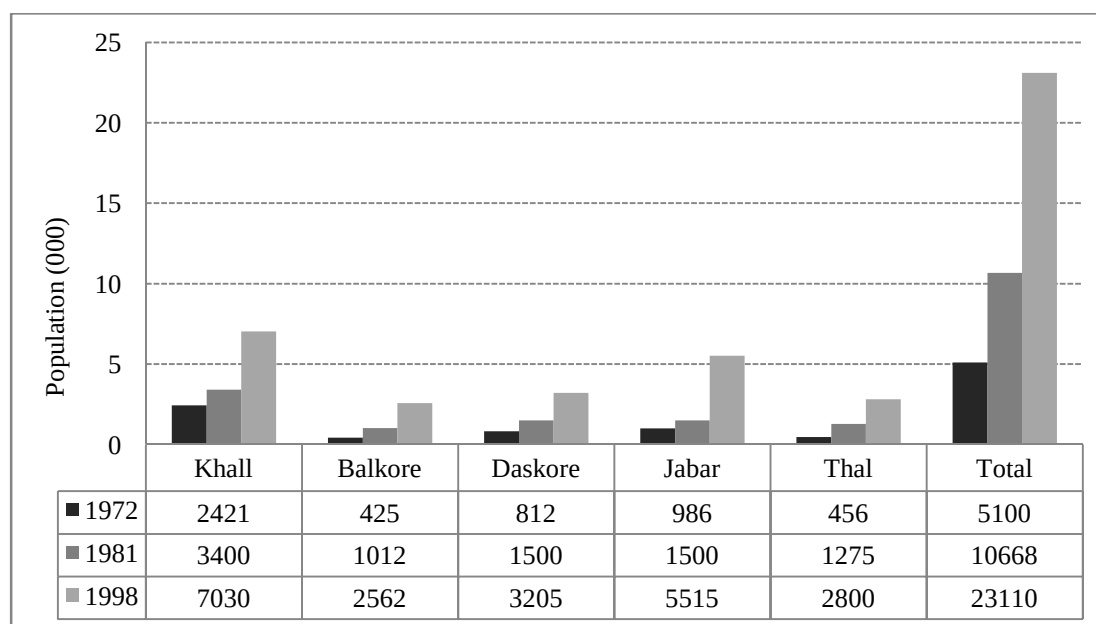
¹⁰ (cf. Tulachan & Neupane, 1999; Wright & Duncan, 2005; Olimova & Olimov, 2007; Hunzai, 2010; Gracheva et al., 2012)

in other mountainous areas of the world (ICIMOD,2010). The study area has passed through several stages of socio-economic transformations. The conversion of the princely state of Dir as a settled district of Pakistan in 1970 has been the important turn in the history of changes in the valley. This political change opened the window for several unending social and economic changes and developments. Hence, the socio-economic environment of the valley has changed considerably during the last four decades. This chapter is focused on quantifying and describing these changes.

3.1 Population Characteristics

The interrelationship between population growth and environmental sustainability has been debated since long and the theory of Thomas Malthus can be quoted as an important example (United Nations, 1973, 2001). Most of the studies and debates have described the negative impacts of population growth on physical environment (cf. United Nations, 1973; Repetto, 1986; Harrison, 1992; World Bank, 1992; FAO, 1994; Templeton & Scherr, 1997; Horizon, 2009; Sati, 2009; Gracheva et al., 2012).

The population of the study area has increased by more than four times from 5100 in 1972 to 23110 in 1998 (Fig 2.1). Thal is the least populous village in the study area but has recorded the highest population growth i.e. around seven times during the same period. The southernmost village i.e. Khall is the most populous locality in the study area where population has increased by less than four times during the study period. In short, the population of the study area has increased from four to seven times in different villages, which is relatively smaller growth as compared to the overall situation of population dynamics in Dir Valley (See chapter 2).

Fig 3.1 Population Growth in the Sample Villages (1972-1998)

(GoP, 1972, 1981, 2000)

Age and sex composition does not reveal any significant variations among male and female population and the average sex ratio of all sample villages is 100 males per 99.1 females. Children aged 0-14 years dominate the population of all villages with a total number of 1486 in 500 households and average of 3.0 children per household. Adults aging 15-59 years make the second dominant group in population composition with a total number of 1296 and average of 2.6 per household. Aged people constitute relatively small portion of population with an average of 1.7 persons per household (Table 3.1).

Table 3.1 Sample Households: Population Composition by Age and Sex

Study area	0-14			15-59			60 and above			Total			Sex Ratio
	Both	M	F	Both	M	F	Both	M	F	Both	M	F	
Khall	227	116	111	210	108	102	143	71	72	580	295	285	97
Balkore	305	150	155	258	130	128	173	84	89	736	364	372	102
Daskore	359	181	178	288	146	142	165	85	80	812	412	400	97
Jabar	265	130	135	215	107	108	152	75	77	632	312	320	103
Thal	330	166	164	325	164	161	231	118	113	886	448	438	98
Total	1486	743	743	1296	655	641	864	433	431	3646	1831	1815	99.1

(Field Survey, 2014)

3.2 Housing and Household Dynamics

Household dynamics – mainly driven by demographic changes and modernization – has played equally important role in environmental changes in the study area as the population growth does¹¹. Various studies from different parts of the world have evaluated the impacts of household dynamics on different sectors of the physical environment and ecological resources. Liu et al., (2003) studied the impacts of household dynamics on biodiversity and found that the population of giant panda has decreased because of an increase in the consumption of fuel wood driven by the growing number of households. Similarly, Knight & Rosa, (2011) have conducted a cross section analysis of the increase in number of household and rate of consumption of energy resources. They hypothesized that the number of household has a positive effect on the fuel wood consumption while household size has a negative impact.

3.2.1 Increase in the Number of Households

The trend of disintegration of joint and extended families and establishment of more and more nuclear families¹² has increased in the study area in the past few decades, as in other parts of the world (cf. Liu et al. 2003; Keilman 2003; Knight and Rosa 2011). While looking at the household characteristics during and before 1970s, it can be observed that 65% of the households were living in joint and extended family systems and only 35% households were in the form of nuclear families (Fig 3.2). The number of nuclear families has significantly increased in the study area during the last four decades. At present the situation has reversed as 64% of the families have become nuclear compared to the 65% joint and extended families four decades ago (Fig 3.2).

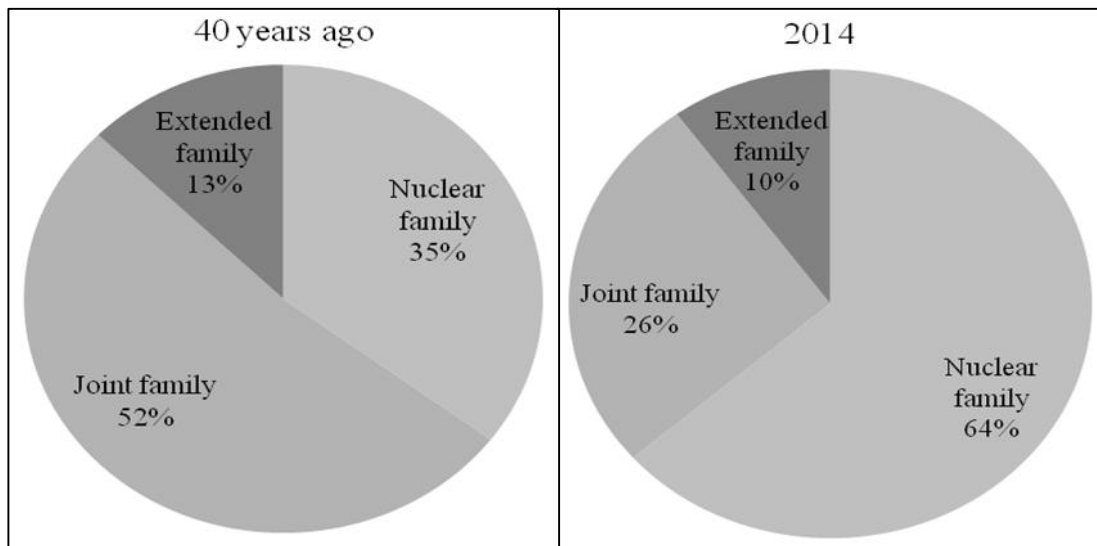
The data analysis revealed that, traditionally, the communities preferred to live in the form of joint and extended families sharing a single roof. It was one of the important integrating factors keeping all the blood relatives together, and a successful strategy to cope with different natural and social issues, such as food insecurity, conflicts, hazards and economic problems etc. As a common perception, the people living in one family have more male members and hence

¹¹ Also see (Keilman, 2003; Liu et al., 2003)

¹² A nuclear family consists of spouses and their children living in one household. Contrary to this, Joint family refers to a family where more than two parents and their off-springs are living in a single household. While, extended family is the one that extends beyond the immediate family, consisting of grandparents, uncles, aunts, and cousins living in the same household e.g. a married couple that lives with either the parents of husband or the wife (for more details, see International Encyclopedia of the Social Sciences, 2008; Encyclopedia Britannica Online, 2011; Wikipedia, 2013).

considered more powerful in terms of manpower, and economically strong which help them have a higher status in the community. Moreover, such families have very limited inter-clan land related and honor associated conflicts.

Fig 3.2 The Dynamics of Family System in the Sample Villages

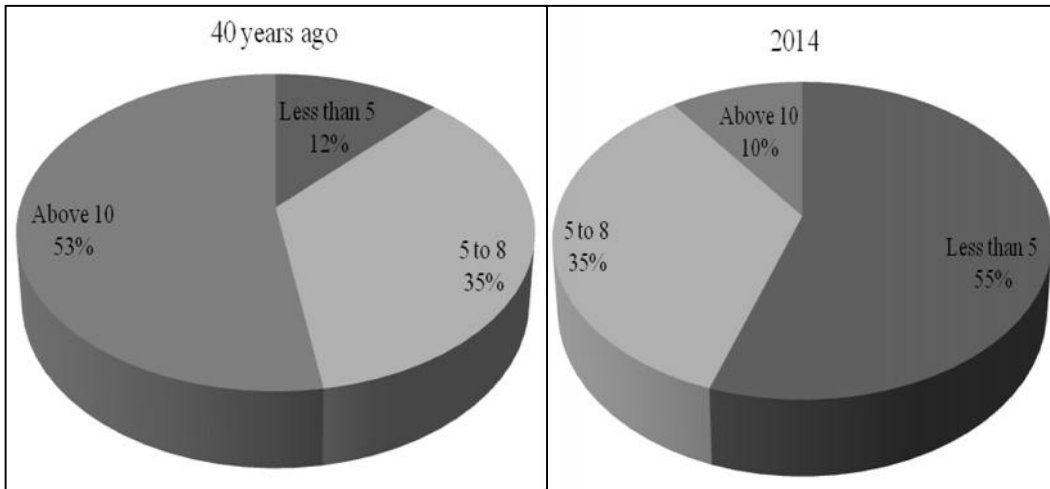


(Field Survey, 20140)

3.2.2 Decrease in Average Household Size

Another impact of the disintegration of joint and extended families is the decrease in average household size during the study period of four decades. This trend has been observed in other parts of the world as well¹³(Keilman, 2003). The percentage of larger households (having 10 members) in most of the localities of the study area was quite high, as it was 53% 40 years back, which has decreased to 10%. While, smaller household size of 5 members has increased from 12% to 55% in the same period (Fig 3.3).

¹³ According to (Keilman, 2003), between 1970 and 2000, the household size in developing countries decreased from 5.1 to 4.4, while in the developed countries it fell from 3.2 to 2.5 people per household.

Fig 3.3 Dynamics of Average Household Size in the Study Area

(Field Survey, 2014)

The driving forces behind these household dynamics are numerous. Increase in the household size makes it difficult for the family members to handle the space limitations and allocation of domestic responsibilities in a single household. Therefore, separation becomes necessary and the families disintegrate. A number of joint families in the study area have disintegrated because of the internal conflicts, which were created as a result of competition for space and allocation of duties among the household members (cf. Goode, 1963).

With improved standards of living of people in the study area, it became possible for the people to secure their livelihood in the form of small families. Additionally, there are a number of other social and cultural factors identified by demographic behavior theories (cf. Verdon, 1998), which play an important role in family disintegration. According to Keilman, (2003) these factors include less tolerance to cultural norms; less religion tendency and increased freedom; women education leading to economic independence of women; more emphasis on equity in gender role and residential autonomy etc.

The increasing number of household and decrease in the average household size has a number of impacts on the elements of socio-economic setup. The production and consumption of goods and diversification of economic activities are among the important outcomes. To meet the increasing needs, the inhabitants are searching for off-farm income, which results into the diversification of economic activities. As more households need more space for the construction of dwellings; land

for the production of food and fodder; and fuel wood for cooking and heating; therefore, forest fringe areas are converted into residential and agricultural lands and the more wood are extracted from the forests to meet energy requirements (See chapter 5). Same findings have also been reported by Liu et al., (2003: 530) as, “household dynamics influence per capita consumption and thus biodiversity through, for example, consumption of wood for fuel, habitat alteration for home building and associated activities”.

3.2.3 Change in House Construction and Building Material

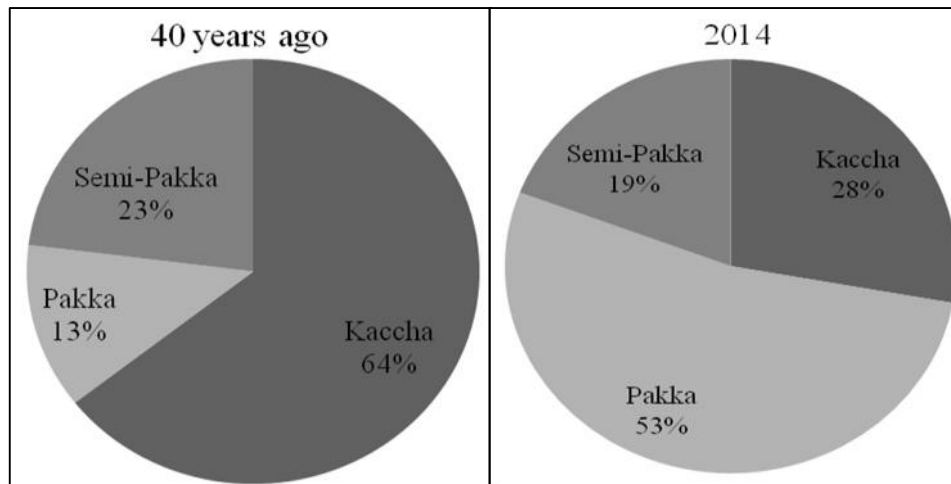
The house design and layout has considerably changed during the last four decades. The major structural transformations in house construction occurred after the political change of 1970s when formal state authorities came into rule. During the reign of Shah Jehan Nawab's, it was strictly forbidden to construct big structure in the jurisdiction of the state. Except a few influential persons in Khall having good relations with Nawab, or those in Usheri Dara who were part of the ruling dynasty, there were no well-furnished houses or private buildings in the whole Dir state. The common people were not allowed to white wash their houses and to construct such a big building which can look prominent. These restrictions were relaxed and house structure and design changed considerably with de-throning of the Nawab.

Based on building material used in the study area, the houses are divided into three major categories. Kaccha house refers to the structure made up of stones, mud and wood without cement. In contrast, pakka houses are those which are completely made up of modern building materials such as bricks, cement blocks with doors and windows usually, but not exclusively, made of iron. When the construction materials used in kaccha houses are supplemented by cement and corrugated sheet the house is said to have semi-pakka structure. The data analysis reveals that during the study period kaccha houses decreased from 64% to 28% of the total households. Contrarily, pakka houses increased from 13% to 53% of the total households, raising the percentage of pakka and semi-pakka houses to 72% (Fig 3.4).

In the traditional kaccha houses the floor is made of mud, and the walls composed of stones or wood sticks usually wild olive covered by mud. The mud used in the floor and the walls is composed of the fine clayey soils of brown color mixed with sand which gives it strength and prevents cracks. The roof is made up of a multi-layered structure of wood which is finally

covered by a mixture of clay and sandy soil or mud mixed up with pebbles. The ceiling layer of the roof is made up of wood logs or tree trunks of pine or deodar. This layer is covered by small pieces of wood usually branches and bushes, which is further covered by a thick cover of leaves. This cover retains the soil or mud and protects it from falling down into the house as well as the soil layer is so thick that can prevent water percolation. The structure of roof and the materials used in it vary widely in the area depending on the availability of local building material particularly timber. The design and composition of semi-pakka house is not similar everywhere. Usually, the floor is made of cement; the walls are made of stones but covered by cement and painted while the roofs are either made of wood and corrugated sheet or wood and mud.

Fig 3.4 Change in House Type by Construction Material in the Study Area



(Field Survey, 20140)

The change from traditional building materials to modern ones is attributed to a number of factors. The main factor is the “motorized access to the regional center and availability of money” (Fazlur-Rahman, 2007b: 212), which have resulted into increase in the use of improved construction materials. Another factor is the unavailability of local timber in low lying villages, which is not sufficient to support the increasing demands of growing number of households for construction wood. Additionally, the kaccha houses need a greater space due to thick stone-made walls and single storey structure while the demand for residential land is increasing. Contrary to this, the pakka houses are composed of thin walls and can meet the space limitations by making double or multi-storey houses. Moreover, the kaccha houses need regular attention and proper

maintenance measures particularly in winter when the roofs start percolation in rainy days. The wood used in the kaccha houses is also exposed to the risk of termites and spoiling due to moisture content.

3.2.4 Change in House Layout, Facilities and Design

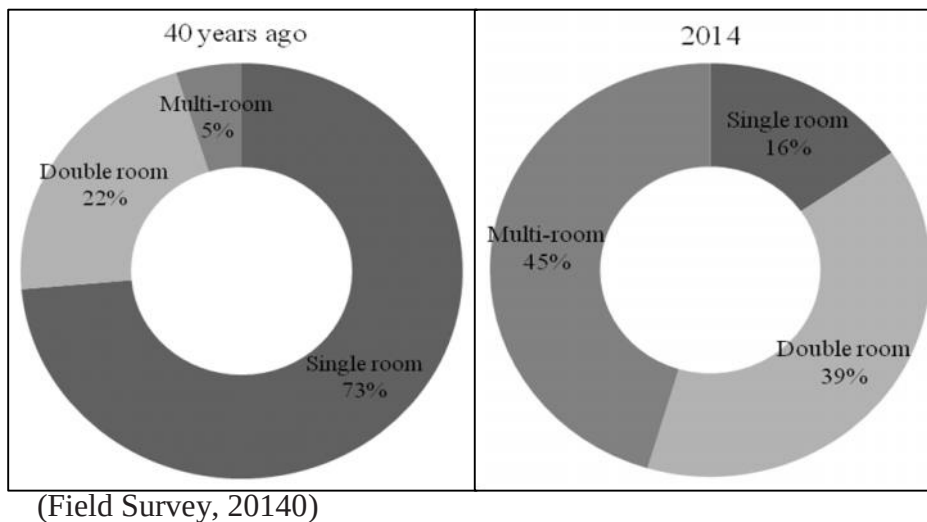
Another major change in the structure and construction design of houses is the introduction of additional facilities to the traditional layout which was usually consisted of a single room. Traditionally, in most parts of the northern mountains of Pakistan the houses used to be in the form of a single room, "...without any windows or ventilation, with animal sheds, hay stores, a byre and a storeroom attached to it on one end [including] all the facilities under the single roof, ranging from kitchen and sleeping area to wood storage and the storage of agricultural implements" (Fazlur-Rahman, 2007b: 211, 212). The single room house in the study area has played a set of functions and very interesting facts are associated with this traditional house as told by the elders in different villages. This single room was constructed in an elongated shape having a big space equal to three to six rooms of normal size. The door was usually made of one or two wooden planks joined together with wooden pegs without hinges and closing locks. During night, a big stone or a strong wooden rod was used from the inner side of the room to keep the door closed.

Just close to the door on either side, the first portion was used as fireplace for heating and cooking with a smoke chamber in the wall. The space of the room was shared by all the members of family as a sleeping place. One corner of the room was used for keeping livestock and some space was specified for storing hay and fodder. Moreover, separate guestrooms were rarely used and most of the people used to share the same single room with their guests. In other parts of this mountainous belt e.g. Chitral, the single room house was modified to a greater extent in quite early times and separate guestrooms, kitchens and animal sheds were constructed (Fazlur-Rahman, 2007b). However, in the study area, such houses were used until 1980s.

The data reveals that during the four decades traditional single room houses have decreased from 73% to 16% while, the number of two or more than two rooms houses has increased (Fig 3.5). Though there are still single room houses in the study area, nonetheless, these houses are not the traditional single room houses; instead such houses either belong to the extremely poor people

usually the herdsmen or smaller families of newly married and separated spouses. With the passage of time, the people used to build separate rooms in order to accommodate new structures for the young family members while the rest of the family sharing the main single room. More and more innovations were added to this traditional house from time to time. Separate bedrooms, guestrooms, animal sheds and kitchens became common after 1970; however, the tradition and importance of the main single room persisted until late 1990s.

Fig 3.5 House Structure by number of Rooms in the Study Area



The transformation of single room house into multi-room buildings was mainly because of population growth resulting into increase in household size accompanied by modernization and improved living standards. The capacity of the single room house was not enough to provide space for a large family. Moreover, the new sense of privacy motivated the inhabitants to give up this old practice of sharing the same roof for sleeping. The trend of sharing house with the guests was also abandoned as the number and relation of the visiting guests changed with increased social interactions. Therefore, most of the households build a separate guestroom, which is an important segment of house. Presently, majority of the households i.e. about 90% have separate guestrooms compared to 20% houses having guestrooms four decades ago (Fig 3.6). The guestrooms are not only used for the purpose of serving guests, but also used as bedrooms by the unmarried young males of the family who in the past used to sleep on the roofs and open spaces.

Another change is the abandonment of the common guesthouse or Village *Hujra*, which was an important element of Pakhtun culture, an institution of socialization and integrating force of traditional villages' societies. It has played a vital role in the Pukhtun code of life as it was not merely a place for men gathering but also a common guesthouse for the whole village, a focal point for community debates, opinions, planning and actions, and a sleeping place for unmarried males. Moreover, it was used for the matrimonial celebrations from where marriage procession was started as well as the bier was carried to the grave from here (cf. Sultan-i-Rome, 2007). *Hujra* was a communal property for the whole village's community and its construction and maintenance was a collective responsibility of all the village's inhabitants. The tradition of communal *hujra* is now rare and in few villages of the upper parts of Dir Valley.

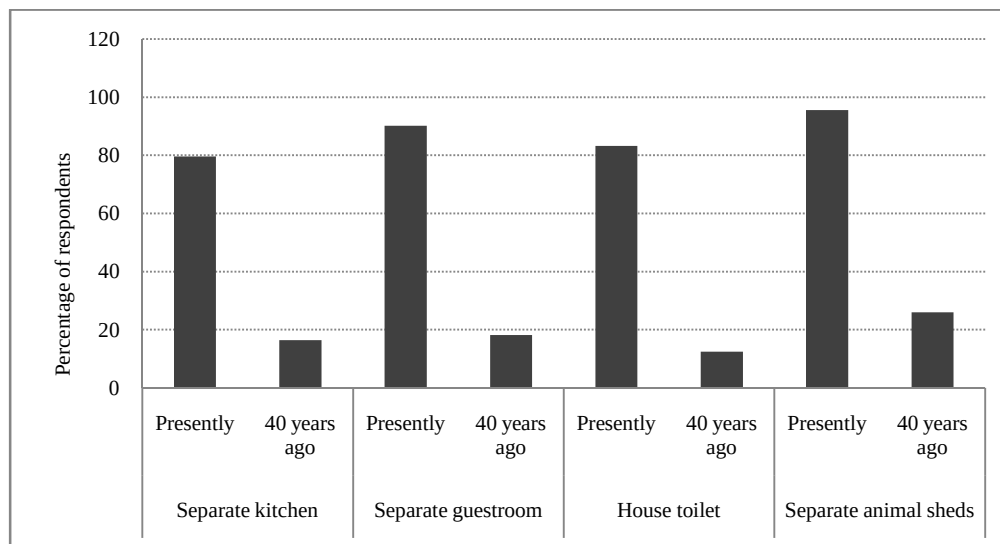
Additionally, the tradition of using open air toilets also decreased with the passage of time and expansion of built up areas. Close house toilet has now become the necessity and one of the basic requirements of a household due to a number of social and cultural factors. The proportion of households with attached toilets has increased from about 15% to more than 80% during the last four decades. The relatively small proportion of households having toilets forty years back, were those belonging to the royal class or the few prosperous families. The structure of the toilet of those times was also very different from the modern toilets of the present times. Those toilets were constructed in one corner of the lawn or outside the main area of the house using stones, mud and wood with a poorly structured door or curtain made out of the old clothes or bags of rice and flour.

The tradition of separate kitchens and animal sheds was also introduced in the late 1980s and became common in 1990s. As mentioned earlier, a portion of the single room house was used as fireplace in the past during winters, while a fuel wood stove in the corridor or veranda was used for cooking purposes in the summer months. The separate kitchens (18%) in the past belonged to the very few prosperous families, majority of which belonged to the Khall area being the most accessible semi-urban locality among the sample sites. Contrary to this, presently about 80% of the houses have separate kitchens in the form of separate room usually detached from the main building having all the basic facilities for cooking (Fig 3.6). At present the remaining 20% of the households, which do not have separate kitchens, use a portion of the corridor for cooking. Another important addition is the use iron stove for heating with a smoke outlet or chimney

erected up the roof through a hole and covered by an umbrella like tin or iron sheet preventing raindrops falling in it. The room with stove in house is used by parents, elderly members of family and kids, also shared by other members as a dining-room particularly for dinner when all the family gets together before going to sleep.

The trend of using a portion of the single room as animal shed and hay storeroom has completely abandoned. Separate animal quarters are constructed usually using mud, stones and wood – a strategy to protect animals from extreme temperature both in summer and winter – where the livestock are kept. Presently, almost all the households i.e. 98% have constructed separate sheds for animals, contrary to 22% four decades ago (Fig 3.6). The structure and accommodation capacity of animal sheds vary widely from village to village depending on livestock population. In Khall and the surrounding areas, each household usually keeps one or two cows for domestic dairy requirements in contrast to the upper areas such as Thal region, where more than a dozen of goats and sheep along with donkeys and bulls are also kept. Therefore, animal sheds in the upper areas are larger compared to those in the lower areas, which are usually in the form of a small single room. In areas with diversity in livestock composition, the animal sheds are composed of a number of rooms or big halls with corridors and shelters made of tree branches used for keeping animals in the summer nights.

Fig 3.6 Changes in House Facilities in the Study Area



(Field Survey, 20140)

Besides temporal changes, variations can also be observed from village to village in house facilities. In the lowermost village i.e. Khall, at present separate kitchens are available in 94% households compared to 25% four decades ago. Similarly, the number of households having separate guestrooms, house toilets, and animal quarters has considerably increased during the study period and presently almost all households have such facilities (Table 3.2). Contrary to this, in the northernmost village i.e. Thal, separate kitchens are available only in 64% households, guestrooms in 71%, house toilets in 60% and animal sheds in 84% of the surveyed households, though the proportion has increased significantly from 2%, 4%, 0% and 14% respectively in last four decades.

Table 3.2 Village-wise Variations in House Facilities in the Study Area

Study area	Separate kitchen		Separate guestroom		House toilet		Separate animal sheds	
	Presently	40 years ago	Presently	40 years ago	Presently	40 years ago	Presently	40 years ago
Khall	94	25	98	36	92	12	100	30
Balkore	75	17	91	7	86	10	100	24
Daskore	75	17	94	8	88	16	96	20
Jabar	90	21	97	36	90	24	98	42
Thal	64	2	71	4	60	0	84	14

(Field Survey, 20140)

3.3 Improvements in Accessibility: Development of Road Networks

The construction of roads in the mountainous areas in general as well as in the study area in particular is one of the important elements of change and development. In the past, due to inaccessibility the area was isolated and kept marginal from the development activities as well as socio-economic transformations occurring in the adjacent plain areas. However, the past few decades have witnessed considerable development in infrastructure and transportation networks which have linked these communities to the rest of the world. These developments have opened the way for several other changes and transformations in every sector of life (cf. Cook & Butz, 2011).

The major effect of accessibility development in the study area is the transformation of traditional economic setup by establishing easy access to markets and off-farm sources of income. At present, the inhabitants – sometimes wholly dependent on local food resources and

indigenous economic activities – now depend more on exogenous food supplies and are well connected to other luxuries of life similar to the plain areas. Extensive studies have been conducted on socio-economic impacts of roads and accessibility improvements in the northern mountains of Pakistan (cf. Grotzbach, 1984; Allan, 1985, 1986, 1989; Ispahani, 1989; Kreutzmann, 1991, 1993, 1998; Uhlig & Kreutzmann, 1995; Kamal & Nasir, 1998; Wood & Malik, 2006).

According to Fazlur-Rahman, (2007b: 193)

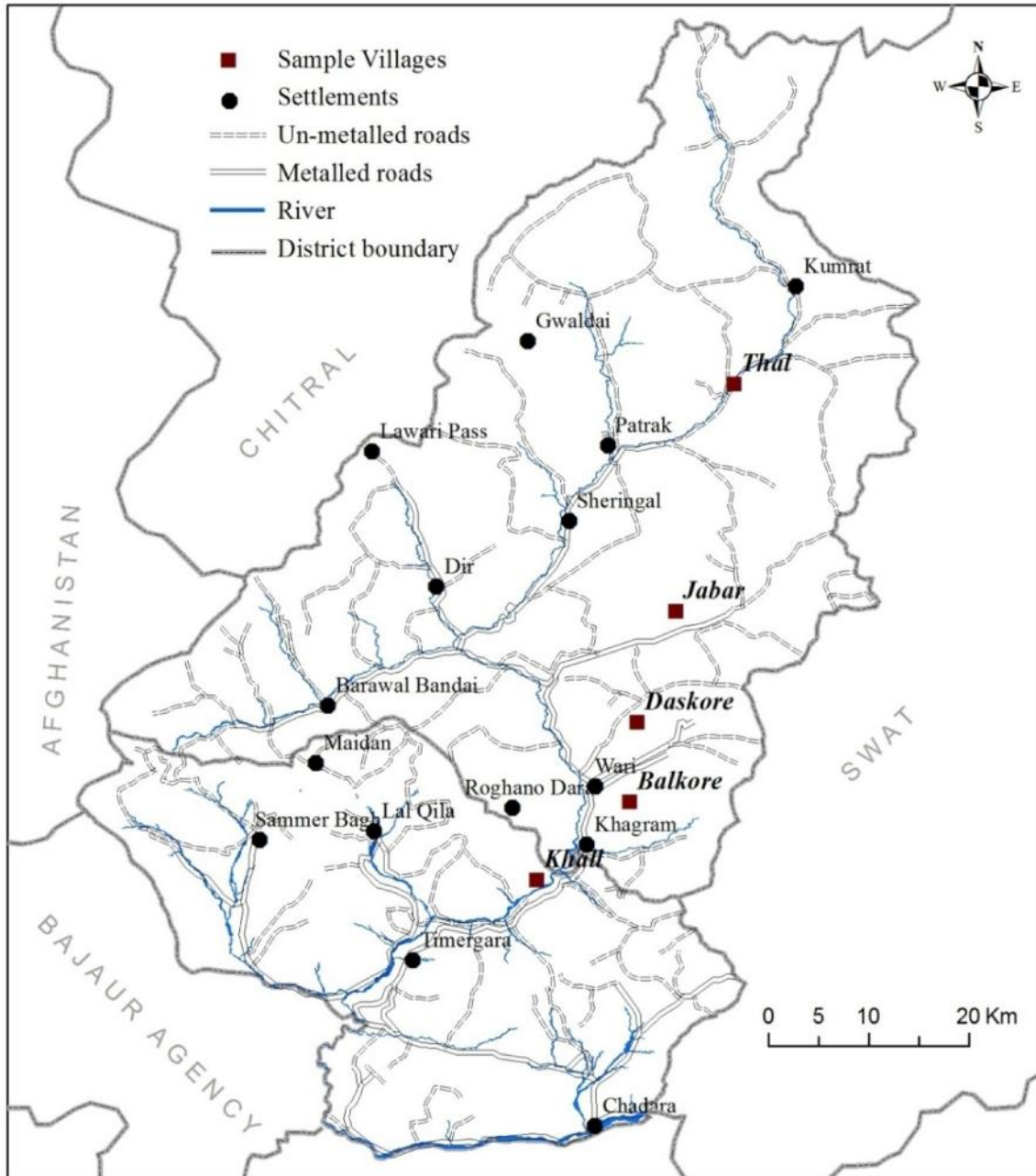
All-weather roads have opened up the so-called ‘closed’ and relatively remote mountain societies to the outside world and exposed them to the contemporary scenario [hence] the pace of changes in the northern mountainous belt of Pakistan, as in other parts of the world, has been rapid and relatively unprecedented in the history of the region.

The change in political status of the study area as discussed in chapter 2 had been the major determinant of accessibility and infrastructural developments. The Nawab of Dir deliberately kept the then State isolated through restricting the means of communication and transport inside the State jurisdiction as well as with the outside. It was a strategy for keeping the people dispersed not to unite against his ruthless rule and also to restrict the movement of British officials and other outsiders. As a result of the Nawab’s policies, the study area remained underdeveloped in terms of accessibility and transportation network. The highway running from Chakdara (the southernmost part of the study area) to the present day Dir city (the capital of the then state) was the only well-developed route before 1970. This route was strictly monitored by the Nawab’s officials and was mainly used for the movements of state’s vehicles. This route was also used by the British Officials once or twice a year moving to Chitral under an agreement between the state ruler and the British.

Besides its limited connectivity to outside and the surrounding areas the internal accessibility was also very poor. Most of the remote villages were connected with the markets and the main road through walking tracks, while donkeys were the only means of transporting goods. Contrary to the situation in the past, presently every village is well connected to the major transport routes and markets through road networks (Fig 3.7). According to the elders in the upper localities, the

roads connecting them to the main road were initially constructed through community efforts after 1970. Later on, the government agencies and various non-governmental organizations improved the roads and now a network of metalled and un-metalled roads can be found throughout the study area.

Fig 3.7 Study Area: Roads Network



(Survey of Pakistan, 2005)

This high degree of accessibility has brought about both positive and negative impacts on the socio-economic and biophysical setup. The important positive effect of improved accessibility is the betterment in material circumstances the inhabitants by increasing [cash income] monetary wealth (cf. Cook & Butz, 2011). This generalization is more applicable in the uppermost and highly remote villages of the study area i.e. Thal, where the mixed mountain agriculture is still the main pillar of household economy and food security. Prior to the construction of roads, the inhabitants of this area were isolated from the nearby localities and their livelihood was associated with indigenous agricultural products. As a result of accessibility to trade centers, agriculture system shifted from subsistence type to commercial form. The farmers started producing high yielding genetic varieties of potato seeds, using chemical fertilizers, pesticides and short ripening crops for the cold areas. On the one hand, it became easy to transport agricultural products to the market while on the other it supplements some exogenous foods to the subsistence livelihood.

Nevertheless, besides bringing these advantages, construction of roads and improved accessibility also caused a number of negative impacts both on the socio-economic and biophysical setup. The local inhabitants reported two important negative changes resulted from improved accessibility besides a number of indirect impacts. One important negative change is the exposure of forest resources to overexploitation both for local consumption and sale. The other negative aspect noticed by local inhabitants is regarding threats to social norms and cultural values as a result of economic independence and adaptation of mix cultures with more urban oriented life styles. Cook & Butz, (2011) have narrated such interesting perceptions of the inhabitants in their study on Shimshal Road Northern Pakistan. A few of their narrations are quoted here which describe the same perceptions as found out in the focused group discussions in the present study.

When the road links the village it will bring with it prosperity, opportunities, and earning sources [...] but it will bring prosperity at the cost of disunity and destruction of moral values. It will facilitate multiple sources of income and then people will not care for each other. [...] The road will provide several facilities, and then people from different backgrounds will come to the village and possibly destroy our peacefulness.

Due to our close kinship our joys of life and sorrows of death were all in the one place. But there has been a decline in sympathy [...] for the reason that more and uneven earning makes people independent. [...] When the road link is made, then the sympathy will vanish because people will become self sufficient...The road will bring prosperity and self-reliance and will end our dependency on one another (Cook and Butz 2011: 30, 31).

3.4 Agricultural Transformations

Similar to other mountainous regions of northern Pakistan, agriculture and animal husbandry have played a key role in the subsistence economy and food security of inhabitants of the study area. Historically, majority of the inhabitants were dependent to a high degree on agricultural land for their survival. The recent changes in various elements of socio-economic setup have affected agriculture in a number of ways and it has become an activity of secondary importance. However, still there are a number of households which depend fully or partially on agriculture for their livelihood. Agriculture sector has undergone several changes in terms of land use, productivity, inputs, output, labor, cropping patterns, irrigation, size and availability of landholdings and farming methods etc.

The increasing demands of population have necessitated innovations and the land is utilized more intensively by introducing modern seeds and fertilizers, more labor, mechanization and cultivating more than one crop per annum. The introduction of modern inputs and innovations in agriculture can also be observed in the surrounding mountainous areas as according to Fazlur-Rahman, (2007b: 196) “many modern innovations have been grafted onto the traditional agricultural system, such as new seed varieties and chemical fertilizers”. Although due to certain constraints, agriculture cannot be fully mechanized; however, mechanization has partially replaced the old sowing and threshing methods. Nevertheless, the traditional bull tilling is still very important and in several areas tractor tilling is not possible due to inaccessibility, thin soil layer and steep slopes of the terrace fields. Tractor is rarely used for ploughing purposes in the upper parts of study area while threshing is predominantly carried out using threshers.

Until recent past, threshing was also done with the help of bulls and donkeys. A piece of land¹⁴ was properly leveled and pressed, and a wooden pivot was fixed in the middle for the rotating bulls. The harvested crops were dried and spread over the ground. The bulls were tied parallel with one another through a rope and with the pivot. The bulls were then kept rotating till the crops were threshed. This tradition was locally known as *ghobal*, and was one of the important reciprocal activities for which both the bulls and the manpower were contributed by all the village dwellers. This method of threshing was a common practice till the late 1990s, which is now completely abandoned and replaced by threshing machines throughout the study area. The grains were separated from the residue and cleaned using traditional methods and the dried grains were grinded through local watermills or a hand-mill within the house locally known as *sarkha*. The tradition of watermills is also losing its importance and found only in the remote areas and the villages where sufficient water is available.

3.4.1 Change in Agricultural Landholdings

Availability of suitable land for agriculture is limited in the study area due to rough topographic characteristics. The available land is mostly in the form of terraced fields. The low lying areas and valley bottoms are comparatively plain and narrow long tracks of cultivable land can be found here. Agricultural lands are extensively fragmented throughout the study area resulting into very small landholdings. The trend of fragmentation of arable land is not only confined to the study area, but can also be observed in the other neighboring mountainous regions of northern Pakistan, mainly driven by inheritance, increasing number of household and decline in household size (Fazlur-Rahman, 2007b: 198). Fragmentation of land from generation to generation has not only affected the arable land ownership of the individuals but also resulted into uneconomical field size.

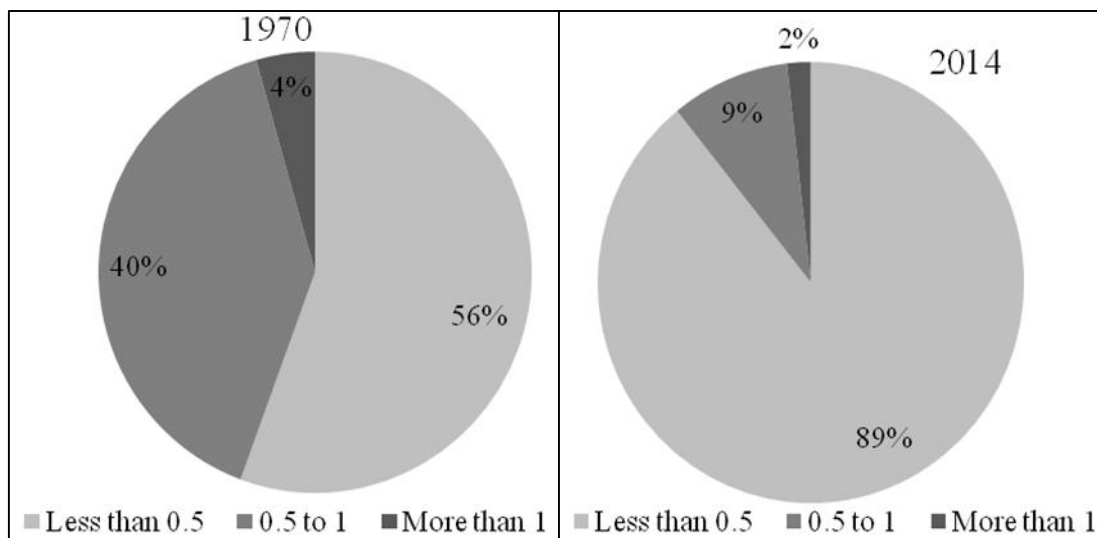
The data reveals that agricultural landholdings have considerably decreased during the study period. It can be seen that the proportion of households with less than 0.5 acres landholding has increased from 56% in 1970 to 89% in 2014 while landholding of more than 1 acre has decreased from 4% to 2% and that of 0.5 to 1 acre has decreased from 40% to 9% since 1970

¹⁴ Usually a flat and wide field or any other open surface in the village area was used for the purpose of threshing. Such land is locally known as *dramand*.

(Fig 3.8). Due to the limited availability of suitable land for agriculture, there are very few households having more than 1 acre arable land.

There is a positive correlation between the size of agricultural landholdings per household and increase in the number of nuclear families (resulted from the subdivision of joint and extended families). The logic is, as the land owned by a single household in the past is now divided into as many parts as the number of new families came into being as a result of subdivision. As a result the shares of individual households become smaller and smaller after every successive subdivision. In the same way, the field which was owned by the single household is divided into small plots according to the number of newly established families and as a result the size decreases drastically. Additionally, as an indirect impact, the extension of built up areas due to increasing number of households engulfed the arable land, which further declined the landholding.

Fig 3.8 Proportion of Agricultural Landholdings per Households in the Study Area



(Field Survey, 20140)

The inheritance practice and transferring of ownership rights to the next generation has slight local variations from village to village but the overall system is the same throughout the study area. Similar to other communities in mountainous areas of Pakistan (cf. Rahman et al., 2014), land under the ownership of a person is subdivided among his sons while usually the daughters are not considered as inheritors and are not given ownership rights in the property held by their

parents. The sons are considered as *real inheritors* to whom the ownership rights are automatically transferred from the parents. However, there are several families without any *real inheritors* and in such cases the land owned by a person is claimed by other potential inheritors¹⁵ – usually the cousins – who divide the land usually after the death of owner. This tradition of dividing the land of a person among the potential inheritors is known as *miras*¹⁶ and is one of the important elements of Muslim Law and Jurisprudence. In such cases the land is not equally divided among the inheritors as also stated by Fazlur-Rahman, (2007b). The shares of the inheritors are specified according to the predefined standard and rules in the Muslim Jurisprudence.

The real inheritors share equal rights in the land of their father and in such cases the land is equally subdivided among the sons. The equity in rights of the real inheritors is common throughout the study area, however, somewhat different from the neighboring valley of Chitral where “...the land division among the real inheritors (brothers) itself is only rough, without proper measurements” (Fazlur-Rahman, 2007b: 199). Usually, the land is subdivided among the sons after the death of the head (father); however, in case of the disintegration of joint families, the land is also divided even if the father is alive. In both the cases, i.e. whether the land owner has sons or not, the females are not given ownership rights in the land. One can see several such cases in which a man has a number of daughters but no son to inherit his property. In such cases; upon the death of the person, his land is divided among the potential inheritors while the daughters are deprived, although they are considered eligible for ownership rights in the land left by their parents, by the Muslim Jurisprudence. However, historically, as a tradition of these societies the daughters are neglected and their land is unlawfully divided among the potential inheritors.

During field visits, the researcher conducted interviews with several aged ladies wherever the customs allowed. A lady in a village in Khall expressed her views as, “my father had the largest share in the arable land of our village as well as a number of other villages and was considered as the richest landlord. However, we – the two sisters – were having no brothers and therefore, when our father was near to death his potential inheritors i.e. our cousins divided all his property

¹⁵ Potential inheritors refer to the kin relatives (cousins, nephew etc.) other than the real inheritors i.e. sons.

¹⁶ The term *miras* also refers to the land and property left behind after the death of a person without real inheritors i.e. sons. Such a person is called *mirat* which literally means a man with no inheritor.

including his house and put us out of our home along with our sick father. We were not given a single room or field in our father's property as all belonged to him was taken away by his nephew and after his death we got settled with the families where we got married. However, we being the daughters of the richest landlord became the poorest members of the community in a hand to mouth conditions having no roof on our heads and all this happened in no time as soon our father died".

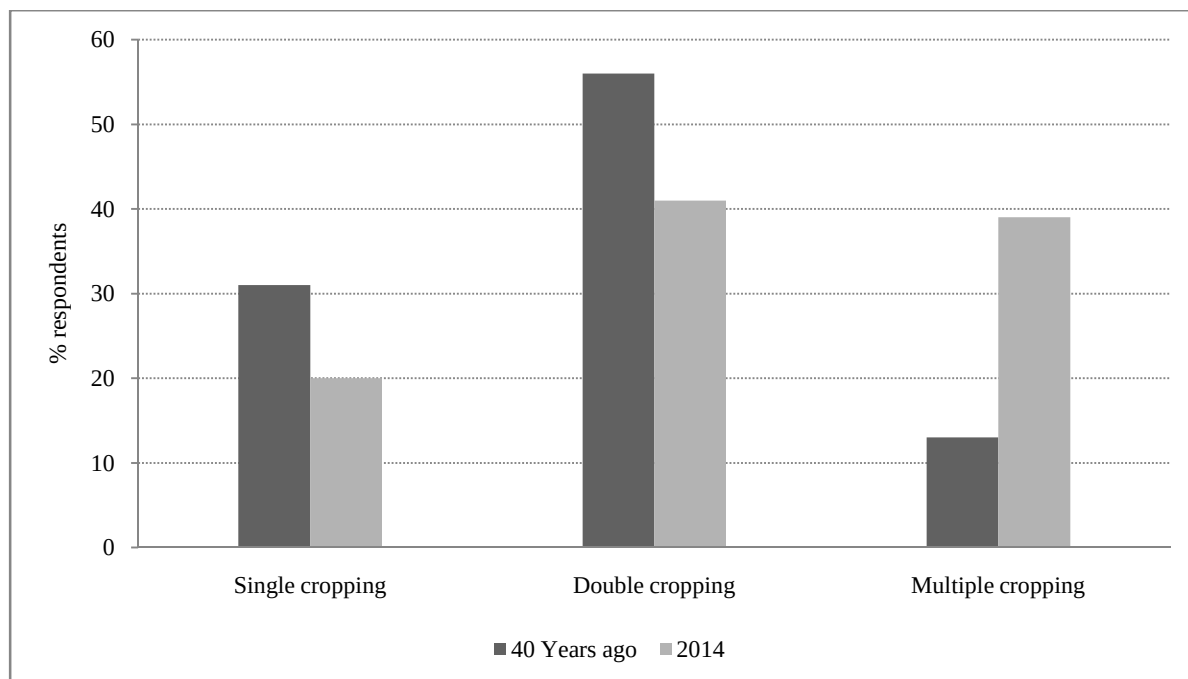
However, presently in the last few years there has been an increasing awareness among the people regarding this unlawful tradition and several families are giving ownership rights to their sisters/daughters. Also awareness has been observed among the deprived ladies for claiming land and property owned by their ancestors. Particularly, in the lower parts of the valley where the courts are easy to access and the women are comparatively more independent as compared to upper parts, a number of petitions have been filed in the court of justice against the occupants. Several such cases have been decided according to the law in favor of the deprived women. Moreover, it was also found out that in a number of villages, women have claimed for the rights in the land owned by their real brothers. Hence, slowly and gradually, the women are getting ownership rights in the land according the rules defined by the Muslims' Sharia.

3.4.2 Changes in Cropping Pattern

Change in cropping pattern and crop rotation is an important strategy to get more production from the arable land and cope with the increasing needs for food and fodder. The areas where one crop per annum was grown in the past are cultivated twice a year and more crops are harvested. The climatic conditions of the lower and middle altitudes favor different crops. As a result these areas enjoy two distinct cropping seasons i.e. *Rabi* and *Khariif*. The data reveals that four decades ago 31% of the respondents were practicing single crop per annum, while 56% people used to harvest two crops and 13% of the respondents are growing more than two crops per year. Presently, 39% of the respondents are growing multiple crops. The proportion of households in the single and double cropping has decreased to 20% and 41% respectively in the past four decades (Fig 3.9). Hence it can be concluded from these statistics that 80% of the respondents use to harvest two or more crops per annum while single cropping is practiced only by 20% of the respondents.

There are several factors behind this change from single cropping to double and multiple cropping. Here also the central role is played by population dynamics accompanied by economic development, technological advancement, availability of labor and capital, household dynamics, accessibility and landholdings. There was a small population and limited demand for food and other products. Therefore, the people used to cultivate the fields in the close proximity of the built up areas and harvest one or two crops per annum depending upon the climatic conditions, crop suitability and household demands. Additionally, per capita landholdings in agricultural land were relatively larger due to the smaller number of households and land owners. The cultivable lands in the surroundings of the villages were difficult to be brought under plough due to the limited availability of labor. Multiple cropping was practiced only in the fertile irrigated fields along the streams and torrents. Besides this, lack of technology, poor accessibility and insufficient capital were the other factors responsible for less intensive cultivation. The inhabitants could not afford to use improved seed varieties and harvest more than one crop in the cold areas. Moreover, the economic constraints didn't allow the people to invest more capital in agriculture and use costly farming methods and inputs.

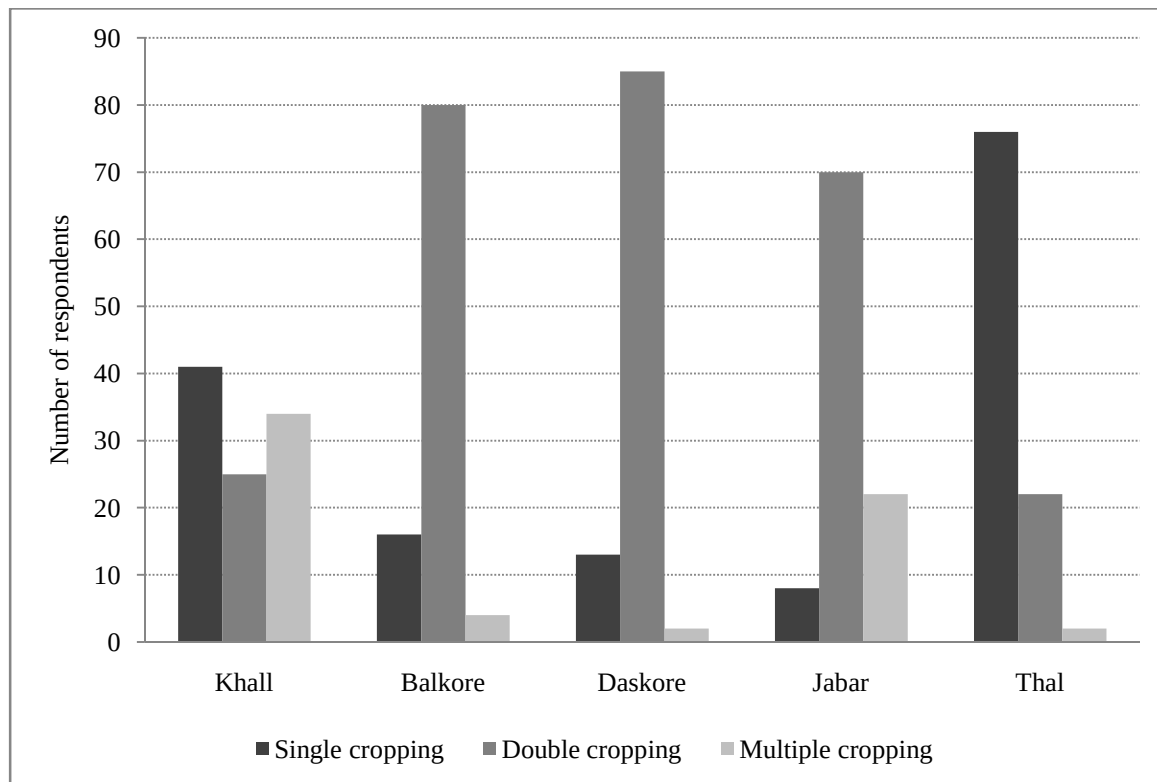
Fig 3.9 Changes in Cropping Pattern in the Study Area in the Past Four Decades



(Field Survey, 2014)

The village-wise data reveals variations in cropping patterns among the sample villages both in present and the past. Khall and the surrounding villages are located at lower elevations; have an easy access to road and market. Most of the cultivated fields are along the streams and the climatic conditions are favorable as compared to the uppermost sample villages i.e. Thal. Therefore, it can be seen that in the past nearly equal number of the households were sowing single, double and multiple crops. About 80% of the households in Thal were growing single crop in the past attributed to relatively less population, remoteness, short growing season or frost free days, marginality from economic growth and other developments and harsh climatic conditions. The rest of three villages i.e. Balkore, Daskore and Jabar are located in the intermediate altitudinal zone and double cropping system was dominated in all of these localities in the past with relatively large proportion of multiple cropping in Jabar (Fig 3.10).

Fig 3.10 Villages-wise Cropping Pattern in the Study Area 40 Years Ago

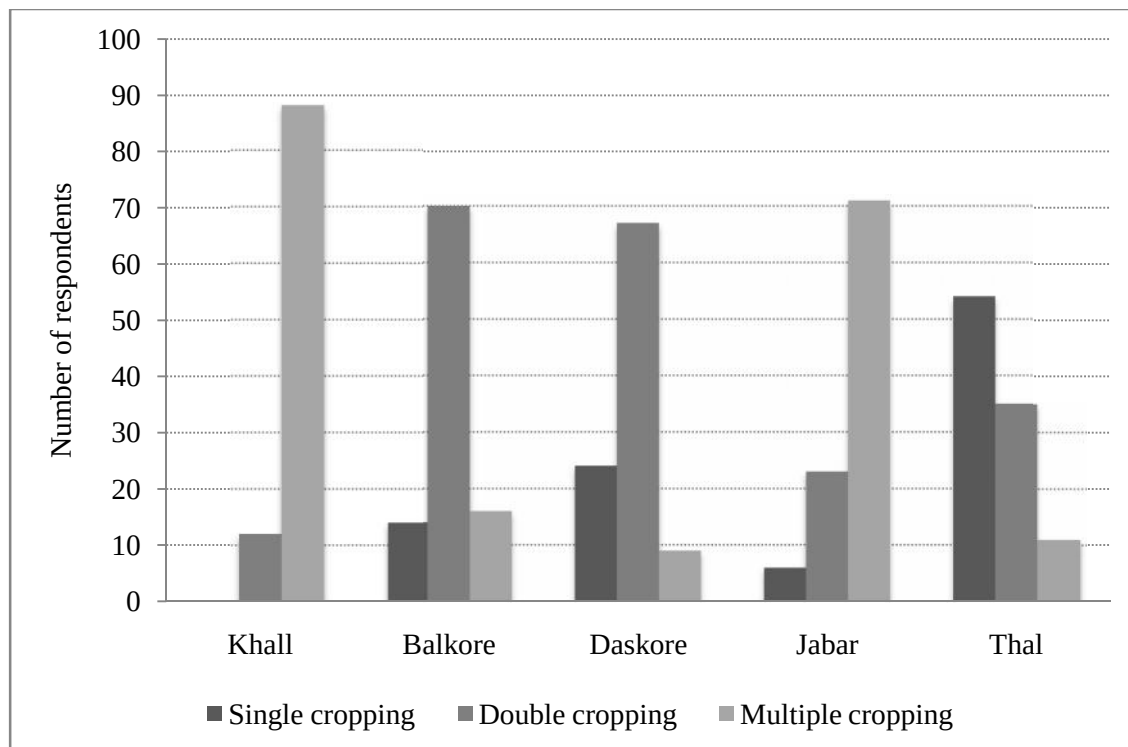


(Field survey, 2014)

In contrast, presently the cropping pattern has completely changed in Khall and about 90% of the surveyed population is harvesting several crops per annum. The rapid technological advances in

agriculture and easy availability of seeds and fertilizers has resulted into complete abandonment of single cropping system while only a small portion of respondents grows single crop in each cropping season i.e. *Rabi* and *Kharif*. Economic development has also played an important role in this change as the people now can invest capital and use costly inputs. Hence, we can see an increase of more than three times in the proportion of households with multiple cropping in Jabar and a slight increase in the rest of the sampled localities (Fig 3.11). The cold climatic conditions of Thal do not support winter (*Rabi*) crops; however, with technological development and more money, the inhabitants can afford short-ripening genetic seeds and harvest more than one crop in these cold areas.

Fig 3.11 Villages-wise Cropping Pattern in the Study Area, 2014



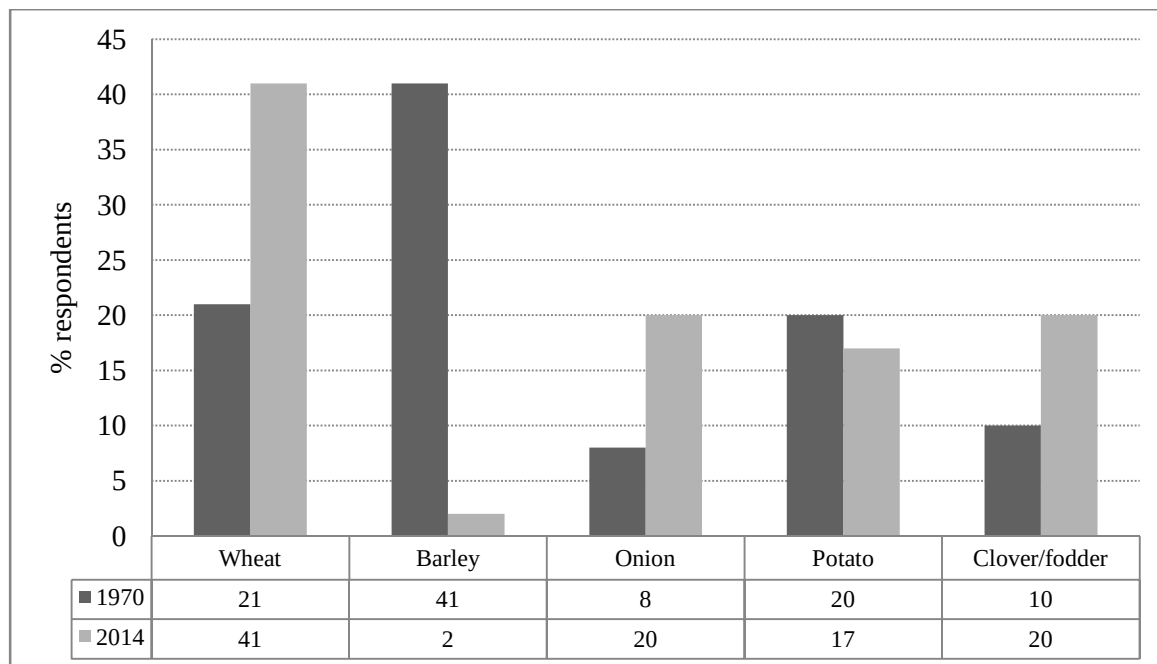
(Field survey, 2014)

Another major change has taken place in the variety of crops grown during the year. The collected data reveal a considerable change in the choice and cultivation of crops compared to those of 1970s. Particularly, the crops grown during the *rabi* season in the past are partially

replaced and other crops are given more importance. Barley was the dominant crop in the past grown by 41% respondents followed by 21% wheat, potato, red clover and onion. The staple diet was barley and therefore, it was the most commonly grown crop in past (Fig 3.12). Other factors for high proportion of barley crop was its drought resistant nature and high yield returns with less efforts and investments. Moreover, a barley crop can be grown in the poorly prepared and less favorable agricultural land on the hillslopes around the villages having infertile soils.

Wheat was the other major cereal crop of *rabi* season cultivated in fertile lowlands along the streams. Unlike barley, wheat needs more attention, well prepared lands and sufficient water for irrigation. Although, most of fodder requirements for livestock were fulfilled from rangelands and forests, yet 10% of the surveyed population was growing red clover as fodder crop during *rabi* season. Fodder crop was mainly grown in Khall and other lower altitude villages where irrigation facilities were available for growing red clover. Onion and potato were the main cash crops and a small number of the surveyed households used to cultivate these crops (Fig 3.12). Potato was mainly grown in Thal and Jabar while onion was cultivated on small scale in almost all sampled villages wherever suitable lands and irrigation facilities were available.

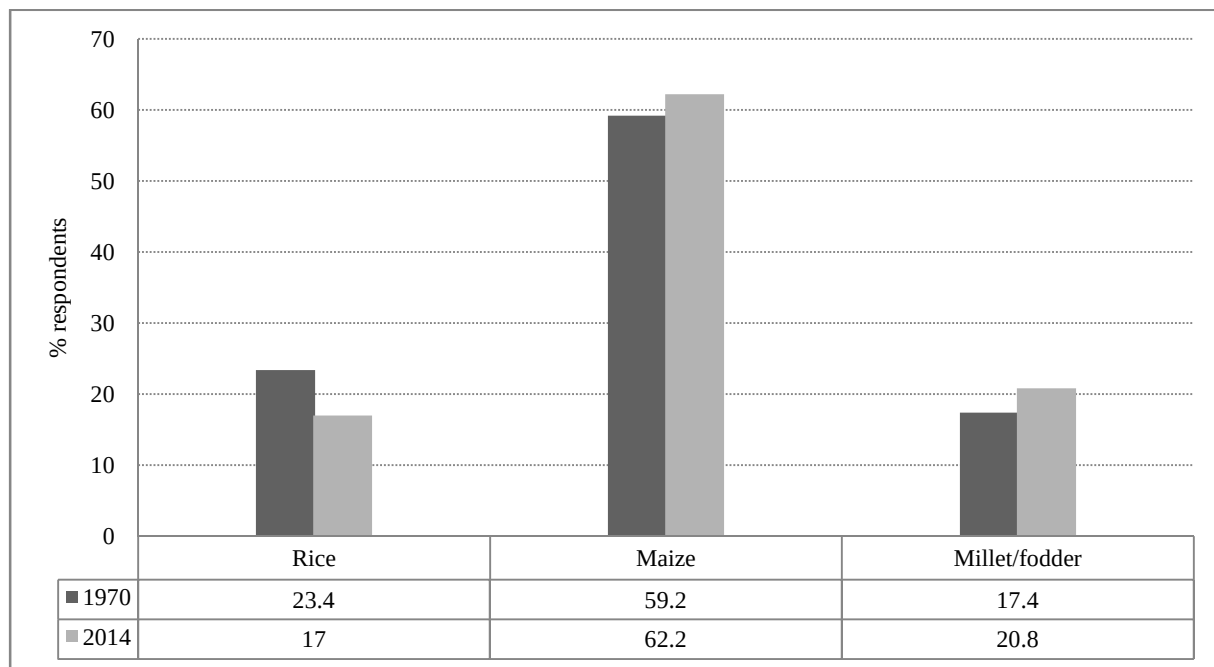
Fig 3.12 Change in the Choice of Major *Rabi* Crops in the Study Area



(Field survey, 2014)

Contrary to the *rabi* crops, slight change has taken place in the types of crops grown in *Kharif* season. Maize was and still is the major *Kharif* crop cultivated in most parts of the study area. The area under maize crop has slightly increased in the past four decades on the cost of decrease in the cultivation of rice (Fig 3.13). Although maize is cultivated in both rain-fed and irrigated lands; however, in rain-fed areas it is grown for fodder purposes. In years of heavy precipitation, its yield is considerable, while in dry conditions it produces fodder only. Moreover, it does not reach to maturity in high altitude areas of Thal and harvested as green fodder before ripening. Rice was and still is predominantly grown in the flood plains of River Panjkora. Nevertheless, in the past, according to the elders, rice was also grown along the streams of Balkore, Daskore and Jabar. Presently, it cannot be cultivated in these areas due to scarcity of irrigation water except few narrow tracks in Jabar, which are irrigated by an irrigation channel taken off from Ushiri Stream.

Fig 3.13 Change in the Choice of Major *Kharif* Crops in the Study Area



(Field survey, 2014)

3.4.3 Modernization of Agriculture: Changes in Inputs

“Modernization consists largely of using improved seeds, modern farm machinery such as tractors, harvesters, threshers, etc., chemical fertilizers and pesticides in an optimal combination with water” (Dholakia & Dholakia, 2009: 1). With population growth and increasing demands for food, agricultural activities shifted from traditional to modern and improved methods in order to get maximum outputs. Data regarding changes in agricultural inputs reveals substantial increase in the use of improved seed varieties. Four decades ago, there was a negligible proportion of the surveyed households using improved seeds, while now about two-third of the respondents are sowing high yielding seed varieties (Table 3.3). The traditional seed of wheat, rice, potato and vegetables have almost disappeared and replaced by high yielding varieties. Wheat in particular, is regularly changed every year and new varieties are introduced. Potato is the major crop grown extensively and exclusively in Thal area and is the main source of income of the inhabitants. The improved costly seed varieties of potato have completely replaced the traditional ones and according to the farmers, the yield has increased manifold.

Table 3.3 Changes in Agricultural Inputs by number of Respondents in the Study Area

Study area	Traditional Manure only		Manure and fertilizers		Improved seeds	
	1970	2014	1970	2014	1970	2014
Khall	54	7	46	93	12	78
Balkore	81	42	19	58	0	49
Daskore	94	64	6	36	0	55
Jabar	31	24	69	76	4	83
Thal	96	43	4	57	2	68
Percentage	71.2	36	28.8	64	3.6	66.6

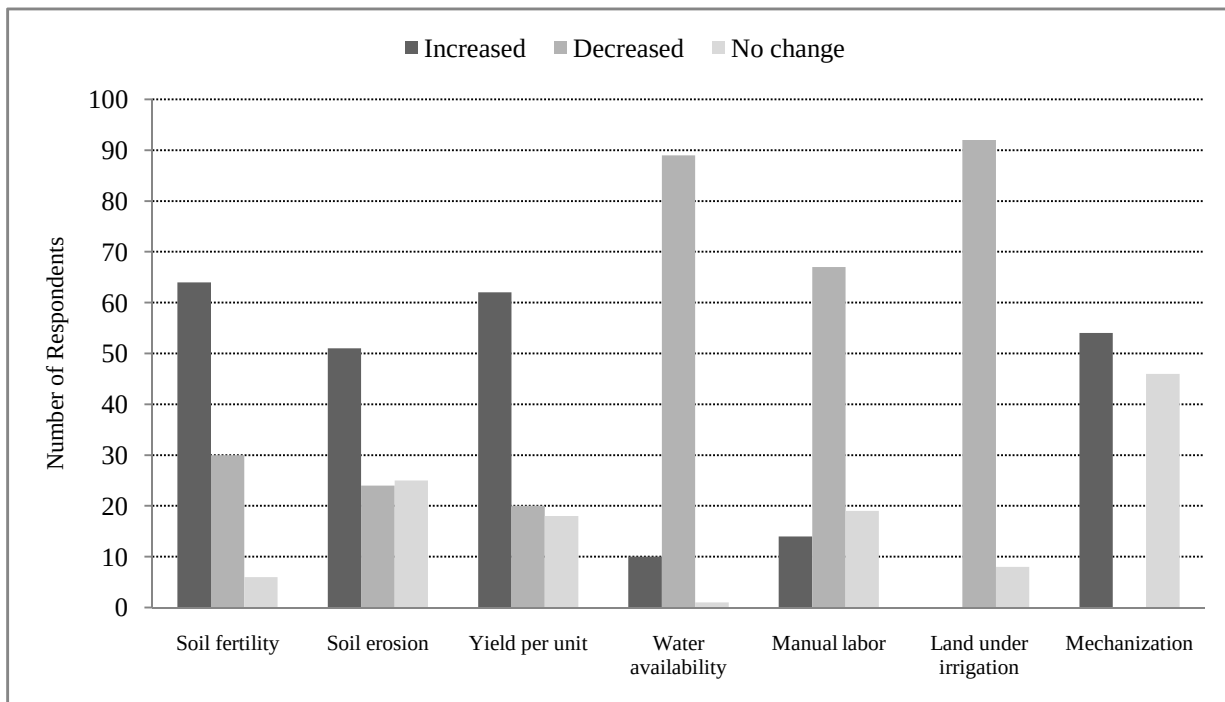
(Field survey, 2014)

Perceptions of people were also observed regarding changes in soil fertility, soil erosion, yield, availability of irrigation water, manual labor and mechanization, and irrigated agricultural lands. Majority of the respondents, i.e. 64% have noticed a positive change in land quality and according to them, soil fertility has increased during the last four decades. This increase in fertility as stated by the local people is due to the introduction of chemical fertilizers and investments in land maintenance. The other 30% respondents who oppose this idea are of the

view that soil fertility has decreased due to intensive and multiple cropping. The lands remain under cultivation round the year due to which the nutrient contents of soils has reduced.

About half of the respondents have also perceived that the problem of soil erosion has increased in the past few decades. Moreover, 92% of the respondents were of the view that land under irrigation has decreased and about the same proportion of the surveyed households reported a decrease in availability of irrigation water. Contrary to this, 10% of the respondents pointed out that irrigation water has increased. However, the increase was mainly reported by the inhabitants, of Khall and Jabar, where irrigation channels have been taken off from the streams during the last two to three decades and un-irrigated areas have been brought under irrigation. In spite of these negative changes, 62% of the respondents have recorded an increase in yield (Fig 3.14). This increase is mainly attributed to the introduction of advance inputs, capital and improved farming methods. Chemical fertilizers and improved seeds particularly have played a key role in increasing yields of different crops.

Fig 3.14 Perceptions of People about Changes in Agriculture



(Field survey, 2014)

3.5 Changes in Animal Husbandry

Livestock keeping is an integral part of the mixed farming system practiced exclusively in the study area as well as most parts of the northern mountainous belt of Pakistan (cf. Tulachan, 2000; Fazlur-Rahman, 2005, 2007b, 2009; Ehlers & Kreutzmann, 2000; Wright & Duncan, 2005; Haq, 2012; Rahman et al., 2014). Livestock keeping is integrated in the farming system and they both are interdependent on each other. Farmlands normally depend on livestock manure for enhancing soil fertility and draught power for tilling while in return the animals depend on cultivated lands for fodder. Animals are kept in the permanent villages during winter and stall fed with stored hay or driven to the nearby rangelands in order to cope with fodder shortages. As soon as the high pastures are free from snow in the beginning of summer, animals are moved there and grazed until the winter arrives. Contrary to this, animals are kept and stall-fed round the year in the low altitude villages. The hillsides with scrub covers are used as grazing grounds and the animals are steered there on daily basis for grazing.

Similar to the other elements of socio-economic setup, the system of animal husbandry is also quite dynamic in nature and continuously keeps changing from time to time (cf. Kreutzmann, 2000). Several changes have taken place in animal husbandry such as livestock population, herd composition, processing of animals' products and dairy, grazing arrangements and feeding methods etc. The intensity of changes and the driving forces vary widely from village to village depending on the local social and physical conditions. Nevertheless, the major factors behind these changes are common, which include infrastructure development and improved accessibility, transformation of economy, household dynamics and population growth.

3.5.1 Commercialization in Animal Husbandry

One of the most important changes in animal husbandry is the marketing of livestock products and generating income from this sector. Historically, most of the byproducts from livestock such as meat and milk used to be consumed in the households; however, partial commercialization can be seen in this sector in various parts of the study area. The commercialization of animals' by products is determined by certain other external factors such as accessibility to market (Tulachan, 2000). Until late 1980s, most of the households inhabiting the high altitude villages of

the study area were isolated from each other as well as there were no transport links to the main road (See section 3.4). Therefore, marketing of livestock byproducts particularly milk and meat was a task next to impossible. The major livestock products exchanged during that time were the wool. The livestock owners used to exchange these products with the village merchants for various items. Salt was the main exchange item in return for livestock products which was transported from the plains of Peshawar Vale and Dargai areas down from the Malakand hills¹⁷. Eggs were the other major exchange items during those times usually in the small village shops. Moreover, egg collectors used to go door to door and collect eggs in return for money and then sold it in the markets.

Nevertheless, marketing of dairy products has now become an easy job with the development of transportation networks. The surplus dairy products are directly sold by the livestock owners to the nearby markets. Although, presently it is hard to find farmers wholly dependent on livestock products; however, it is still an important ingredient of livelihood sustenance (cf. Fazlur-Rahman, 2009). In almost every village of the study area, several livestock owners produce surplus dairy items, which are either sold locally to the needful households or brought to the markets. Fresh milk is mainly consumed in black tea as in most parts of the mountainous areas of Pakistan (cf. Fazlur-Rahman, 2007b; Herbers, 1998, 2000a; Kreutzmann, 2000; Stober, 2001), as well as there are a number of other products and delicious dishes prepared from milk processing.

Besides, consuming and selling fresh milk, butter is another important and highly valued milk product which is exclusively consumed in the study area as in other mountainous localities of Pakistan (cf. Herbers, 2000a, 2000b; Fazlur-Rahman, 2009). Butter is served on special occasions such as ceremonial dishes, to the labor participated in a reciprocal activity and to the special guests. Moreover, due to its limited production, butter has a high market value and in its pure form it is hardly available in the market. As it is considered a healthy diet, it is one of the commonly consumable food items on village level and the households who cannot produce it must purchase it. Therefore, a major quantity of butter produced in the village is consumed and sold locally.

¹⁷ The local merchants used donkeys for transporting salt both in the form of powder for household uses and rocks for animals. The wool and hair exchanged for salt was then transported by the merchants to the markets and converted to cash.

3.5.2 Changes in Herd Size and Composition

Almost every household keeps a few livestock heads in the study area similar to most parts of the northern mountainous belt of Pakistan (cf. Fazlur-Rahman, 2009; Rahman et al., 2014; Ehlers, 1997; Ehlers & Kreutzmann, 2000; Herbers, 1998, 2000a; Stober, 2001). The size and composition of herd vary widely from village to village as well as from household to household. Factors for these variations include; household's capacity for winter-feeding, general pasture characteristics, the economic utility of the animals, and availability of sufficient labor force in the family (cf. Kreutzmann, 2000; Schmidt, 2000a,b, 2004; Sharma & Jodha, 1992; Fazlur-Rahman, 2007b). Altitude is one of the major physical factors playing an important role in diversification of livestock. The lower altitude villages with limited availability of grazing lands/pastures and having access to other off-farm income generating opportunities are less likely to favor huge herd size. In contrast, the villages located in middle and higher altitudes keep rich diversity of animals due to the availability of alpine pastures and rangelands.

It was found out that five major species constitute the livestock population in the study area including cows, bulls, goats, sheep and donkeys. Besides these species, there are very few households in the study area where buffalos and horses are also kept; however, their number is insignificant. Village-wise variations can be observed in the composition of herd as the total number of cows is 117 in the 100 surveyed households of Khall compared to the 386 in the same number of households in Thal. Similarly, the total number of goats and sheep in Khall is 85 heads compared to 141 in Balkore and 421 in Thal and the same variations can be seen in different species among the five sample sites of the study area (Table 3.3).

The total number of cows in the study area has increased from 796 to 903 in the total 500 surveyed households, which means that the average number of cows per household has increased from 1.6 to 1.8 (Table 3.3). This increase in the number of cows may be attributed to the increasing demands for dairy products. Contrary to this, the number of other livestock species has decreased with drastic decline in the number of goats and sheep from 2697 to 945 in the past four decades. The trend of declining goats and sheep number is also observed by Tulachan & Neupane, (1999: 20) according to which, "...the most noticeable change in the mountains is the considerable decline in the population of sheep in total herd composition". The main factors behind this decrease according to the local inhabitants are low dairy and economic benefits of

goats and sheep and the increasing awareness of communities for the conservation of grazing grounds and common property resources. Goats and sheep are considered harmful and responsible for the degradation of rangelands and pastures, and they also damage the standing crops and plants in cultivated areas.

Table 3.3 Changes in Herd Size and Composition during the Past Four Decades

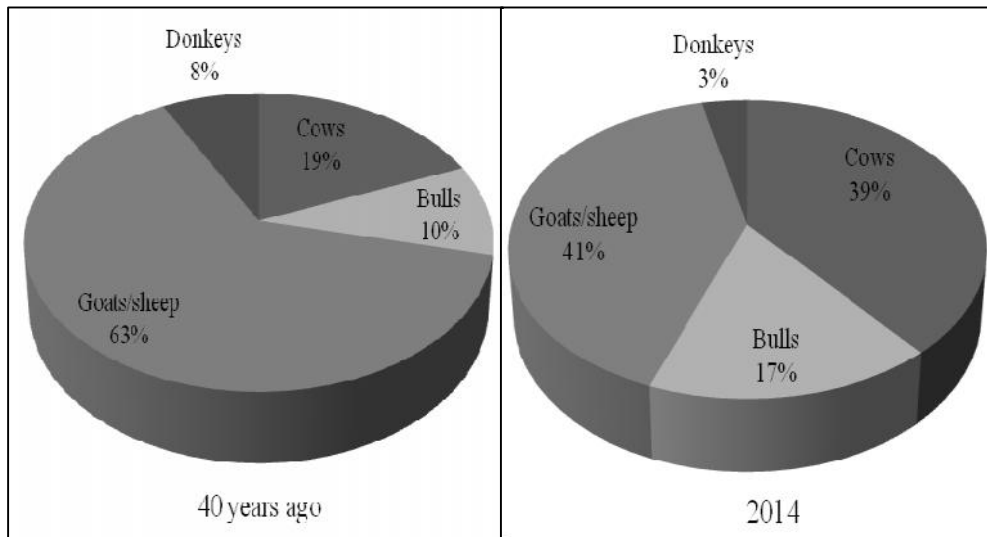
Study area	Cows		Bulls		Goats/sheep		Donkeys	
	Presently	40 years ago	Presently	40 years ago	Presently	40 years ago	Presently	40 years ago
Khall	117	124	64	114	85	360	6	42
Balkore	145	198	124	56	141	457	17	84
Daskore	123	142	75	41	178	545	10	67
Jabar	132	120	58	122	120	465	5	40
Thal	386	212	68	84	421	870	45	94
Total	903	796	389	417	945	2697	83	327
Household Average	1.8	1.6	0.7	0.8	1.9	5.4	0.2	0.7

(Field survey, 2014)

The overall herd composition was dominated by goats and sheep contributing 63% of the total livestock four decades ago followed by 19% cows, 10% bulls and 8% donkeys (Fig 3.15). Donkeys were mainly used for transportation purposes as there were limited means of transport, while the work of bulls was also partially done through donkeys. Keeping bulls was economically less cost-beneficial as compared to donkeys and contributed both in tilling as well as threshing besides transportation. The number of donkeys has also declined considerably in the past four decades (Table 3.3). The main factor for this decline is the development of road networks and modern means of transportation. The highest proportion of donkeys in Thal yet reveals their importance in transporting goods to alpine pastures during summer. Goats and sheep still dominate the livestock composition; however, their proportion has declined from 63% to 41%. A slight increase can be observed in the number of bulls during the study period. The reasons behind this increase are not certain; however, according to the local inhabitants, the tradition of lending and borrowing of bulls has declined. Therefore, almost every household now

needs to keep at least one bull in order to share it with another household and complete the couple for tilling.

Fig 3.15 Changes in Herd Composition



(Field survey, 2014)

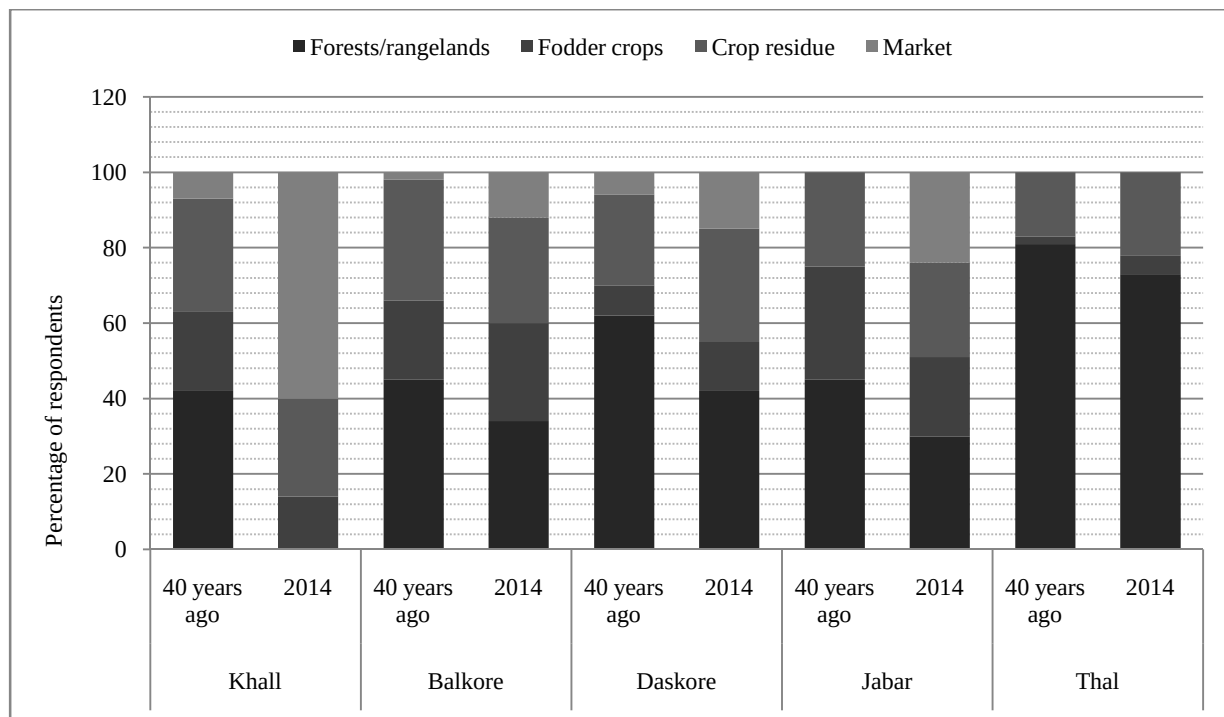
3.5.3 Changes in Livestock Feeding Sources

The main sources of livestock fodder in the study area include; crops' residue such as wheat and maize straw, tree leaves, grasses and shrubs, fodder crops on private lands and fodder purchased from the market. In the past, majority of the households used to feed their animals by locally available resources while a negligible portion of fodder was purchased from the market. Common property resources including forests, rangelands and pastures were the main sources of livestock feed. Whatever the grazing and feeding arrangements for different animals were, the fodder requirements were predominantly met by these resources in almost all parts of the valley (Fig 3.16). A small portion of fodder consumption was supplemented by fodder crops mainly red clover and millet and almost the same portion by the residue from maize, wheat, barley and rice.

Presently, free grazing of animals in the rangelands and forests has decreased to a greater extent and stall feeding is becoming dominant. According to the respondents, grazing grounds have been degraded and the fodder capacity has declined drastically particularly in the lower villages. Consequently, mostly the animals are kept at home and the inhabitants have to rely on purchased fodder for feeding their livestock. The data reveals a consistent decline in the feed contribution

of forests and rangelands, while an increase in fodder dependency on market (Fig 3.16). The same findings are also reported by (Tulachan & Neupane, 1999: 18, 45) as, “There is an increasing trend towards feeding animals with purchased concentrate feed especially among farmers”. The decline in fodder supply from forests is mainly due to the degradation of vegetation cover in the lower parts of the study area and partially due to the shortage of labor.

Fig 3.16 Changes in the Share of Livestock Feeding Sources



(Field survey, 2014)

3.6 Economic Transformations

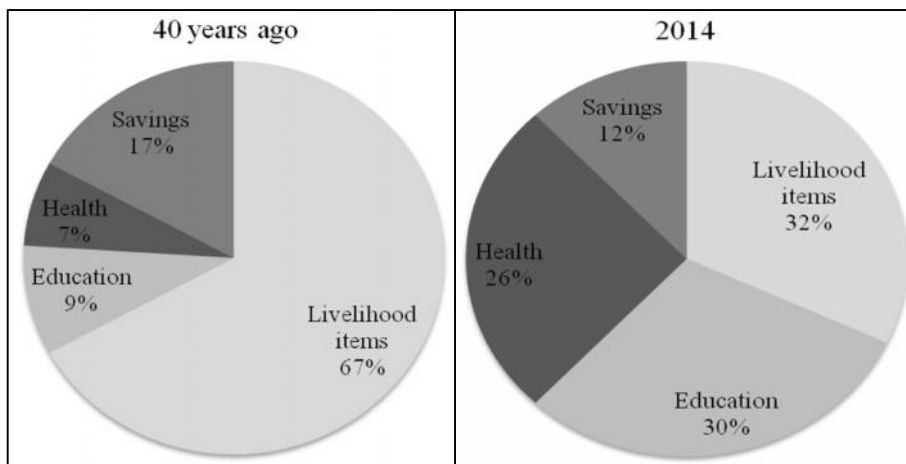
Economic transformation is one of the important changes in the socio-economic setup of the study area. In the past four to five decades, the traditional agrarian economy has almost fully transformed and replaced by a multiplex of off-farm and market oriented economic system. This change is referred to as ‘deagrarisation’¹⁸ by Njegac & Toski, (1999: P 263). Improved accessibility is the main driving force behind the transformation of traditional village economies

¹⁸ It is defined as a socio-economic process whereby agricultural regions lose their primary characteristics and develop a more complex economic structure. For more details see Njegac & Toski, (1999).

in the study area. Accessibility has brought market close to the doors and has become an integral part of the local economy which was purely based on indigenous production in the past.

Population growth and accessibility improvements in the late 1970s and early 1980s completely changed both the demands of people and the means to fulfill them. The dependence on local food stuff of majority of population shifted to market supplies. Moreover, the roads opened the way for education and other luxuries and utilities of urban life. Four decades ago, the people use to spend most of the money i.e. 67% of the total expenditure in livelihood items while a proportion i.e. 7% and 9% in health and education. Contrary to this, presently education sector consumes as much income as the livelihood items i.e. around 30%, while 26% of the total household expenditure is spent in health and medical facilities (Fig 3.17). The local traditional medical treatment is replaced by modern health care measures and hospitals and consequently the expenditure has increased in this sector.

Fig 3.17 Change in the Monthly Expenditure in Various Sectors



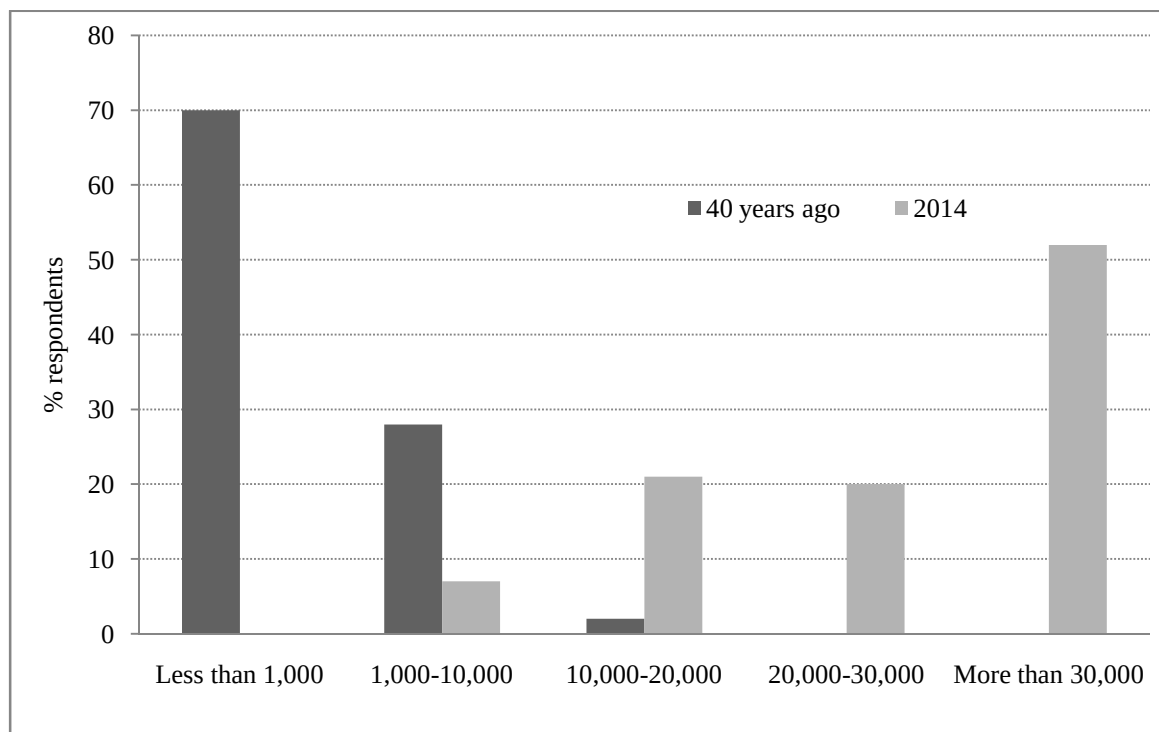
(Field survey, 2014)

The priorities of the inhabitants have completely changed as in the past, the basic purpose of agriculture and animal husbandry was to produce livelihood items and serve the food needs only. Cash income generation was not as important as the production of food items. Presently, more emphasis is on the generation of cash income, while food and other items of daily use are imported from the market and other areas (cf. Fazlur-Rahman, 2007b). As a result, the inhabitants are now more dependent on cash for fulfilling their livelihood needs and other sectors

of advance living standards. The past four decades have experienced a substantial increase in cash income generation in all parts of the study area (Fig 3.18).

A vast majority of the people in the past (70%) were having a total monthly income of less than 1,000 rupees¹⁹, while 27% were earning cash income less than 10,000 rupees and only 2% people earned up to 20,000 rupees. This category included the households with no cash income or very little of it, while few joint and extended families were earning up to 10,000 cash from agriculture, animal husbandry and local village shops or services in the Nawab's state police. On the other hand, presently 52% of the total surveyed households earn more than 30,000 and another 20% have cash income of 20,000 to 30,000 rupees respectively per month. The highest category also includes few households with high cash income of more than 100,000. While correlating these income statistics to the present day household size, it can be stated that majority of the people presently earn more cash income per month than what they need.

Fig 3.18 Change in Cash Income Generation in the Study Area



(Field survey, 2014)

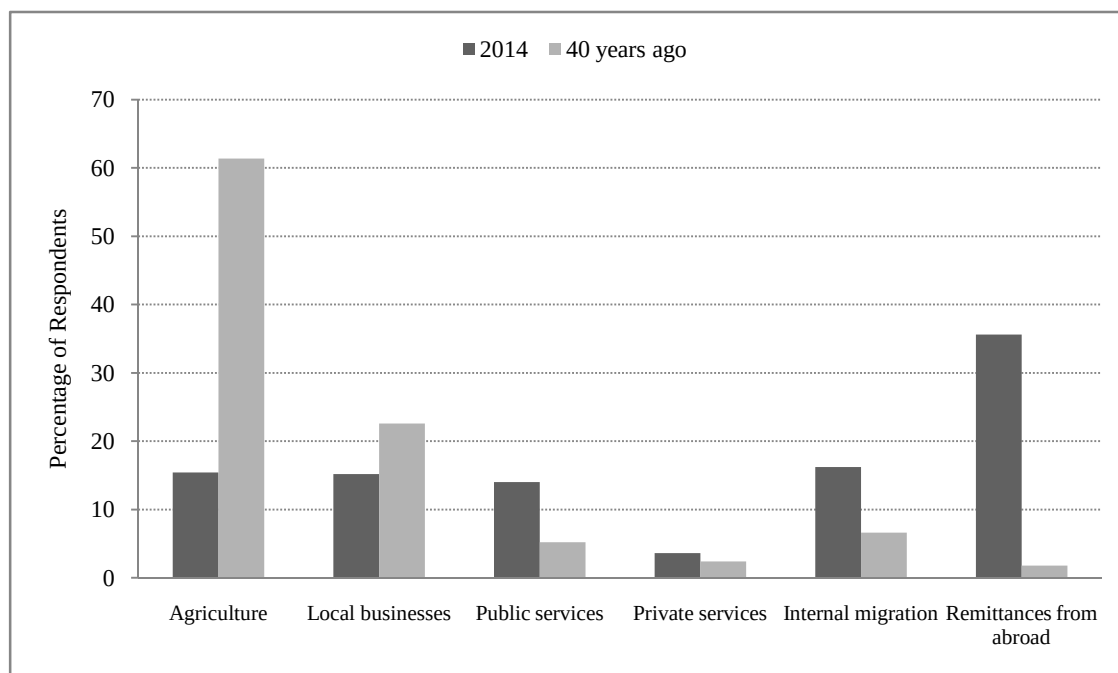
¹⁹ As Pakistani currency has devolved substantially during the study period; therefore, the original income figures were converted to the present currency rate for comparison. In 1970, 1 rupee valued as much as 12 rupees in 2014 according to US dollar rates (Knoema, 2015).

3.6.1 Change in the Sources of Income

While comparing the present and past sources of income in the study area, it is evident that agriculture was the backbone of economy for more than 60% households (Fig 3.19). Although marketing of agricultural products was limited, still it supplemented the major portion to the earnings of households. About 23% of the cash income was contributed by local business which included small village shops, unskilled labor and handicrafts. The local business was predominantly restricted to Khall area which was a small market at that time.

The contribution of other sectors of economy such as public and private sector services and internal and international migrant labor was minimal and limited to the royal families only. However, with the passage of time and increasing needs for cash income, other sectors of income generation gained more importance as agriculture alone cannot support the present day complex economic setup. Agricultural sector contributes only 15% to the cash income at present while the major portion i.e. 36% is contributed by remittances sent by workers living abroad (Fig 3.19). The proportion of public and private sector services to cash income generation has also increased.

Fig 3.19 Change in the Sources of Income



(Field survey, 2014)

3.6.2 Dynamics of Migration and Remittances

Like most parts of the northern mountainous belt of Pakistan (cf. Kreutzmann, 1992, 1993, Herbers, 1998, Fazlur-Rahman, 2007b), migration has become the main sector of cash income generation in the study area during the past few decades. Traditionally, unfavorable conditions of mountainous areas for agricultural production, lack of limited off-farm employment opportunities within the area, increasing demands for cash income and the shift from rural mountain lifestyle to a more urban way of living have been the major factors which drove the people to migrate and search for employment opportunities in the lowlands within the country and abroad (Olimova & Olimova, 2007; ICIMOD, 2010).

According to the available data, until 1970 migration was confined to small scale internal movements only, while in rare cases, people from the prosperous families could manage to go abroad. There were different forms and patterns of internal migration, dominated by seasonal migrant labor to the nearby plain areas. Most of these migrants were engaged in agriculture activities such as harvesting of wheat in summer and sugarcane processing in winter. The destination and duration of stay of the migrants was determined by the type of agricultural activities in the host regions. Those who were engaged in sugarcane processing activities in the plains of Peshawar Vale, used to migrate in winter and spend summer at home. Contrarily, the internal migrants moved to the Indus Plain during the harvesting season of wheat, used to spend winter at home and summer as migrants.

The data reveals that four decades ago the number of internal migrant workers was 94 (persons) in the total 500 surveyed households (Table 3.5). An increase has been observed in the number of internal migration during the past few decades and presently there are a total of 236 workers (persons) in different parts of the country. Although, this increase looks nominal as compared to other changes in socio-economic setup; however, it is because of the drastic increase in international migration (Table 3.5). Presently, the destination of majority of the internal migrants is Karachi where they are usually engaged in the steel and scrap business or with working in the ship-breaking industry. Lahore is another destination for a majority of internal migrant workers which offer a number and diversity of earning opportunities.

Table 3.5 Change in the Number of Internal and Foreign Migrants

Study area	Number of local migrants		Number of foreign migrants	
	40 years ago	2014	40 years ago	2014
Khall	17	42	02	60
Balkore	16	36	00	40
Jabar	20	31	04	68
Daskore	32	65	00	56
Thal	9	62	00	28
Total	94	236	06	252
Household Average	0.18	0.5	0.01	0.5

(Field survey, 2014)

The number of internal and international migrants in the study area is different from the overall statistics of migration in Pakistan. The internal migration flow in the country is higher than international migration, particularly during the last two decades. The number of internal migrants is around eight million, compared to around four million international migrants (Arif, 2009). “This difference may partly be due to unrestricted internal migration, and partly because the cost of internal migration is far less than migrating abroad” (ICIMD, 2010: 23). International migration was minimal until 1970 due to the political scenario, poor economic conditions of the people and costly visa process which was not affordable for majority of the people. A total of 06 persons were migrated abroad from 500 households surveyed (Table 3.45).

During 1970s, a drastic change took place and large scale out-migration started particularly to the Gulf States. Presently, 252 persons in the total 500 households are migrated abroad indicating an average of 0.5 persons per household (Table 3.5). In many cases two or more persons from the larger households are out of the country. The destination of the majority of emigrants is the countries of Middle East mainly Saudi Arabia, United Arab Emirates (UAE) followed by Qatar, Oman and Kuwait. These emigrants are working in construction sector as well as in businesses and skill based professions such as driving and construction.

Remittances sent by emigrants vary from village to village (Fig 3.20) depending on employment sector, duration of stay between successive returns, kind of visa contract and the labor policy of the host countries. There are usually two kinds of visa applied for by the emigrants. In one kind,

the emigrants sign a contract with the employer for specific services with pre-determined terms and conditions and salary packages. Such visas are commonly issued by private employers in UAE in relatively lower costs and offers low salary packages. The general packages in such contracts are, Rs. 15,000 to 25,000 and the associated duties may range from gardening and livestock keeping to driving, construction, teaching in the mosques (*madrasas*) and skilled electrical and engineering works. The inhabitants from comparatively economically marginal families usually prefer this kind of visa as they cannot afford high emigration costs.

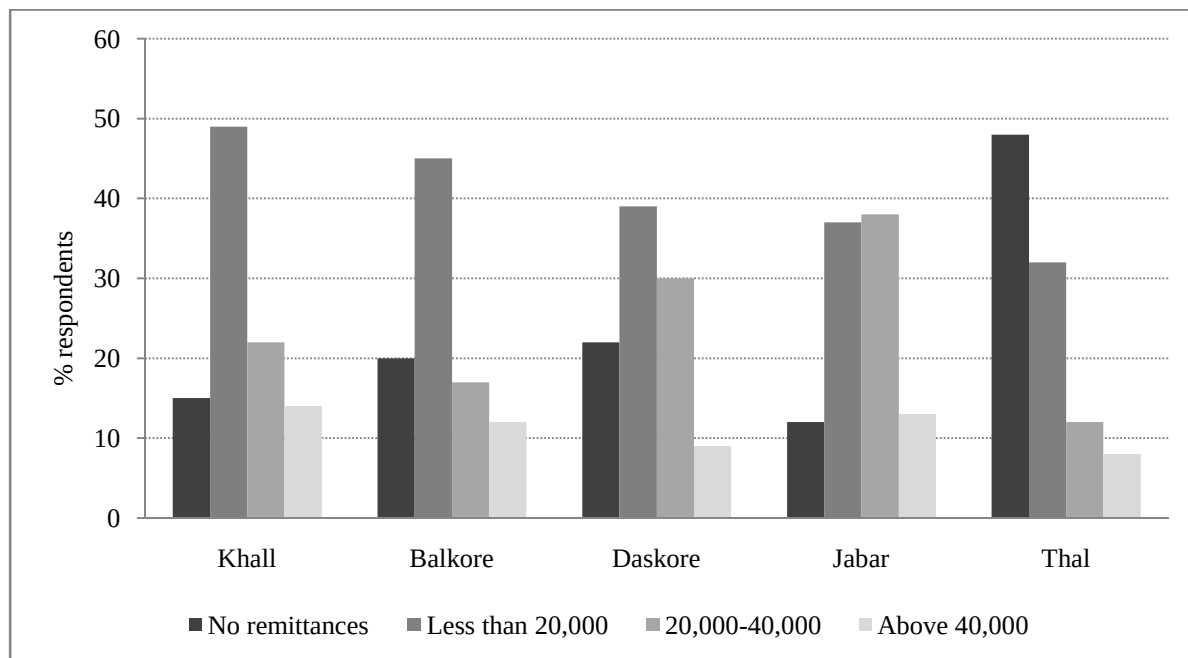
In the other kind of visa, predominantly issued by the contractors and employers in Saudi Arabia, there is no such work contract with any organization or company. The emigrants cannot directly approach to this service and there is a complicated and costly process involved in getting such kind of visa. A firm, company or contractor issues visas and a Pakistani agent purchase them in low costs offering some profit to the issuing consultancies. The agents then pass on the visas to the people who want to go abroad and get a substantial amount of profit in transferring one visa from the consultant to the recipient. In such kind of visa, the emigrant is not bound to work with a particular firm or company and he is free to search for employment of his own choice. The jobs searched for by these emigrants, cover a wide range of sectors such as unskilled wage labor in construction, driving, government and private sector services and businesses. Presently, these visas usually cost Rs. 300,000 to 500,000 and the emigrants can earn Rs.20,000 to more than 100,000 per month depending on the nature of employment. Such migrants regularly pay a considerable amount of money on yearly basis to the visa consultants in the host country in order to renew their work and resident permit.

International migration has become the most important sector of village economy in the past two to three decades and a large number of households fully or partially depend on foreign remittances for their needs. Presently the amount of remittances and the number of abroad workers literally determine the living standards of inhabitants²⁰. Besides economic wellbeing and prosperity, the families receiving remittances also have major shares in local business and investment based activities such as transport, property ownership and the establishment of private sector health and education institutions. Moreover, remittances are invested in different

²⁰ Although in rare cases, families without abroad workers can be seen in a good economic and social status; however, the majority of the privileged families in terms of life standards are those receiving foreign remittances.

businesses sectors in the main urban centers. Wide scale local variations can also be observed in the flow of remittances. Majority of the respondents (about 50%) in the Thal village do not earn any remittances compared to 11% and 13% in Jabar and Khall respectively (Fig 3.20). The highest flow of remittances is recorded in Jabar village followed by Khall. The major factor behind these internal variations is the availability of local natural resources and way of living among various localities.

Fig 3.20 Flow of Remittances to the Study Area



(Field survey, 2014)

3.7 Conclusion

The past few decades have witnessed considerable changes in the socio-economic conditions of the study area and the available literature reveals the same scenario in the surrounding regions of the northern mountainous belt of Pakistan (Ali & De Boer, 2007; Fazlur-Rahman, 2007a; Hoermann & Kollmair, 2009). These changes are attributed to a number factors and according to (ICIMOD, 2010: 13), “mountain ecosystems and people are subject to a variety of drivers of change including globalization; economic policies; and increasing pressure on land and mountain resources due to economic growth and changes in population and lifestyle”. The major changes in the socio-economic setup include population growth, increase in the number of household and

decreasing household size, agricultural transformations, economic changes, increasing rate of out-migration both internal and international, and improvements in accessibility.

Population growth along with adoption of relatively modern life styles resulted into a number of changes in household characteristics and housing structure. The historical and traditional one room house is replaced by multiple rooms and several associated facilities such as separate kitchens, animal sheds, guestrooms and toilets etc. Changes have also taken place in building material, house layout and designs. Moreover, the number of household has increased and the average household size has decreased as a result of disintegration of joint and extended families. These household and population dynamics alter the whole socio-economic setup by multiplying the demands for food, space, income and other luxuries of life. The local resources and farm economies are usually not enough to fulfill these increasing demands. Consequently, the inhabitants need to integrate market based and off-farm earning activities into their traditional economic system (cf. Wright & Duncan, 2005; Njegac & Toski, 1999; ICIMOD, 2005).

In this regard, migration is the most important change for bridging the gap between the growing demands and local production capacity (cf. Hoermann & Kollmair, 2009; Hoermann et al., 2010; ICIMOD, 2010). Financial remittances earned by migrants are becoming the most direct, immediate and significant contribution to the livelihoods of the mountain poor (Olimova & Olimova, 2007). These remittances provide safety for a large dependent population, which is left behind. Macro-economic studies conclude that, a 10% average increase in per capita legally transferred international remittances results into a 3.5% decline in the proportion of poor people (Adams & Page, 2005). Pakistan is ranked fifth amongst the largest remittances receiving countries in the world and for many years, the official remittances sent from abroad have exceeded the direct foreign investments in the country. The statistics reveal that in the fiscal year 2008/09 the officially recorded remittances flows totaled over US\$ 7.2 billion nationwide (ICIMOD, 2010). Similarly, remittances and income earned by internal migrants have become the major contributors of the household economic setup in the study area.

4

LAND USE AND LAND COVER CHANGES

Population growth, rapid improvement in accessibility, out-migration and economic transformations are among important socio-economic changes, which have triggered major changes in the biophysical environment. These include deforestation and degradation of forests resources, shrinking of pasture and decline in per capita cultivated land and shortage of water for irrigation. However, changes are not always negative as on the one hand, the construction of roads has affected physical environment in the form of slope instability and exposure of forest resources to overexploitation (cf. Kreutzmann, 1991; Jodha, et al., 1992), while on the other hand, improved accessibility has enhanced land reclamation and soil fertility as a result of easy access to fertilizers and unused lands. Moreover, it has also enhanced movement of products and people. Out-migration has released pressure on natural resources and supplemented a considerable portion to household income. However, decrease in labor force has a negative impact on the traditional division of labor. Nevertheless, off-farm income and remittances have also brought about positive changes by enhancing investment in agriculture, which has increased productivity of land.

Population growth and increase in population density as a force to modify biophysical environment of mountainous areas, is one of the most debated issue around the world²¹. Similar to other mountainous areas (cf. Repetto, 1986; FAO, 1994; UNFPA, 1991), it usually leads to agricultural expansion through bringing unused land and forest areas under cultivation. Such expansions have often led to conversion of natural grazing lands into agricultural lands and forests into grazing grounds. Intensification of farming activities through crop rotation, introduction of modern agricultural methods, multi-cropping and utilization of land in an exhaustive way for more production is another strategy to meet the increasing demands of population for food. This intensive use of agricultural resources has played a key role in land degradation.

²¹ For more detail see (Price, 1998; Fazlur-Rahman, 2007, 2009; Rahman et al., 2014; Templeton & Scherr, 1997; Sati, 2009; Gracheva et al., 2012; Huddleston & Ataman, 2003; Dhar, 2000; Sonesson & Messerli, 2002; Owen et al., 1998; Steins & Edwards, 1999; Eckholm, 1975; Pretty, 2003; Southgate, 1988; World Bank, 1992)

Nevertheless, population growth has also brought about positive changes as more people can bring more area under cultivation and tree farming, hence increasing tree cover and converting of barren land into productive one (cf. Simon, 1990, 1996). With growing population and increasing number of users, the inhabitants are introducing capital intensive inputs and advance production technologies. These measures have enhanced land conservation by preventing soil erosion and increasing moisture holding capacity²².

4.1 Dynamics of Land Use and Land Cover

Land use and land cover of the study area has considerably changed during the last four decades, determined by socio-economic transformation discussed in the previous chapter. These changes have affected the natural resource base, biological diversity and ecosystems²³. Land cover of the study area is dominated by natural vegetation cover attributed to the physical characteristics such as topography and climatic conditions. The natural vegetation cover can be differentiated into alpine forests above 3,000 meter elevation dominated by deodar; coniferous or lower altitude evergreen forests with a thick cover of pine and wild olive and a number of shrub species mainly; rangelands in the proximal hills of the residential areas covered by scrubs and grasses; and the alpine pastures located at higher altitudes. Similar to the transformations in the socio-economic systems, the past four decades have witnessed substantial changes in the land use and land cover of the study area.

Land use pattern of the study area is divided into five categories including forests, rangelands and pastures, agricultural land, barren land and residential areas or settlements (Fig 4.1). All kinds of tree cover whether thick alpine and coniferous forests or scattered trees found in the lower altitude hills, are included in the category of forests. The category of rangelands and pastures incorporates the alpine pastures located at higher altitudes and used for seasonal grazing, and the hillsides covered by scrubs and bushes of various species near and around the

²² For more details on the positive effects of population growth on the local natural resource base, see (Boserup, 1965; Hyden et al., 1993; Simon, 1990, 1996; Templeton & Scherr, 1997).

²³ Land use land cover change has become one of the important areas in global change research and countless numbers of studies have been conducted on this issue in every part of the world both in the developed and developing countries (cf. Lesschen et al., 2005; Nuseer, 2000; Acevedo et al., 2008; Baskent & Kadiogullari, 2007; Houghton, 1994; Lambin et al., 2001; Ojima, Galvin, & Turner, 1994; Dewan & Yamaguchi, 2009; Dongol et al., 2002; Chen et al., 2001; Crews-Meyer, 2004; Serneels & Lambin, 2001; Baskent & Kadiogullari, 2007; Pan et al., 1999; Liu & Cai, 2012). These studies reflect the importance of land use land cover changes on the environment and the associated communities.

villages which are usually used as grazing grounds round the year. The lands under any kind of cultivation i.e. irrigated, semi-irrigated²⁴ or rain-fed are included in the category of agricultural land. Barren land category covers the areas which are bare of vegetation and are also not under any other kind of land use i.e. agriculture or settlements both in the higher altitudes – usually under snow cover – and at lower elevations near the residential areas. The built up areas including human dwellings and commercial land uses are incorporated in the category of settlements.

Land use pattern determined for the baseline data point i.e. 1970 reveals that the area was predominantly covered by forests, rangelands and pastures. Natural vegetation cover constituted 73% of the land use – 57% forests and 16% rangelands and pastures – evenly distributed throughout the valley (Fig 4.1). Forests were mostly concentrated in the second vertical belt i.e. above the arable land and rangelands and pastures were mainly located above them in the typical vertical organization of land uses in the study area.

Agricultural land was the second major land use covering 17% of the study area. In the northern part of the valley i.e. the present day Upper Dir District, agricultural land was distributed according to the drainage pattern. Most of the agricultural land was found in the valley floors along the banks of Panjkora River and its tributaries. In the lower portion of the valley, major part of the agricultural land was situated in the western part i.e. the Maidan²⁵ and Jandul areas. The former is situated on both banks of Kunnai Stream and its tributaries which also provide sufficient water for irrigated agriculture. The Jandul area irrigated by irrigation channels taken off from the Rud Stream – another tributary of River Panjkora in the south western part of the valley – and this part also dominated by agricultural land use.

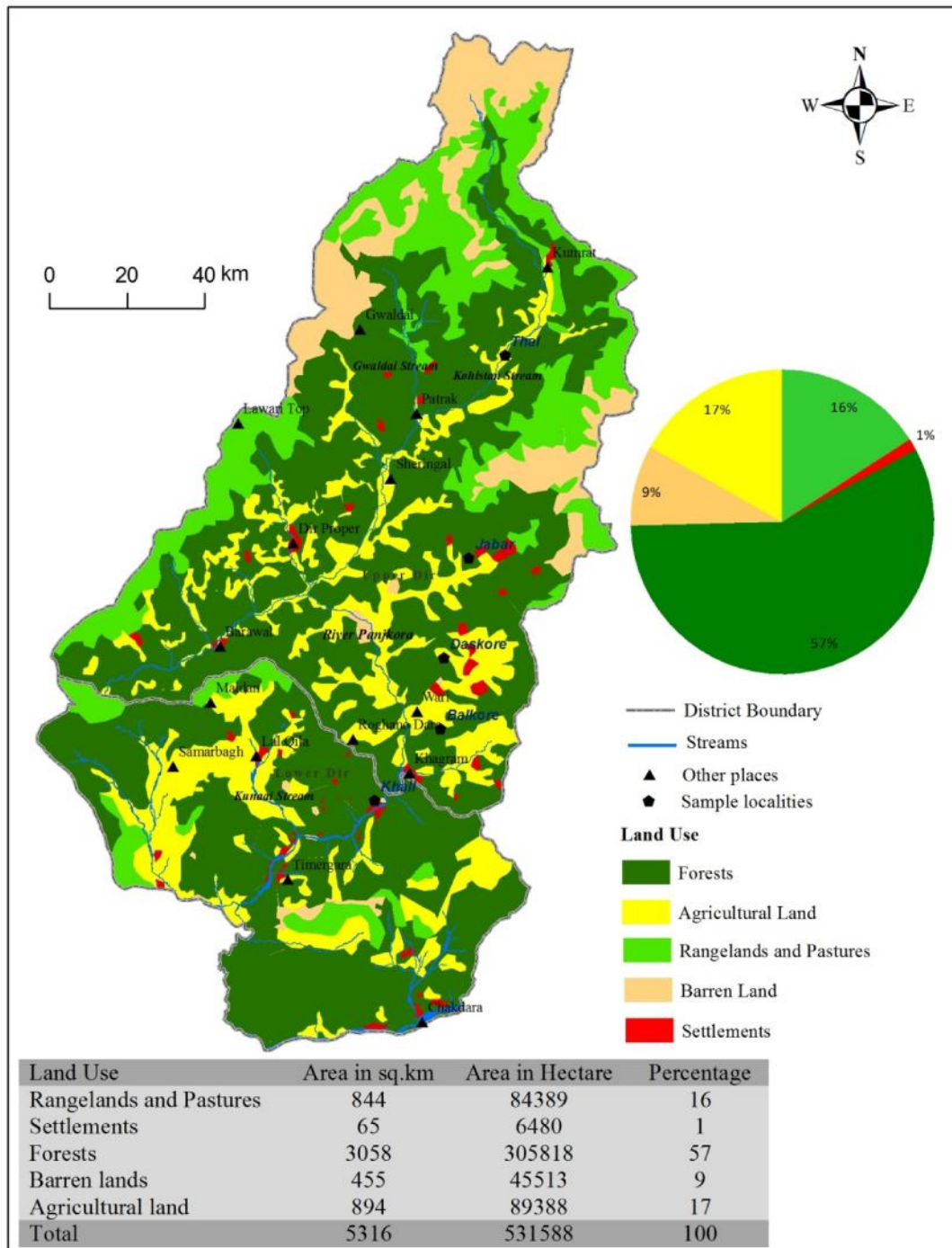
Area under settlements was quite small that was one percent of the total area. Except few, most of the settlements were concentrated in the lower altitude along the valley floors where water

²⁴ Irrigated land category includes the lands with irrigation facilities from a perennial source which provides water round the year. Semi-irrigated land here refers to the areas, which receive irrigation water from a seasonal torrent or springs where the availability of water is not certain for the whole year.

²⁵ The name ‘Maidan’ literally means ‘plain’ and this area was named after the availability of considerable plain area for agriculture.

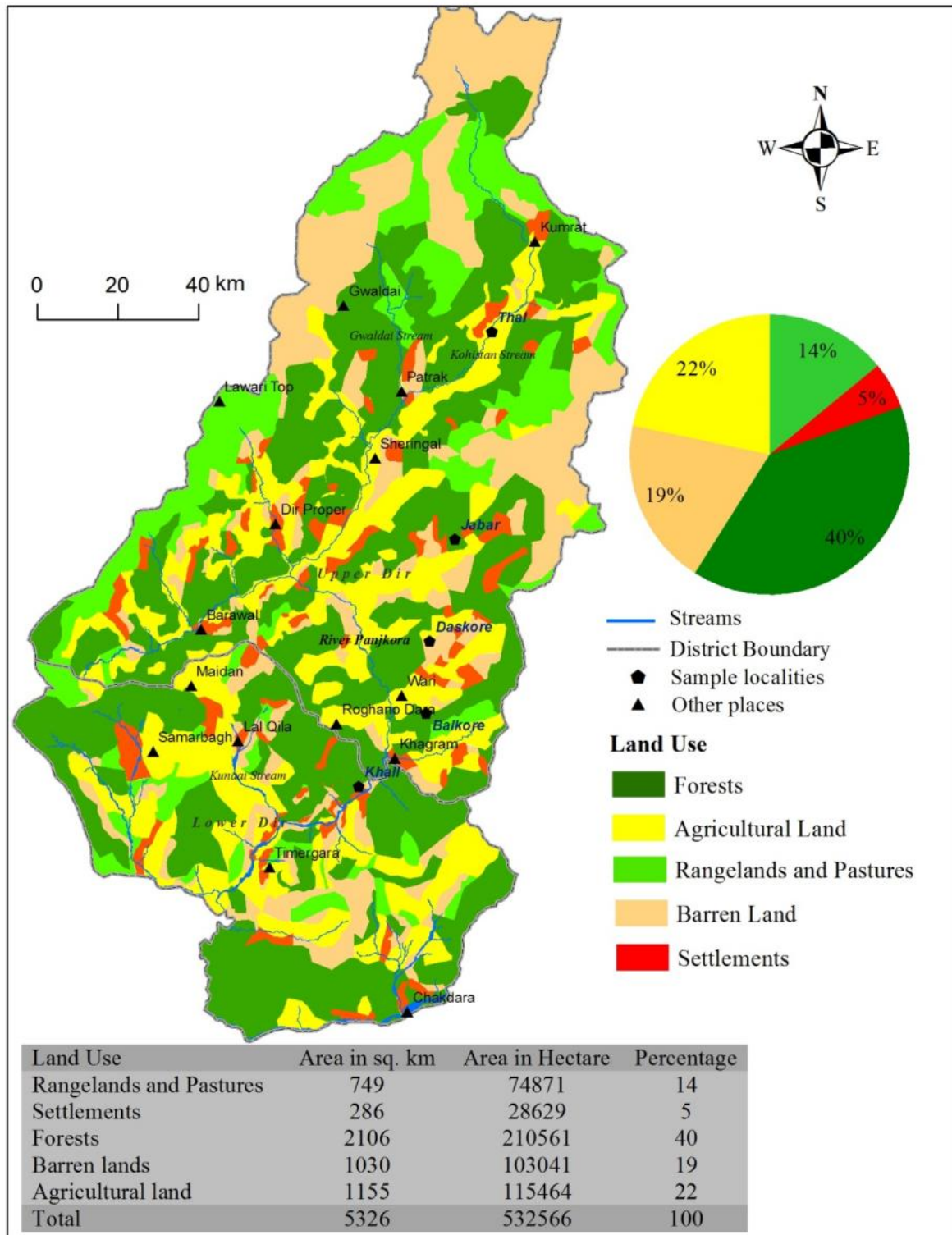
availability coincides with flat land. Barren land, mainly consisting of rock outcrops and glaciers, covered 9% of the total land area in 1970 (Fig 4.1).

Fig 4.1 Land Use Pattern of the Study Area during 1970s



(GoNWFP, 1975)

Fig 4.2 Land Use Pattern of the Study Area during 2012



(GoKPK, 2012b)

The land use pattern has transformed considerably during the past four decades. Land under the three categories i.e. settlements, agriculture and barren has increased, while the area under vegetation, both forests and grazing lands, has decreased (Fig 4.2). Agricultural land now accounts for 22% of the total land of the area with an increase of 5% in the last four decades. Natural vegetation cover has decreased from 73% to 54% during the study period and has shrunk from all sides. The area under forests has decreased drastically by 17% during the past four decades.

Forest cover has decreased throughout the study area and not confined to particular areas. However, it can be observed that in the upper parts most of the forest area has been converted into residential areas, while in the lower parts it has been engulfed by barren lands. The barren lands and land under settlements have also increased to 19% and 5% respectively during the study period. Built up area has extended both towards the forests and agricultural land, while barren lands have been the result of clearing the areas under vegetation cover. The expansion of residential land in the lower part of study area is different than that of the upper part. In the lower part, the existing residential areas have expanded while in the upper part, new areas have been inhabited for which natural vegetation covers have been cleared.

4.2 Changes in Agricultural Land Use

In the past, due to limited demands of small population, shortage of labor force, and unavailability of modern inputs and technologies (see chapter 3), agriculture was practiced only in the valleys and areas close to the village which were easily accessible. The hilly terraces and rain-fed areas were rarely cultivated usually once in a year with the main purpose of fodder production. Even the floodplains of the streams with irrigation facilities and fertile productive soils were also cultivated less intensively due to a small dependent population and large per capita landholdings (see chapter 3).

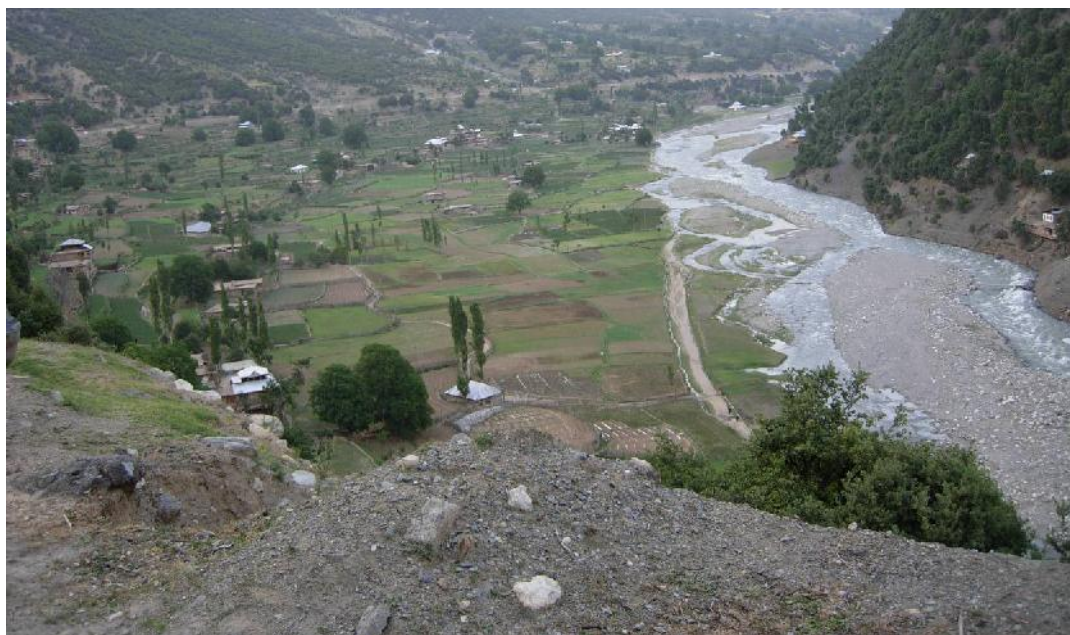
However, with the passage of time and change in the socio-economic conditions, agricultural land use also changed in different respect. Both the extent of arable land and the intensity of cultivation and cropping have increased over the last decades. The existing well-structured fields in the valley bottoms (Fig 4.3) and the arable tracks along the streams (Fig 4.4) are now intensively cultivated as well as the poorly favorable land in the high altitude is also brought

under plough (Fig 4.5). The arable lands, which were cultivated once a year and kept fallow for another year are now cultivated at least twice a year.

Fig 4.3 Cultivated Fields in the Valley Bottom of Balkore



Fig 4.4 Cultivated Fields along the Banks of River Panjkora in Thal



The intensive cultivation often results into the degradation of land in the form of nutrients loss and soil erosion; however, the landowners handle these issues by introducing fertilizers and investing more capital in agriculture. The cultivated floodplains along the streams are well protected through embankments constructed by the community in order to prevent soil erosion and destruction of land in the case of flash floods. The rain-fed and semi-irrigated lands in the hilly areas are protected through the construction of retaining walls which prevent soil loss. Moreover, the field surface is modified in such a way (Fig 4.3) to restrain much amount of rain or flood water as well as not to lose soil nutrients in the form of gully erosion and rain-splash effect. The less favorable hill slopes around the villages at high altitude such as shown in Fig 4.5 and Fig 4.7, are brought under cultivation through introducing suitable seed varieties of barley, maize and potato (in case of Thal). In other villages, mostly such lands are cultivated for the purpose of fodder production and the main fodder crops grown include barley, millet and grasses.

Fig 4.5 Poorly Structured Cultivated Fields in the High Altitudes in Thal



In addition to crop intensification, considerable improvements can also be observed in irrigation infrastructure. The canal taken off from Ushiri Stream in Ushiri Dara in the 1970s is the major

example in this regard, which has brought more than half of the total cultivated land of Jabar village under irrigation. Besides this major canal, a number of small water courses and minor canals have been taken off from the local streams. Due to these minor canals, the proportion of irrigated and semi-irrigated land has increased considerably during the last four decades (Table 4.1), particularly in Jabar where the number of respondents having land under irrigation has increased from 52% in 1970 to 88% in 2014.

The overall figures reveal that the proportion of irrigated landowners has increased from 44% to 65% during the study period, while the rain-fed land ownership has decreased from 42% to 15%. It may be noted that these figures may not be confused with the perceptions of people about the decrease in the availability of irrigation water discussed in chapter 3. Although the potential water availability for irrigation has decreased according to the inhabitants; however, the irrigation infrastructure has been improved which has brought more land under irrigation. The decrease in irrigated landholdings in Thal instead of the excessive availability of water is because of the increase in the extension of cultivated land towards the high mountains pastures and poorly suitable areas (Fig 4.5). Although water is available, but these fields are not irrigated due to the cold conditions and a single crop is harvested usually before maturity.

Table 4.1 Proportion of Agricultural Landholdings under Irrigation

Study Area	Proportion of landowners by irrigation (%age)					
	Irrigated		Semi-irrigated		Rain-fed	
	1970	2014	1970	2014	1970	2014
Khall	42	64	2	30	56	6
Balkore	54	42	22	35	24	23
Daskore	62	50	18	14	20	36
Jabar	52	88	20	7	20	5
Thal	92	81	4	13	4	6
%age	44	65	13	20	42	15

(Field Survey, 20140)

Besides drawing water courses and canals from the streams, large areas located above the command areas of the streams have also been brought under semi-irrigation method through the construction of small water storage reservoirs (Fig 4.6). These reservoirs are used to store the water diverted either from a seasonal torrent or spring on daily basis. The stored water is released once or twice in a day depending on availability. The water from such reservoirs is distributed to

the fields through narrow water courses and managed under complex utilization systems varying from village to village (see chapter 5).

Fig 4.6 Water Storage Reservoir Constructed by the Community



Besides improvements in cropping methods and irrigation networks, other change associated with agricultural land is the expansion of arable land. The expansion of agricultural land is determined by a number of external factors such as population growth, increase in the number of households, availability of labor, capital, technology and advance inputs, and irrigation facilities. Agricultural land has expanded mainly into the grazing lands and forest areas. The gentle slopes of the rangelands and forests are cleared and modified into terrace fields (Fig 4.7) locally known as *Karin*. Rain-fed agriculture is practiced in these terraced fields and normally only one crop, usually wheat or barley can be harvested per annum. In many villages particularly in Daskore and Balkore, the inhabitants have modified the barren slopes close to the residential areas used for the cultivation of fodder crops and grasses.

Fig 4.7 Rain-Fed Cultivated Terraces on Hill Slopes around the Village



4.3 Expansion of Built Up Areas: Extent and Trends

In the study area, due to rough topography, the availability of suitable land for the construction of settlements is quite limited. As we move upward into the hills and mountains, the slopes become steeper; the climatic conditions become more inhospitable; accessibility becomes more difficult; and environmental fragility increases. All these pushing factors hinder the establishment of settlements at higher elevations throughout the study area. Hence, as a common feature among all the villages and sub-valleys of the study area, the built up areas are restricted to the foothills where land surface is comparatively flatter. Generally, nucleated settlements are found concentrated on the valley floor or the gentler slopes of the village territory (Fig 4.8). The areas close to the banks of river Panjkora in Khall and Thal are the major sites for the construction of settlements. Therefore, linear settlement pattern can be observed in these localities followed by nucleated settlements in the second altitudinal belt. The settlement pattern becomes scattered with isolated dwellings found on suitable areas as we move away from the linear settlements in the valley towards the hills (Fig 4.9).

Fig 4.8 Concentrated Settlements on Hill Slopes

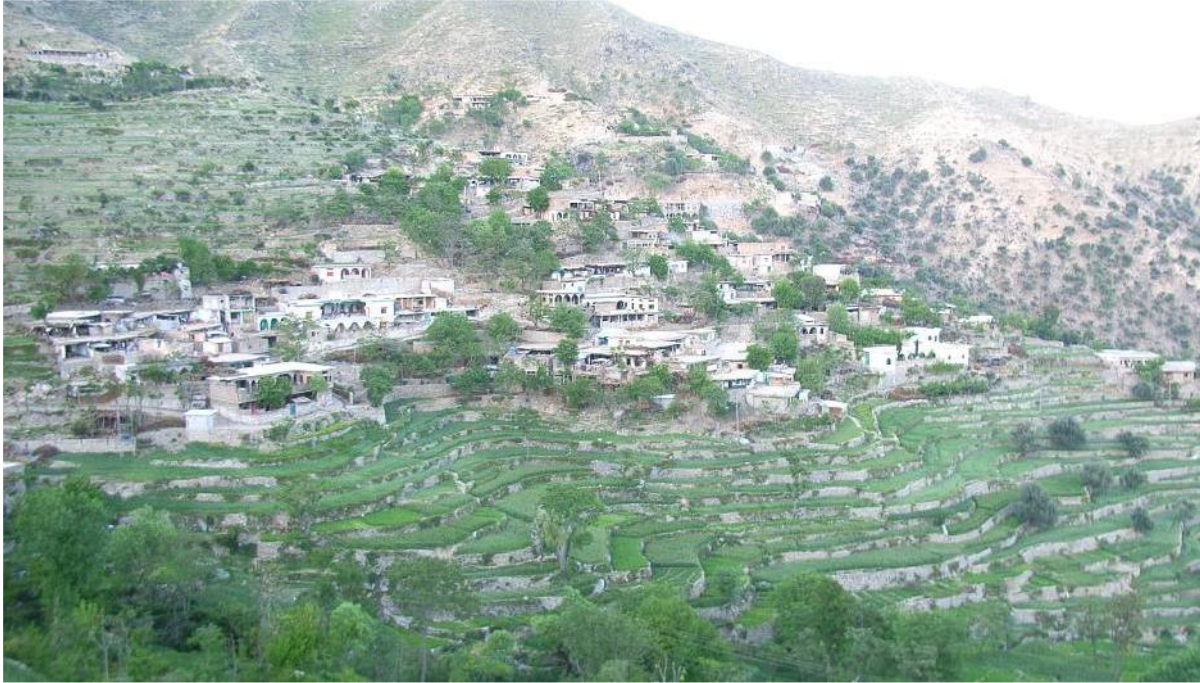


Fig 4.9 Linear Settlements along the Banks of River Panjkora in Thal



The built up area has increased from 1% of the total land area to 5% in the past four decades. Although this increase seems not substantial if compared with the increase in the number of households during the same period; however, this change is controlled by the limited availability of suitable spaces around the existing settlement. It can be observed that the existing residential areas have been fully occupied by settlements one above the other and the open spaces have completely been covered during the past few decades. Contrary to the construction of buildings close to the existing settlements, presently the built up areas are expanding with a very rapid rate towards the available open spaces around the main residential site.

The major factors behind the expansion of built up areas include population growth and associated household dynamics such as increase in the number of household and disintegration of joint families. As a simple correlation, more population obviously needs more space in order to construct dwellings and other associated structures. The drastic increase in the number of households mainly triggered off by population growth has resulted into a multifold increase in the demands for living space and the existing residential areas are not capable to accommodate more settlements. To acquire more space for construction of settlements, the nearby forests and rangelands are cleared as well as the built up areas are expanding engulfing agricultural lands (Fig 4.10 and 4.11).

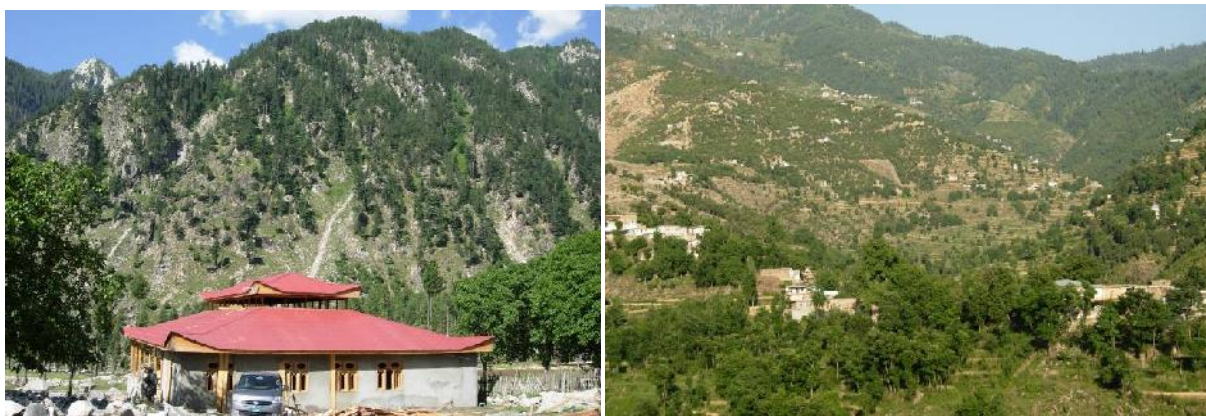
Fig 4.10 the Expansion of Settlements towards Agricultural Land



Rapid expansion of residential areas has recently become one of the major issues as well as an important aspect of the current changes threatening the sustainability of natural resource base in the study area. The major impact of this expansion is the accelerated rate of deforestation and destruction of natural habitats. It can be observed that the settlement areas are expanding and

encroaching two other land uses i.e. agricultural land or forests and rangelands throughout the study area. The villages where the surrounding hills and areas covered by vegetation are too steep to be used for the construction of settlements, the built up areas have expanded towards the cultivated lands (Fig 4.10). As a result of such expansion, isolated dwellings can be seen in the cultivated fields in many parts of the study area. However, if suitable land is available and accessibility does not obstruct, settlements are constructed in the nearby forest areas and rangelands, which are owned by the local inhabitants (Fig 4.11).

Fig 4.11 Construction of Settlements in Rangelands and Forest Cover Areas



4.4 Dynamics of Vegetation Cover and Deforestation

Forest resources are among the highly valued and productive local natural resources in the study area and considered as assets of wealth generation and livelihood support. Adedayo et al., (2010: 440) describes the benefits of forest resources to the rural people under four categories including; (a) Goods for subsistence such as fuel-wood, medicinal herbs, construction wood, fodder, honey and edible leaves, roots and wild fruits etc. (b) Goods for income generation which includes all of the above products, crafts and timber wood (c) Employment opportunities and (d) Other utilities such as providing grazing grounds, precious environmental services which include watershed and biodiversity conservation. The extraction of these benefits from the forests in an exploitative manner may lead to the deforestation²⁶ and degradation of these precious natural assets.

²⁶ In the present day research on global environmental changes and the World Mountains, deforestation and the associated ecological disturbances is probably the most extensively debated issue around the world. For details, see (Barbier&Burgess, 2001; Angelsen, 1999; Giliba et al., 2011; Das, 2011; Allen & Barnes, 1985; Ives, 1987;

Deforestation has become one of the key issues in global change research in mountainous areas of the world. Nevertheless, various studies present contradictory arguments regarding the real state of deforestation; some suggesting extremely alarming rates of forest cover degradation e.g. (Allen & Barnes, 1985; Eckholm, 1975; Pouliot et al., 2012; Barbier & Burgess, 2001), while other reporting an increase in forest covers such as (Simon, 1981; Clawson, 1981). Allen and Barnes, (1985: 164) have described these contradictory arguments as, certain studies conveyed that “many developing countries are on the verge of being transformed into vast deserts [while] other studies conclude that there will be abundant forest resources in both the near and distant future”. However, that particular study also states that the best available information reveals considerable deforestation in the developing countries (Allen & Barnes, 1985).

The northern mountainous belt of Pakistan including the districts of Mansehra, Malakand, Swat, Shangla and Dir etc. are the main hub of natural forests in Pakistan (Siddiqui, et al., 1999; Shams, 2000; Khalid, 2003; Khan, 2006). Over the past few decades, these forests have been exposed to the process of degradation at quite an alarming rate and a number of studies have dug deeply into the issue by quantifying its severity, causes and accelerating factors, and the social and environmental outcomes (Ives & Messerli, 1989; Rahman et al., 2014; Siddiqui et al., 1999; Ali et al., 2005; Naughton-Treves & Day, 2012). The actual debates on the dynamics of forest covers in the northern mountainous belt of Pakistan started after the publication of two important theories, ‘the Theory of Himalayan Environmental Degradation’ (Ives, 1987) and ‘the Himalayan Dilemma’ (Ives & Messerli, 1989). Since then, a number of scholars from various fields have investigated the issues of deforestation in different parts of this mountainous belt with contrasting views and findings. Several micro level studies conducted in this region support the hypothesis of an alarming rate of deforestation in the northern mountainous belt of Pakistan²⁷.

Nevertheless, in contrast, there are certain sources, which reject the theory of deforestation and present a satisfactory scenario and increase in forest cover during the recent past (GoKPK, 2012b). “...Consequently, and similar to other localities, calculation of reforestation as well as

Harrison, 1992; Southgate, 1990; Pichon, 1997; Sydenstricker-Neto, 2012; Carr, 2006; Geist & Lambin, 2001; Robinson et al., 2013; Malingreau et al., 2012; Pouliot et al., 2012; Walter, 2012).

²⁷ See (Allan, 1987; Aase, 1999; Eberhardt et al., 2006; Ehlers, 1996, 1997; Schickhoff, 1995; Schmidt, 2000b; Israr-ud-Din & Fazlur-Rahman, 2003).

deforestation rates became a major challenge for researchers” (Rahman et al., 2014: 168). The analysis of vegetation cover dynamics performed in this study also reveals a drastic decrease in the forest area i.e. from 58% to 40% during the last four decades. Fig 4.1 and 4.2 presents a comparison of area under vegetation cover for the two data points i.e. 1970 and 2014. Large scale deforestation can be observed which has converted the densely vegetative cover areas into detached forest parcels. The forests, which were once distributed throughout the valley, are now confined to the high mountains and hilltops only. The elders of the valley are also lamenting on the severe deforestation in the area as the dense forest cover of the 1970s has converted to barren lands and other land uses during their living memories. The driving forces behind the degradation of forest and high rate of deforestation are numerous (See chapter 5).

The forests of the study area have been degraded both in terms of extent and diversity. The selective harvesting of various tree species for timber, fuel wood and other purposes have resulted into disappearance of certain species and endangering others in different parts of the study area. The extraction of fuel wood varies widely from village to village depending on the nature, availability, productivity and diversity of forests and the local socio-economic conditions. In Thal – which is the most densely forest cover area among the selected localities – forests contribute a considerable portion to the household economy. Here wood is harvested for a variety of purposes ranging from the construction of houses and animal sheds to making fences of cultivated lands and fuel wood and both for domestic consumption and sale. Other non-timber forest products (NTFPs) such as medicinal herbs, grasses, wild fruits and edible leaves, and fodder plants also play an important role in the domestic economic set up and livelihood subsistence.

4.4.1 Changing Diversity: Disappearance and Endangerment of Tree Species

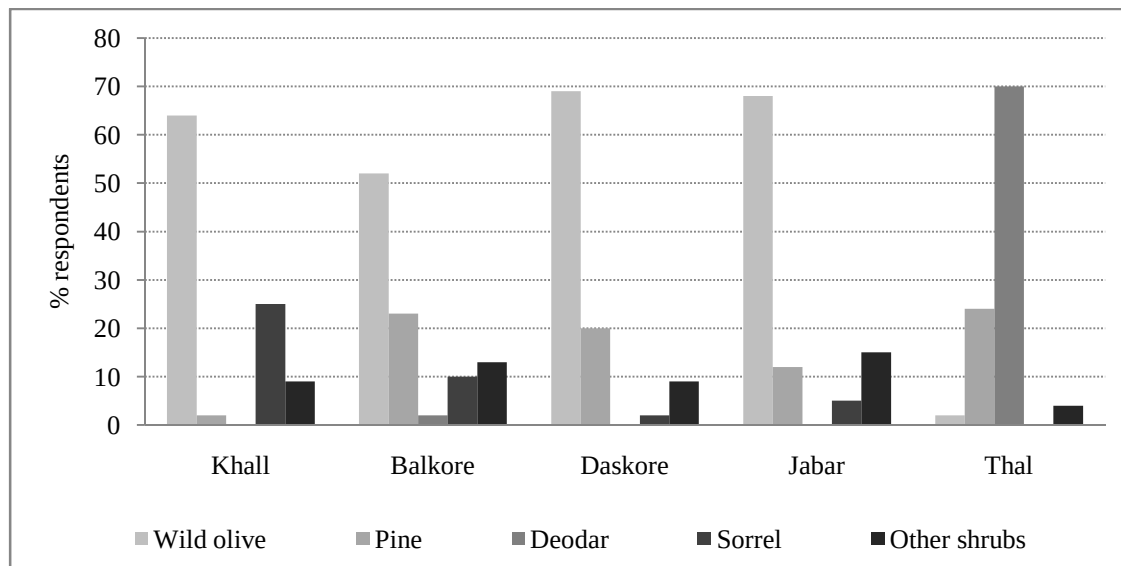
The forests of Thal area are dominated by highly valued deodar species covering most parts of the area above Kalkot village up to the snow line (Fig 4.13). Other major species include wild olive, coniferous trees, wild fruit trees and a rich variety of shrubs and small plants. Besides timber products, the wood of deodar and pine trees is extensively used as fuel wood and is considered as the most favorable fire source. Therefore, it can be seen that more than 70% of the inhabitants harvest fuel wood from deodar forests and around 20% use pine wood for fuel purposes in Thal area (Fig 4.12).

Fig 4.12 Deodar Forests of Thal Village



On the other hand, deodar forests are not found in rest of the localities and wild olive is the main source of fuel wood, as it is the most wide spread tree species varying in density from village to village. *Dodonaea viscosa* (Switch sorrel) is the common shrub found almost everywhere in the area covering the low lying hillsides of villages as well as found in the olive and pine forests. It is extensively harvested mainly for fuel and secondarily for making animal shelters and field fences, but it spread rapidly and covers the harvested area because of its high regeneration capacity.

Fig 4.13 Village-wise Variations in Extracting Fuel Wood from Different Trees



(Field Survey, 20140)

The excessive extraction of fuel wood from selected tree species in different villages (Fig 4.13) has often lead to disappearance and endangerment of certain plants and tree species (Table 4.2). According to the respondents, deodar trees were found in the three localities i.e. Balkore, Daskore and Jabar four to five decades ago, which has completely disappeared now. Additionally, pine species are endangered and only found scattered and few in number on the hilltops, while it was the dominant tree species of these localities in the past. Wild olive is another dominant and common tree species and found in almost all parts of the study area. It has a low timber value but it is extensively used as fuel wood throughout the study area. Olive trees

are highly appreciated for fuel and therefore, recklessly harvested both for domestic consumption as well as selling in the local markets.

At present, similar to other localities (cf. Khan & Khan, 2009) an increasing trend of selling whole forest parcels to contractors has been observed in several parts of the study area. The owners of the forests clear the area either for plantation of high valued timber plants such as pine or rapidly growing and high fuel wood yielding plants such as eucalyptus and acacia. Moreover, in several areas olive is harvested and the forest cover area is converted into agricultural land or *Karin*. However, in many cases the afforestation efforts face failure due to socio-economic and climatic reasons and the area remains barren or covered by shrubs such as switch sorrel (Fig 4.14 and 4.15). According to the elders, the area shown in fig 4.14 was densely covered by wild olive two to three decades ago, which was sold to contractors for income generation. Similar situation has been reported from Jabar (fig 4.15), where trees were sold by the local owners to a wood contractor in late 1990s for earning money. As a result of such unchecked cutting, wild olive is one of the highly endangered tree species in most parts of the study area.

Table 4.2 Disappeared and Endangered Vegetation Diversity

	Disappeared	Endanger	Increased
Khall	• Wild olive • Switch sorrel • Common myrtle • Plane	• Pine • Mulberry • Willow	• Cactus • Eucalyptus • Acacia
Balkore	• Deodar • Common myrtle • Cedar	• Pine • Wild olive • Switch sorrel	• Cactus • Eucalyptus
Daskore	• Deodar • Cedar	• Pine • Wild olive • Switch sorrel	--
Jabar	• Deodar • Cedar	• Pine • Wild olive	--
Thal	--	• Pine • Deodar	Planted species

(Field Survey, 20140)

Fig 4.14 Area Cleared from Wild Olive in a Village in Khall



Fig 4.15 Forest Parcels Cleared from Wild Olive in Jabar



4.6 Conclusion

The socio-economic transformations (discussed in the previous chapter) triggered a number of changes in various aspects of physical environment particularly land use land cover changes (cf. Liniger & Lynden, 2005). Researchers have identified a number of causes and driving forces behind land use changes (cf. Geist & Lambin, 2002; Verburg et al., 2003). Population and household dynamics along with other factors are the main driving forces resulting into substantial changes in the land use pattern and leading towards environmental degradation. “Human populations are growing in many mountainous areas in developing countries [and] concerns about harmful environmental impacts of population growth in the hills and mountains are frequently raised in research” (Templeton & Scherr, 1997: 2). Growing population and increasing number of households need more space and thus resulting into the expansion of built up areas, which engulf other land use categories.

The built up areas have expanded towards both the agricultural land and vegetation cover. In the villages with limited suitable residential land, built up areas have expanded towards the agricultural land. The expansion of built up areas towards the vegetation cover has affected the forests and rangelands both directly and indirectly. In the former case, vegetation cover areas are cleared for acquiring space for the construction of new houses. In the latter case, people who inhabit those areas use to harvest forests for fuel wood and timber resulting into the conversion of vegetation cover into barren land. A total of 17% decrease has been observed in forest cover areas during the study period. Hence, barren lands have expanded considerably along with the settlements expansion. Moreover, the species diversity has also affected along with the shrinkage of forest cover areas. Several trees and plants species have disappeared from various localities, while a number of other species is in danger of extinction.

5 CHANGES AND PROBLEMS OF NATURAL RESOURCE MANAGEMENT

“People living on hillsides and mountain slopes are literally dwelling ‘at the margin’ of society, of the national economy and of the wider biophysical environment” (Stocking, 2005: 25). Rough topographic and harsh winter conditions are the two main factors determining the availability, production and potential of natural resources in the study area. The scarce and spatially diversified natural resources (cf. Ehlers, 2008) need careful utilization and management, for which local adaptations or creative adjustments²⁸ are essential. Historically, the inhabitants of mountainous regions of Pakistan including the study area have managed natural resources through traditional approaches using indigenous knowledge about the physical and anthropogenic conditions of the area (cf. Kurien, 1995; Agarwal, 1995; Gadguk and Berkes, 1991). Village level resource management institutions, rules and regulations are formulated in such a way both to secure equity among the users and sustainability of the natural resource base (cf. Spain, 1973; Nichols, 2001; Fazlur-Rahman, 2007 a,b). However, with the passage of time and in response to demographic pressure, changing livelihood strategies and market demand, these institutional arrangements have been considerably transformed.

5.1 Changes in the Ownership of Natural Resources

For the adequate management and sustainable utilization, natural resources in the study area are kept under various ownership regimes. The allocation of resources under different ownership regimes depends upon the nature, availability, productivity, and regeneration capacity of the resources in question. Mainly, the resources of mountains are kept under four types of ownership regimes i.e. private or individual property; common property; state property; and access

²⁸ Creative adjustments encompass all the local adaptations and strategies introduced by the inhabitants in order to survive in the harsh mountainous environment and utilize the natural resources in a sustainable way. These adjustments have widely been studied and documented around the world (see: Fürer-Haimendorf, 1971; Rhoades & Thompson, 1975, Guillet, 1983, MacDonald, 1998, Ehlers & Kreutzmann, 2000, Messerli & Ives, 1997; Rahman et al., 2014)

resources. Each category has a definite set of clearly defined property rights, duties and obligations, which regulate the use of resources and govern the management strategies. Categorization of natural resources is one of the basic characteristics of the traditional mountain communities which help in the sustainable utilization of the scarce resources and smooth running of the egalitarian societies. Fazlur-Rahman, (2007b) has defined the major ownership regimes, property rights associated with each category and the benefit stream.

In the study area, similar to the other mountainous districts of northern Khyber Pakhtunkhwa, the natural resources are held by the inhabitants under de facto ownership and there is no role of the state authorities in resource management. The natural resources are kept under two ownership regimes i.e. private ownership and common property ownership, while state property is not recognizable and none of the local resources purely belongs to the state. Natural resources of the study area can be classified into three major groups; (a) Land resources which include the arable, residential and barren land close to the built up areas; (b) Water resources and; (c) Vegetation including the forests, rangelands and pastures. The rules and regulations regarding management of resources under either ownership vary from village to village. Additionally, the ownership regimes and associated property rights are continuously changing. Modifications are subject to changes in socio-cultural, political, historical and biophysical conditions in the area.

5.1.1 Resources under Private or Individual Ownership

In most cases, the ownership of property or access to the benefit stream is held by individual owners such as a person or a household. The owners have the authority to exclude non-owners and encroachments from the outsiders; however, they are bound to undertake the uses which are acceptable to the community. Generally, the private property is inheritable, and can be traded and exchanged (Fazlur-Rahman, 2007b). Nevertheless, the private ownership may not always be de jure i.e. recognized by the state authorities and in many areas the local inhabitants are the de facto owners of the natural resources. Ownership regimes vary in different villages of the study area; however arable land is the main natural resource in this category throughout the study area along with residential land and forests in some areas.

5.1.1.1 Arable Land Management

Arable land and land suitable for the construction of settlements are generally the scarcest resource in the mountainous regions; hence, considered the most precious natural assets. Arable land in the study area is classified into three main categories; irrigated land or *sholgara*; semi-irrigated land or *jwardara*; and rain-fed land or *lalma*. Although the distribution of land resources and different categories widely vary from village to village and valley to valley; however, a common vertical land use pattern exists. Generally, irrigated land is situated in the valley bottom and low lying areas of the valleys along the banks of the streams and torrents. Due to the physiographic and drainage characteristics, the landscape of the study area is modified into small valleys each drained by a central torrent/stream. Most of the irrigated lands are situated along the valley floors which can be irrigated from the stream. Hence, irrigated land is the lowermost belt in the vertical land use in almost all the sub-valleys of the study area. Semi-irrigated lands are found in the second altitudinal belt of the land use usually irrigated occasionally from the seasonal torrents and springs. Rain-fed land is found on the hillsides above the built up areas and the semi-irrigated lands. This land is generally situated above the main irrigation sources acquired through modifying the barren slopes of hills near the settlements.

Irrigated land is the most valuable land resource – due to its high productivity, scarce availability – and thus predominantly held as private property by individual owners. Irrigated land was distributed among the individuals (households or persons) through locally devised appropriation plans (see below) and frequently divided and subdivided among the inheritors according to the proportionate shares of individuals in the property locally known as *doftar* or *dawtar*²⁹. The major change recorded in the ownership of irrigated agricultural land, is the abrupt and complete individualization started in 1970s after the end of Nawab's rule. Until then, the state i.e. the Nawab was the ultimate owner of *dawtar* and all the resources within the jurisdiction of the princely state. Although the people used the lands, but there was no permanent private ownership

²⁹ *Dawtar* is a common local term, which refers to the sum of all the local resources including land, natural vegetation and water. The people, who are the bonafide residents of the community in question, possess shares in *dawtar* and hence, have fixed rights in all the available natural resources. Such people are referred to as *dawtarian* in contrast to the non-bonafide residents, usually the in-migrants, who do not have ownership rights in *dawtar* and the associated benefit stream. This term has been extensively used in literature, spelled sometimes *doftar* or *daftar* as well (Zarin&Schmidt, 1984; Sultan-i-Rome, 2005, 2008; Nafees et al., 2009; Rahman et al., 2014).

– except in the villages, which belonged to the people loyal to Nawab. The people used to occupy different areas and cultivate land on temporary basis for a fixed period of time and then shift to some other places and utilize the resources there under the traditional circulatory tenure system. However, when Nawabism came to an end, the people belonging to the then major tribes, Sultan Khel and Painsa Khel and some minor tribes occupied the respective valleys where their members were residing. This was the start of permanent distribution of *dawtar*/resources.

Presently, irrigated land has been distributed permanently among the owners of *dawtar* and still continuously being fragmented according to the law of inheritance. The property rights and benefits extracted from the irrigated land purely belong to the individual owners. Nevertheless, there are certain duties related to the utilization and management of land, which are imposed by the village community and the owners have to respect those customary regulations. Some of the general and common regulations regarding the use of cultivated land under private ownership practiced throughout the valley are discussed here.

Cultivated fields are used as grazing grounds after the crops are harvested. Livestock can freely graze on crops residue anywhere and the owner can impose no restrictions on such grazing or entry of animals regardless of residential status i.e. either bonafide with share in *dawtar* or non-permanent migrant members of the community. In villages – where agro-forestry is practiced – the animals are not allowed to enter the fields in order to keep the plants protected from being grazed. In such villages, even the owner of the land is not allowed by the community to use his un-cropped fields for grazing purposes.

After new crops are sown, the fences are repaired and ban is imposed on the entry of livestock into the fields. The fields situated along the paths and roads, need to be protected from the entry of grazing animals on the way to and from the rangelands³⁰. The owners of the fields bordering the paths have to construct and maintain the protection fences along the path or road to protect the whole parcel of cultivated land. Additionally, due to limited availability of flat grounds for drying and threshing the harvested crops – particularly wheat – such activities are undertaken within the cultivated fields in the fallow period. The land under the ownership of any member of

³⁰ In many cases, the standing crops of a whole parcel of cultivated land belonging to a number of owners are harmed by the grazing animals entering through a single damaged point in the fences along the paths. Particularly the *Karin* (the poorly structured rain-fed terraces) in almost all the villages of the study area, are exposed to such kind of harm.

the community, where fields are open and large enough for drying and threshing, can freely be used for this purpose by anyone in the village. The fields are also used as passage ways for tractors and threshing machines reaching the threshing sites, however, the users are bound to pay the cost of reconstruction.

In irrigated fields, the water courses are distributed throughout the land and may have passed through the middle or a side of the field. The water courses are locally called *lakhty* and are one of the most important traditional infrastructures made and maintained by the community. In most cases, the water courses are narrow conduits made with the soils of the fields and are seldom concrete. The water courses running through the field are cleaned and repaired by the owner.

5.1.1.2 Management of Built up Area

Residential land is very scarce in the study area and is only available in the valley floors and gentler slopes of the lower altitude hills. In the past due to low population and smaller number of households, the village residential areas were treated as common property. Those who needed to construct new dwellings, used to go for any suitable place in the village territory and build houses there without any restrictions from the rest of the community. The only condition for occupying an area and constructing a new house was to be a bonafide member of the community and possess share in *dawtar*. During the time of feudal system – when there was no permanent ownership of natural resources – the temporal tenure and frequent shifting of families from one place to another resulted into temporary settlements. Thus, there was no concept of permanent appropriation of residential land among the individuals of the community.

When the feudal system came to an end the people started to settle permanently, but due to sufficient availability of space and the smaller number of owners, the residential land was kept common. Still there are a number of villages where residential land is not privatized and people construct houses in common areas. Such type of construction in the community land resulted into severe complications and conflicts in the management and common property. The inhabitants of the villages started to compete for better places and to occupy as much land as possible. Moreover, the continuous growth in population and number of households further aggravated the situation, thus leading to private ownership.

Presently, the communal management of residential land is practiced in few villages of the study area, which is due to low land values or complications in the process of privatization. In most of the villages, residential lands have been measured in local units usually *gaam*, which equals to 160 square feet. After measuring, the area is divided into plots or strips locally called *barkha*. The *barkha* are distributed among the co-owners proportionally to their shares in *dawtar*. To avoid conflicts and biasness in allotting plots/*barkha* to the individual, the traditional lottery system or *khasanry*³¹ is followed (Fig 5.1). However, prior to the process of drawing lots, land for certain community services such as roads, mosques, paths, graveyards and water reservoirs etc. is specified from the common land. Hence, when the land is privatized, the resultant private property purely belongs to the owner and he can hold back the encroachments made for any communal uses; nevertheless, exceptions do occur.

Fig 5.1 Measurement and Individualization of Land³²



³¹ *Khasanry* refers to the traditional method of drawing lots through which land and other resources are allotted to the users (Zarin&Schmidt, 1984; Sultan-i-Rome, 2005, 2008; Nafees et al., 2009). It is also known as *pacha* in some areas due to the use of small pellets or pebbles (*pacha*) as draw representing the names of the shareholders or co-owners. Each of the shareholders chooses a pellet or pebble to be his draw. All the pellets are then handed over to a third person who collects them into his lap. A plot is specified and the man is said to pick a pebble anonymously and thus the land is allotted to the person whose draw came out from the lap.

³² This picture was taken recently in village Shalkani in Khall region of the study area. In this village along with a number of other villages in the surrounding areas, the residential lands and village's barren lands are still under common property ownership due to a number of reasons, mainly conflicts in the process of individualization. The inhabitants of these villages are presently making attempts to complete the process of distribution of property among the co-owners.

5.1.1.3 Management of Privately Owned Forests

One of the important aspects of changes and transformations in the study area is the change in ownership of forest resources. In the past – before the political change in 1970s – forests were held and managed as common property resources in most parts of the study area. The forests of more remote and high altitude mountains were treated as open access resources, which were hardly accessible and hence not claimed by any community. Nevertheless, whether under common property or open access, the forests were ultimately the property of the feudal rulers. During those times – according to the elders – there was no concept of private ownership as forests were available almost everywhere in the study area.

Moreover, the small population and less number of dependent users could easily fulfill their needs for fuel wood and timber without threatening the sustainability of forest resources. Therefore, the private ownership of forests did not matter; instead people prefer to keep these valuable assets as common property. The common property ownership was considered to be more effective for the management and sustainability of forest resources under strong institutional arrangement of duties and obligations. However, with population growth, socio-economic changes and increased demands for forest products, the common property resources are exposed to overexploitation and degradation. This threat of common property degradation was one of the important factors which ultimately resulted into the privatization of commonly owned forest resources in majority of the small valleys and villages. Nevertheless, sustainability was not the only issue behind the change in the ownership of forest resources.

Presently, forests in many areas are held under private ownership or by a small group of individuals or families. In private ownership, the owners are not bound to community's rules and regulations in the utilization of owned forests. Commercial exploitation of fuel wood and timber is generally banned in common property forests, while in individual ownership; the owners are free to sale forest products. Additionally, individual owners can freely extract fuel wood, fodder and timber for their domestic uses round the year. The owners can also sell or exchange the whole forest parcel either the standing trees or the whole share.

Hence, on the one hand, privatization is a strategy against the overexploitation of common property forests on competitive basis. But on the other hand, the relaxation of communal rules

and regulations in individual ownership results into the unchecked utilization of forests both for domestic and commercial purposes. According to the local elders, the forests of Khall, Balkore and Daskore as well as a number of other villages were relatively more protected in communal ownership until the late 1980s. The commercial utilization of forests in these areas under individual ownership was the major setback of privatization which accelerated the rate of deforestation manifolds. In several areas, parcels of barren land can be observed within the dense vegetative covers resulting from the commercial harvest of individual forest shares.

5.1.2 Resources under Common Property

Common property refers to the property which is held by a group of people such as village community, a clan or tribe. Under this ownership, the co-owners have right of access to the resources and the benefit stream is shared under a predefined appropriation and extraction plan. The common property resource management systems and the rules and regulations governing the distribution of benefits among the co-owners vary widely from village to village. Common property is held by a fixed number of owners and the benefits are distributed proportionately to the shares of the individuals or on equity basis in some cases.

The shares of the individuals are not equal everywhere determined by various factors such as the overall natural resource management system and several other socio-political and cultural elements. The extraction of benefits from common property resources and the patterns of utilization also vary, depending on the nature and importance of a particular resource to the user groups. Moreover, selling in common property resources is generally not permitted by the community. At present, three major natural resources are kept under common property ownership in the study area including water, rangelands/pastures and forests.

5.1.2.1 Water Resource Management

There are two major sources of water in most parts of the study area i.e. springs and streams. Wells in rare cases are found in Khall area. Water for drinking and domestic purposes is available in form of springs in most parts of the study area with a few exceptions. In case of irrigation, water is a scarce resource in areas such as Khall, Balkore and Daskore while sufficiently available in other areas such as Thal and Jabar.

The supply method of drinking and domestic water varies both spatially and temporally. The data reveals that in past majority of the respondents i.e. 55.8% supplied water to home through self fetching while 30.8% used animal power for fetching drinking water. Pipeline water supply schemes were rare and available only to 13% of the surveyed households (Table 5.1). Presently large majority of the households use pipeline supply systems. Variations can also be seen among the villages as in Khall 95% of the households have pipeline water supply schemes while the trend of using animal power has completely abandoned. The pipeline supply schemes in majority of the villages are installed and managed on cooperative basis. Nevertheless, in a number of villages in the low lying areas, water supply schemes are provided by government to the majority of households.

Table 5.1 Change in Supply Methods of Drinking and Domestic Water in the Study Area

Study Area	Pipeline water supply		Self-fetching		Through donkeys	
	2014	40 years ago	2014	40 years ago	2014	40 years ago
Khall	95	25	5	54	0	21
Balkore	75	6	15	54	10	40
Daskore	68	9	16	63	16	28
Jabar	85	24	13	60	2	16
Thal	54	3	40	48	6	49

(Field survey, 2014)

The water rights of individual households and the utilization patterns are determined by a number of factors varying from village to village. In most cases, the whole village community depends on a single springs for fulfilling drinking and domestic water needs. The water from the spring is stored into a tank/reservoir usually constructed and maintained by the community. A high site is selected for the installation of tank and water supply scheme in order to bring majority of the households under its command. The individual pipelines are connected to a main pipe taken from the tank and in most cases guarded by a regulating valve. The availability of depends on the capacity of spring in question and the number of users. Usually, an operator is appointed by the community who takes care of the maintenance and schedule. The operator is paid in cash on monthly basis and the money is collected on per connection basis. In case of repairs and maintenance, the expenditure is equally contributed by the community under the same rules.

Irrigation water is managed and utilized as common property resource throughout the study area with village to village variations in water distribution rights and allocation system. Utilization rights in irrigation water are basically allocated to the lands not to the people, whether the land belongs to the bonafide residents or not. The most common method used for the distribution of water rights is the weekly turn-wise or *wara bandi* system practiced widely throughout Dir Valley as well as in the sample villages. Share in water usage is usually determined by the size of landholding or *dawtar* shares in most of the villages. Two major types of *wara bandi* system can be observed in the study area i.e. one with weekly rotation and other with no rotation. In some areas, the turn comes each seventh day on a fix basis i.e. every land owner can use water on a certain day of the week for a fix number of hours according to the size of landholding or *dawtar* share. On the other hand, in the system with weekly rotation, six days of the week are allocated among the users, while the seventh day is kept free in order to rotate the turn. Hence, an owner having water turn on Saturday in the first cycle, will have his turn on Friday in the second cycle i.e. one day earlier in the forthcoming week.

As mentioned earlier, irrigation water is either drawn off from the streams or, in other cases; spring water is stored in small reservoirs. In the former case, fix number of hours is allocated to the water users on weekly basis. In the later case, the water is stored in the reservoir and released to the fields two times a day i.e. once in the morning and then in the evening. However, with the expansion of pipeline supply methods from springs to the homes, the performance of reservoir irrigation has declined drastically in the recent past. Presently, this tradition is very rarely practiced as the spring water is diverted into pipelines and there is no extra discharge to be stored in the reservoirs. In many areas, abandoned reservoirs can be seen revealing the history of this traditional irrigation system and its gradual abandonment.

5.1.2.2 Management of Communal Forests

Presently forests are mostly held under private ownership (see 5.2.1.3) but still the communal ownership is not fully abandoned. The rules and regulations for the management of common forests are almost similar throughout the study area with slight variations. The specified user group of communal forests varies in different areas. It may consist of the members of a clan/lineage/tribe, a village community or the inhabitants of a whole small valley consisting of a number of villages. In any case, each member of the user group has the rights to withdraw

benefits from the common forests according to well defined rules. The property rights or share in the benefit stream of individuals in the user group is on equity basis in certain cases, while in other areas; the rights of individuals are defined by the shares they possess in *dawtar*. Additionally, each member of the user group is bound to perform certain duties regarding the protection, conservation and utilization of communal forests.

The extraction of forest products under communal ownership is governed under community rules and regulations in all the sample sites as well as in other parts of the district. At present, in Balkore, Daskore and Jabar, the forests are relatively less dense and trees can only be found in limited number on the hilltops. The forests close to the residential areas have been measured and allotted to individual clans and lineage groups, while forests at higher elevations are usually kept as communal resource. The unrestricted extraction of fuel wood and timber has led to severe deforestation; implying modification in forest utilization rules.

The cutting of standing trees for timber and commercial uses is now strictly banned in these areas to prevent further deforestation. The extraction of fuel wood is banned in almost all the villages, with relaxation for a short period of one or two months in winter. During the ban period, the forests are guarded by a person – known as *kakhy* – appointed by the community and paid either monthly in cash or in the form of grains in each cropping season. The *kakhy* monitors the utilization of forest products both by the user group and the outsiders/free riders. When the ban is relaxed, the members of the user group extract a specific quantity³³ of fuel wood from the forests on daily basis. The quantity of forest products extracted daily varies from village to village determined by certain local rules and regulations. In some areas, the quantity is fixed according to the shares of the members of user group in *dawtar*, while in some other areas; the quantity depends on household size. Contrary to this, in several areas the products are extracted on per-household basis and this pattern is locally known as *da logi pa sar*, which means per kitchen.

In Thal region, forests at high elevations (Kumrat) are managed under a strong institutional mechanism. The community have established checking points on the roads coming down from the forests and appointed security guards. Regular salaries and allowances are paid to these guards by the community. The guards check each vehicle coming from the forests loaded with

³³ The quantity is usually measured in head loads. A normal head load weighs up to 40 kg.

dead fuel wood. In case if someone is caught bringing green wood, is handed over to the community and fined by Rs. 100,000, which is a heavy amount. These institutional measures – according to the elders – have brought about positive outcomes in protecting these highly valuable forest resources. Unfortunately, these measures are confined to the high altitude deodar forests, while at lower elevations private ownership restricts the application of rules. The major factor behind the abandonment of common property ownership is the weakening of traditional management institutions, which is also a product of several other factors such as out-migration. Consequently, the forests are threatened in either way as under private ownership, there are no community restrictions, while in common property the governing institutions have become less efficient.

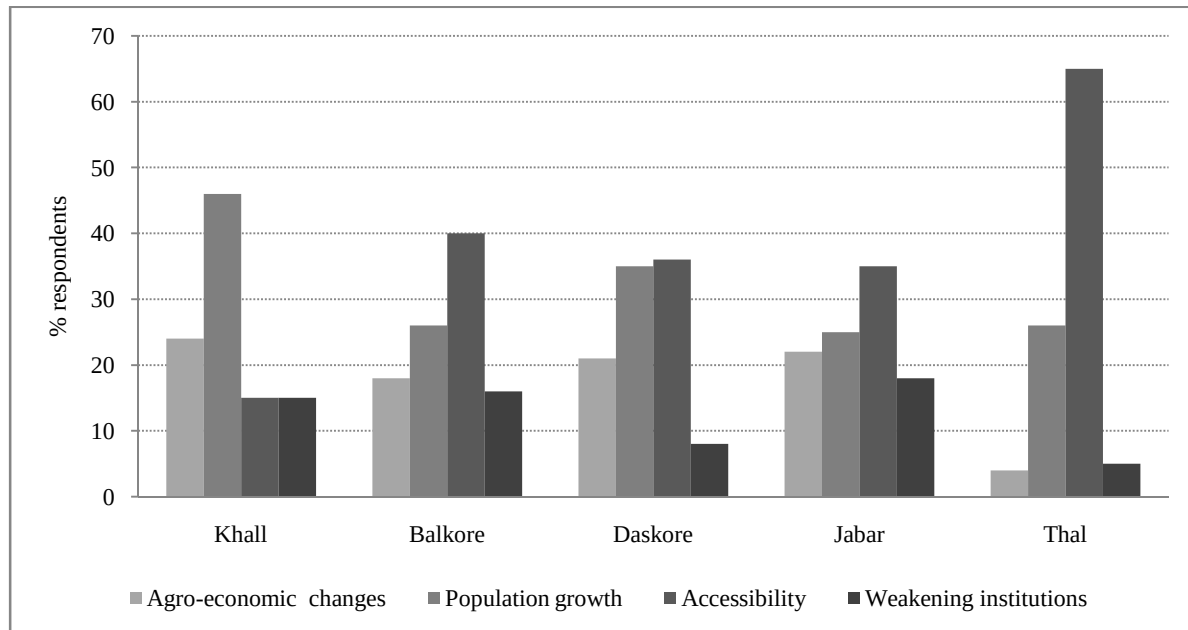
5.2 Socio-Economic Drivers of Deforestation

Forest cover degradation and the changing composition of plant species is a complex process governed by a variety of factors and thus it is difficult to generalize the drivers of deforestation. Barbier & Burgess, (2001: 417) have identified the key factors which have a major role in tropical deforestation both within and across the countries. According to them, “these factors include, income; population growth/density; agricultural prices/returns; agricultural yields; agricultural exports/export share; lodging processes/returns/production; roads and road buildings; sale factors (size of forest stock, land area etc.); institutional factors (political stability, property rights, rule of law etc.)”. Although, these factors may be considered as the common driving forces of forest cover degradation; however, the intensity and nature of impacts of various drivers vary from region to region.

Therefore, it is difficult to make any generalization about the drivers of deforestation, which may be applicable to all the mountainous regions. Any such argument can be more appropriately made for micro-regions after in-depth studies of the forest cover dynamics and the governing factors. Data analysis reveals that deforestation is triggered off by the changes in several aspects of the socio-economic setup. The major factors which have played a crucial role in deforestation in the study area include; population growth and household dynamics, economic and agricultural changes, accessibility, and the transformation of management institutions. According to majority of the respondents population growth – along with the associated household dynamics – and the

substantial improvements in accessibility are the two important factors responsible for the rapid rate of deforestation in the study area (Fig 5.2).

Fig 5.2 Perception of the Local Inhabitants regarding the Drivers of Deforestation



(Field survey, 2014)

5.2.1 Population Growth and Deforestation

According to Ali et al., (2005: 371) “...the conventional view on deforestation in Pakistan is that rural people overexploit the forests for local consumptive use. This view implies the projection of a simple relationship between deforestation and population growth in the Hindukush Himalaya region, which assumes that rapid population growth is the main factor that has led to [the degradation] of forest cover”. This was proposed by Ives, (1987) in ‘The Theory of Himalayan Environmental Degradation (THED)’, which attributed the high rates of deforestation in the Hindukush-Himalayan belt to the unprecedented growth in human and livestock populations. Although this theory “has later been criticized based on empirical evidence arguing that the alleged relationship between deforestation and population growth is based on inadequate and questionable data” (Ali et al., 2005: 372); nevertheless, it provided a platform to scientific debates and research on this extremely important environmental issue.

The hypothesis of THED is supported by the findings of several studies (Sharma & Banskota, 1992; Pretty, 2003; Fazlur-Rahman, 2007b, 2009; Owen et al., 1998; Steins & Edwards, 1999; Eckholm, 1975; Jodha, 1992, 2007; Rahman et al., 2014), along with identifying a number of other driving forces. “Globally, the trend of accelerated environmental degradation in recent times has primarily been driven by land use changes as a consequence of frontier expansion and population growth. [...] Population growth is undoubtedly one of the most critical socio-economic factors that could alter the pattern of forest resource use” (Giliba et al., 2011: 31). The empirical evidences of the present study as well as the narratives about the correlation between population growth and deforestation support the argument that the forest cover is negatively affected as the population grows.

Population growth has affected forest cover of the study area in two ways firstly by overexploitation of forests and secondly by triggering off the underlying drivers such as household dynamics and expansion of built-up area. The forest fringe population directly depends on these resources for a number of basic household needs such as fuel wood, timber, fodder and selling. Hence, as a simple correlation, the pressure on forests for the extraction of these benefits has multiplied as a result of population growth during the last four decades. “As population increases, the supply of people who clear trees increases and the demand for products from forests or forest land grows too. As a result, a larger area is deforested and biodiversity diminishes” (Templeton & Scherr, 1997: 28).

Majority of the elders interviewed during field work were of the view that, in the past wood was available in abundance, everywhere and closer to the houses. The built up areas of those times seemed to be surrounded by forests from all the sides and nobody needed to cut the green trees and store wood for fuel purposes. The dry and dead wood fallen from the trees was available in the nearby forest covers and the people used to collect it on demand basis. There was no trend of storing fuel wood for long times except in the areas where due to severe snowfall in winter, the inhabitants used to collect enough fuel wood in the summer months. As a result of population growth and excessive collection of fuel wood, dry wood is no more available and the people started to cut green trees and shrubs.

Presently, dry wood is only available in the deodar forests of the higher altitudes in Thal region. Large number big dead trees of deodar and pine can be seen fallen in the forests at higher

elevations in the Thal region (Fig 5.3). According to the elders, a mature deodar tree has a minimum life of one hundred years as well as after falling, it resist decomposition for another 100 years.

Fig 5.3 Dead Fallen Trees in the Forests of Thal



It was observed during the field visits that the dry fallen wood is collected extensively in the summer and transported to the permanent settlements usually through running water (Fig 5.4). Due to non-availability of dead fallen wood close to the permanent settlements, people now travel long distances to the higher elevations in order to collect and store enough wood for winter. In many cases, to meet the demands, standing trees in the nearby forests are cut down, which has further worsened the situation and the vegetation covers close to the villages are rapidly deteriorating. A study on the drivers of deforestation in Basho Valley, northern Pakistan carried out by Ali et al., (2005: 376) also finds the same result and one of his narrations with the elders is quoted here.

According to the village elders, dead and fallen wood is no longer easily available in the forest as it was in the past. Therefore, people (mostly young girls responsible for collection of fire-wood) have to travel longer distances to collect wood. According to the two elderly women interviewed who have been collecting wood in the forest for the last 40 years, before the period of commercial harvesting, dead and fallen wood in nearby forest areas was sufficient to meet local fire-wood needs. People did not need to cut standing trees for this purpose.

Fig 5.4 Transporting Wood through Running Water in Thal



5.2.2 Household Dynamics and Deforestation

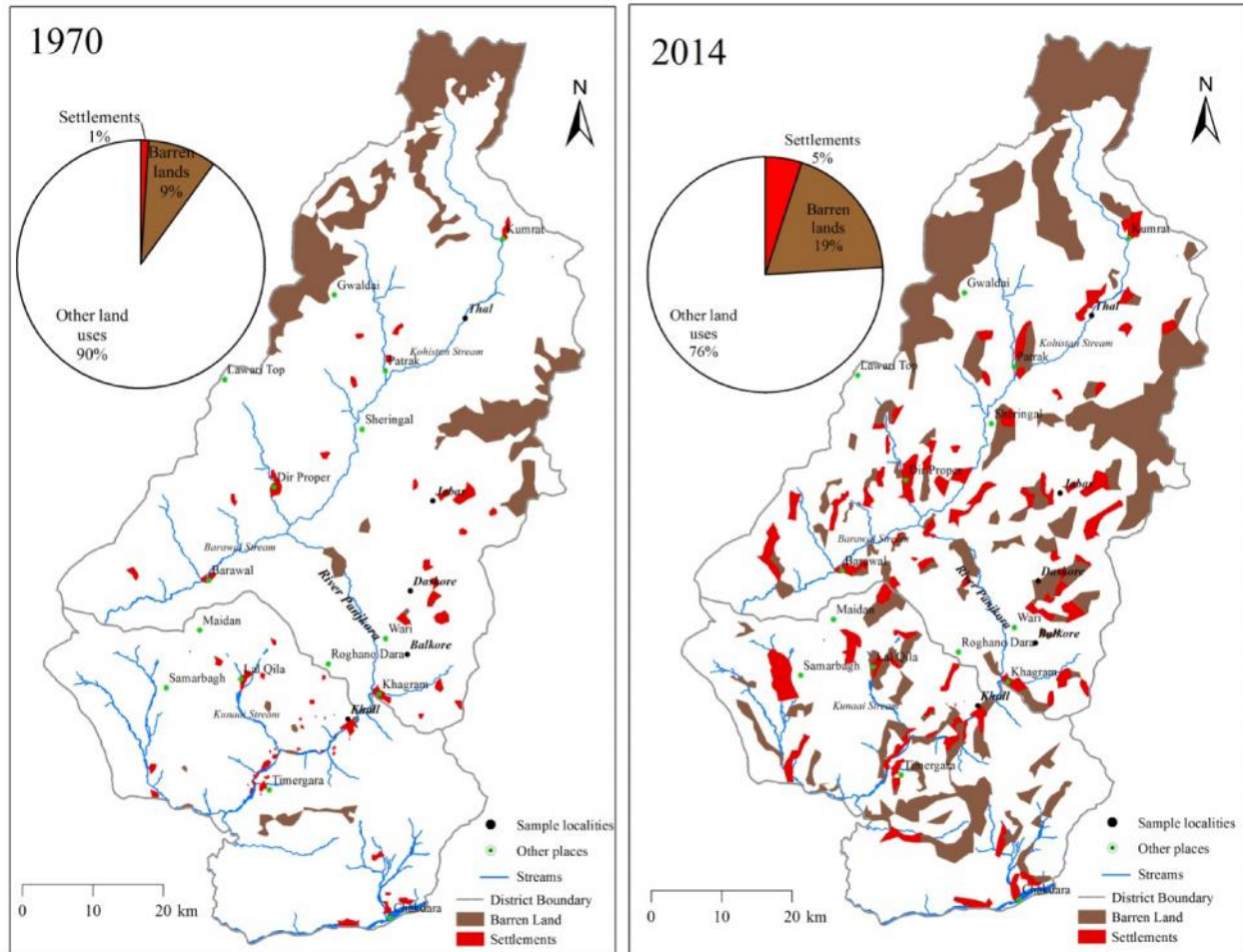
The changing housing conditions have brought about a number of consequences on the bio-physical setup. The increasing number of households and decrease in the average household size of the study area has affected the forest cover in two ways. On the one hand, the increasing number of households – as a result of population growth and increasing trend of single family system (see section 3.3) – has resulted in the expansion of built up areas, while on the other hand, the pressure on forests for the collection of timber as well as non-timber forest products (NTFPs) has increased.

5.2.2.1 Clearing Forests for the Construction of Settlements

There were fewer families in the past and built up areas were smaller. Living in the form of single families and scattered settlements was restricted by a variety of physical and socio-cultural factors covering 1% of the total land of the study area (Fig 5.5). The increasing trend of single family system has resulted into expansion of built-up areas throughout the study area. Limited availability of built-up land in the main villages is leading towards scattered settlements. Presently, the built up area of the valley constitutes 5% of the total land surface compared to the 1% in 1970 (Fig 5.5).

Although, built up areas have expanded to the agricultural land as well; but, due to the scarcity of cultivable land the expansion is more towards the forests and grazing grounds. Clearing of forest areas for construction of dwellings has become a common practice. A study conducted in the village Ambodiaviavy in Madagascar (Harrison, 1992) has illustrated the correlation of household dynamics and deforestation as, in 1947; a total of 32 people in eight families came and settled over in to this dense forest cover area after their old village was burnt by French colonials. Until 1990s, the valley bottom lands filled up completely and the new couples started to clear forest on the valley slopes. As a result of this expansion, in a period of about four decades, two third of the forests of the valley were cleared by the people.

Fig 5.5 Expansion of Residential and Barren Lands from 1970-2014



Another important aspect of the expansion of settlement area is a regular pattern of the expanding barren lands. Fig 5.5 reveals that wherever built up areas are expanded barren lands have also increased. During the last four decades, the proportion of barren lands has increased from 9% to 19% and this increase has engulfed vegetation cover i.e. rangelands and forests. The settlements not only need space for which the forest area is cleared, but also the nearby vegetation is further deteriorated and converted into barren land as a result of regular extraction of fuel wood and timber. Therefore, the forests are continuously squeezing and concentrating in the northern parts only as the built up area is expanding in the south.

5.2.2.2 Increase in the Use of Forest Products

Due to a smaller number of households in the past, the use of timber and fuel wood was negligible compared to the regeneration capacity of natural vegetation. The people used to live in joint and extended families in single room houses. At maximum, a few standing trees were cut once in several years for the construction and repair of houses and livestock shelters, if the dry wood didn't meet the demands. Similar to other mountainous regions of Pakistan as stated by Ali et al.,(2005: 376) "...the majority of houses built before the 1980s consist of a single room partitioned into a bedroom and a kitchen [...] as there was no tradition of building big houses, timber was needed in limited quantities". Moreover, fuel wood was also consumed in limited quantities.

The situation changed after the drastic socio-economic and cultural changes, and raised living standards of people during 1970s and 1980s. During the 1980s and 1990s, the increasing trend of constructing big houses with multiple rooms – separate guestrooms, kitchens, animal sheds and several living rooms – multiplied the consumption of timber. Presently, even the smallest house with a household size of two heads (the spouses) consists of at least four rooms i.e. a living room, a guestroom, a kitchen and an animal shed.

The abandonment of single room houses and the transformation of joint and extended families increased substantially the consumption of firewood and timber. An elder in Balkore narrated the increase in consumption of firewood with the disintegration of joint families in these words. "In the early times, there were few families collecting dead wood from the nearby forests in the quantity they needed. When one family disintegrates, each of the resultant single families collects and consumes almost the same quantity of wood which was enough for the entire joint family. It means that the consumption of wood increases directly with increase in the number of new families. On the one hand, as mentioned earlier, the new families need space outside the main built up areas and in most cases the space is acquired through clearing forest areas (Fig 5.6). On the other hand, the use of timber has increased many times for the construction of new housing units.

Fig 5.6 Clearing Forest Areas for Construction of Settlements



Due to excessive use of timber until late 1990s (Fig 5.7), presently timber is not available locally in the low lying areas and the inhabitants are fully dependent on other building materials such as cement and iron. Although, the tradition of concrete houses has reached to the remote mountainous areas as well, still majority of the inhabitants of high altitude villages such as Thal

depend on local building material. Additionally, the inhabitants of such cold areas prefer to live in houses made up of wood and mud, which are relatively more weather-friendly than those composed of bricks and cement.

Fig 5.7 House Constructed in 1984, Presently used as a Shop



Nevertheless, majority of the inhabitants in the forest fringe and remote villages still depends on forest products for the construction of houses and livestock shelters. Deodar wood is preferred due to its high resistance against termite and rain water. Pine trees are the other major timber sources; although, it is decomposed quickly and easily by termites and water. In the low lying areas e.g. Khall and the surrounding villages, timber for construction purposes is not available locally, so the people either purchase it from the market or get it through illegal means. For this purpose, people in need of timber make a deal with forest owners directly or with the contractors in the upper parts of the study area. The timber is then supplied using the alternate routes in the mountains away from the main road, where there are no forest check-posts and risk of being caught by the forest department people.

In Balkore, Daskore and Jabar, pine wood is used as timber, either from local forests or brought from nearby valleys. However, the unchecked exploitation of timber has resulted in severe

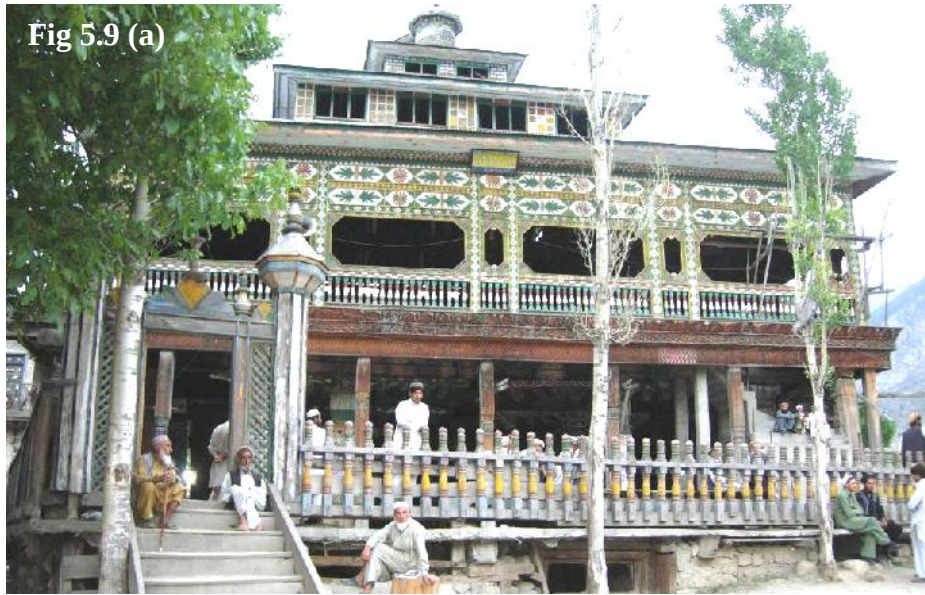
deforestation and presently the wood is hardly available locally. Deodar is currently available only in Thal region where it is used in the construction of buildings (Fig 5.8). The wood is neatly cut into files with two to four inch width, which are used in the form of supporting frames to the stone blocks usually granite. Round wooden logs of hard wood are buried vertically inside the walls which act as pillars to withstand the roofs. There are a few persons in the whole region, who are skillful in the construction of such strong and long standing structures from these locally available materials.

Fig 5.8 Present use of Timber Wood in Construction of Houses



In the lower parts of the valley – as the timber is not available locally – the inhabitants cannot afford to use timber in other infrastructure and only use it in the construction of houses and animal sheds. Contrary to this, in forest fringe areas particularly at high altitude in Thal and the rest of Kohistan region, timber is not only used in the construction of houses but used extensively in a number of other structures as well. The building shown in fig 5.9(a) is a mosque constructed a few decades ago with timber as the only building material. The pillars of the mosque are made of thick tree trunks (Fig 5.9b) with big logs placed over horizontally in the form of beams supporting the roofs.

Fig 5.9 The use of Timber and Non-Timber Wood in Various Infrastructures



The bridges all over the area are also made up of the highly valued deodar wood through community efforts and using indigenous skills (Fig 5.9c). Besides these pedestrians' passageways, the bridges used for vehicles transport are also constructed by the community using thick logs (Fig 5.10). Another major use of wood can be seen in the fences of cultivated fields (Fig 5.9d). In Thal, electricity is produced locally through small hydropower plants and wood is the main material, which constitutes the infrastructure. Besides the buildings of power plants, the electric poles used in electricity supply systems are also made of wood trunks (Fig 5.9e).

Fig 5.10 Locally Constructed Wooden Bridge in Thal Village in Thal



5.2.3 Accessibility, Economic Development and Deforestation

Accessibility is probably the most important factor behind deforestation in the study area as in other mountainous regions (cf. Allen & Barnes 1985; Kreutzmann, 1991, 1993, 1998 Kreutzmann, 1998, 1999; Uhlig and Kreutzmann, 1995; Grotzbach, 1984; Allan, 1985, 1986, 1989; Ali et al., 2005; Israr-ud-Din and Fazlur-Rahman, 2003; Khan and Khan, 2009). Accessibility was very limited and transport system was undeveloped until 1970. The

construction of roads and improvement in accessibility opened the way for economic development and improved the living standards of inhabitants at the cost of ecological disturbances. Unlike the findings of Khan & Naqvi, (2000), the elders of the study area perceive a positive correlation between economic development and deforestation. Khan & Naqvi, (2000) has referred to the 'environment-poverty nexus' concluding that being poor means more dependence on natural resources and ultimate degradation of the local environment. However, the present study does not support this assumption and finds that the socio-economic developments since 1970 have exposed forests to the process of degradation.

A study conducted by Khan & Khan (2009) on poverty-deforestation link also reveals that deforestation is accelerated by economic development and poverty alleviation. The study urges that, "...if, as generally believed, the poor do indeed depend more on natural resources for their livelihoods, then in principle they could be contributing relatively more to resource degradation, even if not absolutely so. We find no support for the hypotheses that resource degradation is inversely associated with income or that poverty and forest degradation are positively associated" (Khan & Khan 2009: 2609). There are several other studies which reject the hypothesis of poverty as a driver of forest cover degradation and suggest that although the poorest may be more dependent on forests but they cannot be blamed for deforestation (Deininger & Minten, 1999; Swinton et al., 2003; Ravnborg, 2003). Another study states that poor people do not have easy access to the valuable resources, while the prosperous families may cause more harm in terms of degradation (Agudelo et al., 2003). Moreover, as stated by Jodha, (1998), the poorest people have more reasons to preserve and protect their ecological resources as they are more dependent on them than those who are in well-to-do conditions.

The same argument is predominantly and unanimously supported by the inhabitants of the study area. The elders linked poverty with accessibility and perceived that until the people were poor, the accessibility was limited and the local ecological diversity was protected. The economic transformations of the late 1970s and 1980s resulted into considerable improvements in accessibility and road networks which exposed forests to overexploitation. The forests of the upper parts of the study area were protected as it was very difficult to transport bulks of timber and fuel wood due to the lack of roads. Presently the high altitude mountains and even the alpine pastures have been linked to the low lying areas. Although, most of the roads to the high

mountainous areas are unpaved, but still suitable even for heavy vehicles such as tractor trolleys and trucks etc. (Fig 5.11). The truck shown in Fig 5.11 is being loaded with fuel wood extracted from deodar trees in the high altitude forests of Thal. This route has exposed the dense and intact forest cover to the process of commercial harvesting as well as to a high rate of fuel wood extraction by the local inhabitants.

Fig 5.11 Truck Route in the High Mountains Forests of Thal



The main road connecting the lower villages of Kohistan region to Dir Town was constructed during the 1970s and the extensions were made later on resulting into a network of roads running to the far-off villages and forests. Initially, the inhabitants of the area used to harvest timber, transport it to Sheringal (a trade center located the way from Dir to Thal) and sell it to various business parties. This method of commercial harvesting caused little harm as the local inhabitants were not capable to cut and process huge volumes of timber and fuel wood to the town. According to the local elders, later in 1990s, the contractors and officials of the Forestry Department established wood processing factories (Fig 5.12) near forests in Thal and started to harvest and transport bulk of timber. The contractors use advance machines and heavy vehicles

to cut and transport the wood resulting in a high rate of deforestation. According to the local stakeholders, forest owners receive about 10 to 20% of the income, while the rest of 80 to 90% goes to the contractors and forest officials.

Fig 5.12 Timber Processing Center in Kalkot Village near Thal



5. 3 Conclusion

Mountains provide vital natural resources both to the communities living here as well as to the people of the low lands and those living in their proximity (Fazlur-Rahman, 2007b: 1). Due to landscape variations, the altitudinal compression of climatic zones, mountain ecosystems are characterized by high biological diversity (IPCC, 2007a,b; Körner, 2009a,b) and are home to more than half of the world's biodiversity (Hassan et al., 2005). Natural resources of mountainous areas and hillsides are fragile and precarious making them sensitive to changes in land use, environmental conditions and various external factors such as political instability and conflicts (Helleman et al., 2005).

The locally available resources are of vital importance to the inhabitants as they depend either partially or fully in remote regions for their domestic needs. The inhabitants of such areas have a better understanding of their local environment, opportunities and threats and are therefore aware of how to manage the assets provided by nature (Johnson et al., 1982; Zurick, 1990; Ning, 1997). Using their traditional environmental knowledge, the inhabitants have devised institutional arrangements for the management and utilization of natural resource. With the passage of time and demographic changes, the indigenous resource management systems and institutions have undergone various transformations. The ownership of natural resources and the associated property rights have changed and modified which have resulted into a number of positive and negative outcomes.

Forest resources in particular, have been subjected to the process of degradation during the last few decades. Institutional weaknesses and changes in the ownership and utilization patterns have played an important role in the ongoing deforestation. In the past, forest resources were held under common property ownership. The rules and regulations governing the utilization and management of forest resources were formulated and implemented by the local communities. With the passage of time and changing circumstances, forest resources in most parts of the study area were privatized and communal management was abandoned. As a result of this change, the communal restrictions on commercial harvest and rules for the extraction of timber and fuel wood were released and the forests were exposed to overexploitation. Other drivers of deforestation include population growth, household dynamics and construction of roads to the remote and high altitude forests.

Global environmental change has become one of the important subjects of interest for researchers around the world in the recent decades and extensive research is carried out on this issue particularly in mountainous areas (Kozak, 2003; Peco et al., 2006; Falcucci et al., 2007; Korner, 2009; Bjornsen, et al., 2012; Price & Weingartner, 2012). Globally, mountain ecosystems are changing due to high rates of coupled physical and socio-economic transformations (Messerli, 2012; Gret-Regamey & Brunner, 2010; Oldfield & Messerli, 1999). Mountain researchers describe the changes in three broad aspects including biophysical systems, socio-economic systems and natural resource management systems. While having a glance to the existing literature, it can be found out that several changes have occurred in all the three major aspects of mountain environment around the world (cf. Nancy, et al., 2013; Amanda, et al., 2013; Thomas, et al., 2008; Ruiz-Labourdette et al., 2013; Creeden et al., 2014). All these systems are interlinked and the transformations in one set affect the other associated systems and bring about changes in various aspects.

The process of environmental transformations is actively taking place in the mountainous areas of Northern Pakistan and changes have been occurring in various aspects of physical, socio-economic and natural resource management setup for the last three four decades. The major biophysical changes include; decrease in per capita and per unit crop yield, decline in natural resource base and productivity of resources, decrease in irrigation water, overuse of forests and common property resources, land degradation, deforestation and loss of biodiversity, changing patterns of rainfall and temperature, increase in the occurrence and intensity of natural hazards and extreme weather events. These changes have occurred in a very short period of time driven by various natural and anthropogenic forces, and are still going on (Ali et al., 2006; Fazlur-Rahman, 2007a, 2007b; Flint, 1994; Gautam, et al., 2003; Nüsser 2000; Nüsser & Clemens, 1996; Rahman et al., 2008; Schickhoff, 1995; Stellerecht, 1997, 1998; Rahman et al., 2014).

The socio-economic setup of this mountainous belt has also changed considerably in the recent decades, which has affected the physical environment in a number of ways. Population growth, diversification of economic activities, unprecedented rate of outmigration, increase in

accessibility, land use changes, increasing dependence on exogenous food supplies, declining importance of mixed mountain agriculture, shifting of traditional life style to a more urban oriented lines, modernized housing structure and improved accessibility etc are among the major changes occurred in the socio-economic environment. Population of the study area has grown almost 9 times from 1951 to 1998 with an increase in population density from 28 persons per square kilometer to 245 during the same period and this growth has brought considerable consequences on various aspects of environment.

One of the major and direct consequences of population growth on the socio-economic structure is changing household characteristics. It was found that houses have considerably changed both in terms of physical structure as well as number and household size. Historically, the people used to live in the form of joint and extended families and a single roof was shared by a large number of family members ranging from 5 to 10 persons. Consequently, the number of households was quite small in the past as compared to the present time. The rapid and unprecedented growth of population along with some other socio-economic factors led towards the disintegration of joint families and the people began to prefer living in the form of nuclear families decreasing drastically the average household size (cf. Liu et al., 2003; Keilman, 2003; Knight & Rosa, 2011). Moreover, the traditional house layout, which usually consisted of a single big room performing all the functions of a household, has also been replaced by multiple rooms houses with separate guestroom, bedrooms, animal sheds and modern attached toilets (cf. Fazlur-Rahman, 2007).

Household dynamics are also closely linked with economic transformations and improvements in accessibility. The past few decades have witnessed significant development in transportation networks and communication in the whole northern mountainous belt of Pakistan including the study area (cf. Grotzbach, 1984; Allan, 1985, 1986, 1989; Ispahani, 1989; Kreutzmann, 1991, 1993, 1998; Uhlig & Kreutzmann, 1995; Kamal & Nasir, 1998; Wood & Malik, 2006). The rapid development in communication infrastructure – the so-called globalization – has brought these remote mountainous communities close to the rest of the world and has opened the way to changes in every sphere of life and environment. Economic transformations in the form of market integration into economic setup, diversification of economic activities, access to services

and trade, and increase in cash income generation, are among the important and visible outcomes of improved accessibility and motorized transportation.

In past, agriculture and animal husbandry were the two main pillars of household economic structure and a minimal contribution was made by off-farm activities. However, due to limited demands of the small population, agricultural land was utilized less intensively. Traditional agricultural methods and local inputs were used and usually one or two crops were cultivated per annum. Presently, although agriculture and animal husbandry are the activities of secondary importance, but are still practiced and contribute a considerable portion to livelihood subsistence. Several advancements have been brought in agriculture through introducing genetic seeds, chemical fertilizers and mechanization. Agricultural lands are utilized intensively and more than two crops are harvested in a year. Improved accessibility has played an important role in shifting agriculture and animal husbandry from subsistence to commercial type. Agricultural machineries and modern inputs are now easily available even in the high mountainous areas and the products – both from dairy and agriculture – are transported to the markets.

Changes have taken place in every aspect of agriculture and animal husbandry mainly triggered off by population growth, household dynamics, modernization and improved accessibility. Agricultural lands have extensively been fragmented and the average landholding per household has decreased drastically along with an unsustainable decrease in field size. The landholdings are decreased under the law of inheritance with every successive generation and disintegration of joint families. As a result, presently the landholdings of individual households have become very small as about 90% of the households have less than 0.5 acres agricultural land and, in many areas; further fragmentation has become a question mark. Similarly, several changes have also occurred in animal husbandry.

Commercialization of various dairy products has become possible in the high mountainous areas as a result of easy and motorized access to the trade centers. However, the most important change in animal husbandry has occurred in herd size and composition. Several species such as goats, sheep and donkeys have lost importance and their number has decreased drastically, while the number of cows has increased due to increase in demands for dairy products. The main factors behind the decline in the number of goats and sheep are their less dairy and economic benefits and the increasing awareness of the inhabitants to protect grazing grounds and common

property resources. Moreover, rearing small animals requires more labor and young tale is no more willing to take up this job. Goats and sheep are considered harmful and responsible for the degradation of rangelands and pastures, and they also damage standing crops and plants in cultivated areas. Livestock feeding methods and sources of fodder have also changed with the passage of time. The open grazing of livestock and locally available fodder sources in the past have been replaced by stall feeding method and the dependency on exogenous fodder supply has increased in the recent decades.

All these changes in the socio-economic setup have affected the biophysical environment in several ways with the most visible effects on the land use and natural resource base. Due to the physiographic and climatic setup of the region, the land cover is dominated by natural vegetation with small patches of agricultural land and built up areas. Considerable changes have taken place in the land use pattern of the area during the last four decades. These land use changes are not controlled by a single force but are the consequence of the interplaying socio-economic, institutional and environmental factors. There are a number of proximate causes such as the extraction of wood and fuel from the forests, and underlying factors such as, demographic changes, economic conditions and transformations, accessibility, technological advances and several other institutional, management and cultural dynamics, topography and rainfall etc.

Built up areas have expanded substantially as a result of population growth and increase in the number of nuclear families and separate houses. In mountainous areas in general and in the study area in particular, the availability of suitable land for construction of settlements is quite limited due to rough topography. Due to the breakup of joint families and establishment of nuclear families, the existing residential lands are not enough to accommodate the increasing number of houses. As a result, the built up areas have expanded in all directions and the settlements are constructed out of the main residential clusters. The expansion of built up areas has either engulfed the cultivated lands within the villages' territories or the nearby rangelands and forests have been cleared for the construction of new settlements. Consequently, the area under natural vegetation cover has decreased substantially during the past few decades.

Deforestation may be termed as the most important issue among the consequences of recent changes in the whole northern mountainous belt of Pakistan including the study area. Both the extent of forest cover areas and the diversity of species have adversely been affected. It was

found out that a number of plant species have disappeared from various localities with a number of others being endangered. The disappearance of plant species is due to the selective harvesting for fuel wood, timber and commercial purposes. Deodar and pine trees are particularly the most vulnerable tree species, which are cut at an alarming rate in the high mountainous areas.

The process of forest cover degradation is governed by a variety of factors and it is not possible to make any generalization about the causes of deforestation (cf. Barbier & Burgess, 2001). However, the findings of the present study unveil certain socio-economic factors which have played the key role in deforestation during the past four to five decades. Population growth and the associated household dynamics are the root causes for the high rate of deforestation in the study area and such findings have also been revealed by several studies for the rest of Hindukush-Himalayan mountainous belt of northern Pakistan (Ali et al., 2005; Sharma & Banskota, 1992; Pretty, 2003; Owen et al., 1998; Jodha, 1992, 2007; Rahman et al., 2014). Population growth has not only affected forests directly by overcutting for increased domestic and economic demands but also by multiplying the needs for residential space and agricultural land. Besides population growth and household dynamics, improved accessibility and weakened natural resource management institutions are the other important factors which have exposed the forests to degradation.

As a consequence of the above mentioned changes, the traditional natural resource management system has also undergone transformations. The locally available resources are of vital importance to the inhabitants as they depend either partially or fully for their livelihood subsistence and economic well being on such resources. Although, the natural resources are limited but the inhabitants had a better understanding of the environment, opportunities and threats and were aware of how to manage the assets provided by nature (cf. Johnson et al., 1982; Zurick, 1990; Ning, 1997). Therefore, traditionally, the inhabitants introduced their own institutions and approaches for the adequate management and utilization of natural resources. There has been no interference from the state authorities regarding the ownership and management of natural resources. Hence, the ownership regimes and property rights as well as the pattern of utilization had been defined by the locally introduced rules and regulations.

Historically, the available natural resources have been given different ownership status depending on the availability and intensity of utilization of the resources in question. A set of

rules and regulations were formulated unwritten for defining the duties and obligations and access and withdrawal rights for different resources under various ownership regimes. Nevertheless, these institutions and traditional resource management approaches were effective environmentally, but their performance was gradually weakened by population growth and other socio-economic changes. Therefore, considerable changes have taken place in various aspects of natural resource management during the study period. Most of these changes have adversely affected the sustainability of natural resource base.

Forests and rangeland resources in particular, have been exposed to severe degradation as a result of changes in ownership and management mechanisms and weakening of traditional institutions. The community based rules and regulations guiding the utilization of forest resources under common property are relaxed after the change in ownership regimes and the traditional monitoring mechanisms are abandoned. Similarly, agricultural land historically managed under communal ownership is exposed to the process of frequent fragmentation in private ownership resulting into the degradation of land resources. Moreover, the change in ownership and management of water resources has resulted into a drastic decrease in the availability of irrigation water. Hence, it can be concluded that the traditional natural resource management strategies and rules and regulations were comparatively more effective in maintaining sustainability in spite of certain shortcomings.

REFERENCES

- Aase TH (1999) Converting Forest into Weapons in the Western Himalayas. In: Price M (Ed.), *Global Change in the Mountains*. Parthenon New York, USA. 147-149.
- Acevedo MF, Baird, Monticino M, Lyons D, Palomino J, Rosales J, et al. (2008) Models of natural and human dynamics in forest landscapes: cross-site and cross-cultural synthesis. *Geoforum* 39:846-866.
- Adams RH, Page J (2005) Do international migration and remittances reduce poverty in developing countries?' *World Development* 33(10):1645-1669.
- Adedayo AG, Oyun MB, Kadeba O (2010) Access of rural women to forest resources and its impact on rural household welfare in North Central Nigeria. *Forest Policy and Economics* 12:439-450.
- Adger WN, Huq S, Brown K, Conway D, Hulme M (2003) Adaptation to climate change in the developing world. *Progress in Development Studies* 3 (3):179-195.
- Agarwal A (1995) Dismantling the divide between indigenous and scientific knowledge. *Development and Change* 26(3):413-439.
- Agudelo C, Rivera B, Tapasco J, Estrada R (2003) Designing policies to reduce rural poverty and environmental degradation in a hillside zone of the Colombian Andes. *World Development* 31 (11):1921-1931.
- Ahmed SA (1976) *Millennium and Charisma among Pathans*. London, UK; Routledge and Kegan Paul.
- Ali J, Benjaminsen TA, Kammad AA, Dick BQ (2005) The road to deforestation: An assessment of forest loss and its causes in Basho Valley, Northern Pakistan. *Global Environmental Change* 15:370-380.
- Ali T, Shabaz B, Suleri A (2006) Analysis of myths and realities of deforestation in Northwest Pakistan: implications for forestry extension. *International Journal of Agriculture & Biology* 8(1):107-110.
- Al-Jalay SZ, Nazeer MM (1992) *Off-farm employment in the North West Frontier Province of Pakistan: A case study of Shangla Par/Alpuri Sub-division in Swat District*. ICIMOD, Kathmandu Nepal.
- Allan N (1985) Periodic and daily markets in the highland-lowland interaction systems: Hindukush-Western Himalaya. In: Singh TV and Kaur J (Eds.), *Integrated mountain development*. New Delhi, India.
- Allan N (1986) Accessibility and altitudinal zonation models of mountains. *Mountain Research and Development* 6(3):185-194.

- Allan N (1987) Impact of Afghan refugees on the vegetation resources of Pakistan's Hindukush-Himalaya. *Mountain Research and Development* 7(3):200-204.
- Allan N (1989) Kashgar to Islamabad: The impact of the Karakoram Highway on mountain society and habitat. *Scottish Geographical Magazine* 105(3):130-141.
- Allen JC, Barnes DF (1985) The Causes of Deforestation in Developing Countries. *Annals of the Association of American Geographers* 75(2):163-184.
- Amanda S, Allison KL, Jennifer H, Kate AB et al. (2013) The added complications of climate change: understanding and managing biodiversity and ecosystems. *Frontiers in Ecology and the Environment* 11(9):494-501.
- Angelsen A (1999) Agricultural expansion and deforestation: Modelling the impact of population, market forces and property rights. *Journal of Development Economics* 58(1):185-218.
- Arif GM (2009) *Recruitment of Pakistani workers for overseas employment: Mechanisms, exploitation and vulnerabilities*. International Labor Organization, Geneva.
- Barbier EB, Burgess CJ (2001) The economics of tropical deforestation. *Journal of Economic Surveys* 15(3):413-433.
- Barth F (1956) *Indus and Swat Kohistan: An Ethnographic Survey*. Studies Honouring the Centennial of Universitetets Ethnografiske Museum, II. Oslo.
- Baskent EZ, Kadiogullari AI (2007) Spatial and temporal dynamics of land use pattern in Turkey: a case study in Inegöl. *Landscape and Urban Planning* 81:316-327.
- Beniston M (2005) Mountain climates and climate change: an overview of processes focusing on the European Alps. *Pure and Applied Geophysics* 162:1587-1606.
- Beniston M, Stoffel M (2013) Assessing the impacts of climatic change on mountain water resources. *Science of the Total Environment* xxx (2013) xxx-xxx. In Press: DOI: 10.1016/j.scitotenv.2013.11.122
- Bjornsen A, et al., (2012) Global change and the world's mountains—Research needs and emerging themes for sustainable development. *Mountain Research and Development* 32:47–54.
- Boserup E (1965) *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*. Aldine Publishing Co. Chicago: USA.
- Bradshaw CJ, Sodhi NS, Brook BW (2009) Tropical turmoil: a biodiversity tragedy in progress. *Frontiers in Ecology and the Environment* 7:79–87.
- Bucala A (2014) The impact of human activities on land use and land cover changes and environmental processes in the Gorce Mountains (Western Polish Carpathians) in the past 50 year. *Journal of Environmental Management* 138(1):4-14.

- Butchart SH, Walpole M, Collen B, Strien V et al., (2010) Global biodiversity: indicators of recent declines. *Science* 328:1164-1168.
- Caroe, O (1958) *The Pathans 550 BC to AD 1957*. Oxford University Press, Karachi, Pakistan.
- Carr DL (2006) A tale of two roads: Land tenure, poverty, and politics on the Guatemalan frontier. *Geoforum* 37(1):94-103.
- Chen L, Wang J, Fu B, Qiu Y (2001) Land-use change in a small catchment of northern Loess Plateau, China. *Agriculture, Ecosystems & Environment* 86(1):163-172.
- Chowdhury RR (2006b) Landscape change in the Calakmul Biosphere Reserve, Mexico: modeling the driving forces of smallholder deforestation in land parcels. *Applied Geography* 26:129–152.
- Chowdhury RR (2006a) Driving forces of tropical deforestation: the role of remote sensing and spatial models. *Singapore journal of tropical geography* 27:82-101.
- Clawson M (1981) Entering the 21st century: The Global 2000 report to the President. *Resources* 66:19-21.
- Cohen WB, Spies TA, Fiorella M (1995) Estimating the age and structure of forest in a multi-ownership landscape in western Oregon, USA. *International Journal of Remote Sensing* 16:721-746.
- Cook N, Butz D (2011) Narratives of Accessibility and Social Change in Shimshal, Northern Pakistan. *Mountain Research and Development* 31(1):27-34.
- Crews-Meyer KA (2004) Agricultural landscape change and stability in northeast Thailand: historical patch-level analysis. *Agriculture, Ecosystems & Environment* 101:155-169.
- Dani AH (1986) *Historic City of Taxila*. Sang-e-Meel Publications, Lahore Pakistan.
- Das N (2011) Women's dependence on forest and participation in forestry: A case study of joint forest management program in West Bengal. *Journal of Forest Economics* 17:67-89.
- Defries RS, Rudel T, Uriarte M, Hansen M (2010) Deforestation driven by urban population growth and agricultural trade in the twenty-first century. *Nature Geoscience* 3:178-181.
- Deininger KW, Minten B (1999) Poverty, policies, and deforestation: the case of Mexico. *Economic Development and Cultural Change* 47(2):313-344.
- Dewan AM, Yamaguchi Y (2009) Land use and land cover change in Greater Dhaka, Bangladesh: using remote sensing to promote sustainable urbanization. *Applied Geography* 29:390-401.
- Dhar TN (2000) *Land policies, land management and land degradation in the Hindu Kush-Himalayas*. ICIMOD, Kathmandu Nepal.
- Dholakia BH, Dholakia RH (2009) *Modernization of agriculture and economic development the Indian experience*. Indian Institute of Management, Ahmedabad, India.

- Dongol CM, Hughey KF, Bigsby HR (2002) Capital formation and sustainable community forestry in Nepal. *Mountain Research and Development* 22(2):70-77
- Durand A (2001) *The making of a frontier*. Osford University Press Karachi, Pakistan.
- Eckholm EP (1975) The deterioration of mountain environments. *Science* 189:764-770.
- Ehiagbanare (2007) Economic contributions of the forest to the economy of Edo State, Nigeria. *African Journal of Agricultural Research* 2(11):583–586.
- Ehlers E (1996) Population growth, resource management and well adapted land-use in the Bagrot/Karakoram. *Applied Geography and Development* 48:7-28.
- Ehlers E (1997) Traditional environmental knowledge and consciousness and the problem of sustained agricultural development. *Applied geography and development* 49:79-95.
- Ehlers E (2008) Sustainability – Indigenous Knowledge Systems – Traditional Land Uses in the Northern Areas of Pakistan as an Example. In Israr-Ud-Din (Ed.), *Proceedings of the Third Hindu Kush Cultural Conference Pp. 108-125*. Oxford University Press. Karachi, Pakistan.
- Ehlers E, Kreutzmann H (2000) High mountain ecology and economy potential and constraints. In: Ehlers E & Kreutzmann H (Eds.), *High Mountain Pastoralism in Northern Pakistan* (132:09-36). Stuttgart: Erdkundliches Wissen.
- Encyclopedia Britannica Online (2011) Nuclear family. Encyclopedia Britannica. Available online: <http://www.britannica.com/EBchecked/topic/421619/nuclear-family>. (Accessed on 17 February 2013).
- Falcucci A, Maiorano L, Boitani L (2007) Changes in land-use/land-cover patterns in Italy and their implications for biodiversity conservation. *Landscape Ecology* 22:617-631.
- FAO = [Food and Agriculture Organization] (1994) *Land degradation in South Asia: Its severity, causes and effects upon the people*. World Soil Resources Reports No. 78. Rome: Food and Agriculture Organization of the United Nations.
- Fazlur-Rahman (2005) Rural development in the mountainous areas of Pakistan: Integration of village organizations in the planning process: Some observation from Astor Valley, Northern Pakistan. *Journal of Rural Development & Administration* XXXVI(1-4):37-65.
- Fazlur-Rahman (2007a) Agro-pastoral economy, property rights and locally formulated resource management mechanisms in Astor valley, northern areas of Pakistan. *Pakistan Journal of Geography* XVII(1&2):55-75.
- Fazlur-Rahman (2007b) *Persistence and Transformation in the Eastern Hindu Kush: A Study of Resource Management Systems in Mehlp Valley, Chitral, North Pakistan* (Vol. 118): Bonner Geographische Abhandlungen.

- Fazlur-Rahman (2009) Population growth and sustainability of common property resource management systems in the eastern Hindu Kush: the use of communal fodder resources in Melp Valley, North Pakistan. *Journal of Mountain Science* 6(4):380-393.
- Flint EP (1994) Changes in land use in South and Southeast Asia from 1880 to 1980: A data base prepared as part of a coordinated research program on carbon fluxes in the tropics. *Chemosphere* 29(5):1015-1062.
- Fürer-Haimendorf C (1971) Comparisons between the Mountain Peoples of the Philippines and Some Tribes of North-East India. *Geographical Journal* 137(3):339-348.
- Gadguk M, Berkes F (1991) Traditional resource management systems. *Resource Management and Optimization* 8(3):151-156.
- Gautam AP, Webb EL, Shivakoti GP, Zebisch MA (2003) Land use dynamics and landscape change pattern in a mountain watershed in Nepal. *Agriculture, Ecosystems & Environment* 99(1-3):83-96.
- Geist HJ, Lambdin EF (2001) *What drives tropical deforestation? A meta-analysis of proximate and underlying causes of deforestation based on sub-national case study evidence*. LUC International Project Office Louvain-la-Neuve, Belgium.
- Geist HJ, Lambin EF (2002) Proximate causes and underlying driving forces of tropical deforestation. *Bioscience* 52(2):143–150.
- General Staff of India (1901) *Military report and Gazetteer on Dir, Swat and Bajaur, Part 1*. Government of India Press, Calcutta.
- Gentle P, Maraseni TN (2012) Climate change, poverty and livelihoods: adaptation practices by rural mountain communities in Nepal. *Environmental Science & Policy* 21:24-34.
- Giliba RA, Boon KE, Kayombo JC, Chirenje IL, Musamba BE (2011) The Influence of Socio- economic Factors on Deforestation: A Case Study of the Berek Forest Reserve in Tanzania. *Journal of Biodiversity* 2(1):31-39.
- GoKPK (2012b) *Landcover Atlas of Pakistan*. Pakistan Forest Institute, Peshawar.
- GoKPK = [Government of Khyber Pakhtunkhwa Province] (2012a) Khyber Pakhtunkhwa Development Statistics 2012. Bureau of Statistics Planning & Development Department Government of Khyber Pakhtunkhwa, Peshawar.
- GoNWFP = [Government of North West Frontier Province] (1975) *Land use survey of North West Frontier Province Part I Peshawar and Malakand Division*. Peshawar, Pakistan.
- Goode W (1963) *World Revolution and Family Patterns*. Free Press, New York, USA.
- GoP = [Government of Pakistan] (1972) *District Census Report of Dir District, 1972*. Population census organization of Pakistan, Islamabad.

- GoP (1981) *District Census Report of Dir District, 1981*. Population census organization of Pakistan, Islamabad.
- GoP (1991) *The Pakistan National Conservation Strategy*. The World Conservation Union (IUCN), Karachi, Pakistan.
- GoP (2000) *District Census Report of Dir Lower District, 1998*. Population census organization of Pakistan, Islamabad.
- GoP (1961) *District Census Report of Dir District, 1972*. Population census organization of Pakistan, Islamabad.
- Government of the Punjab (1898) *Gazetteer of the Peshawar district 1897—98*. Government of the Punjab, Lahore, [Reprint by Sang-e-Meel Publication Lahore 1989].
- Gracheva R, Kohle RT, Tadelbauer J, Meessen H (2012) Population dynamics, changes in land management, and the future of mountain areas in Northern Caucasus: The example of North Ossetia. *Erdkundi* 66(3):179-219.
- Gret-Regamey A, Brunner SH (2010) *Mountain ecosystem services – who cares? In Extended abstract, Global Change and the World's Mountains*. Perth. Scotland.
- Grotzbach E (1984) Mobility of labor in high mountains and socio-economic integration of peripheral areas. *Mountain Research and Development* 3(4):229-235.
- Guillet D (1983) Towards a Cultural Ecology of Mountains: The Central Andes and the Himalaya Compared. *Current Anthropology* 24(5):561-574.
- Haagsma B (1995) Traditional water management and state intervention: The case of Santo Antao, Cape Verde. *Mountain Research and Development* 15(1):39-56.
- Haq (2012) Tenure system as a determinant of resource management and utilization in mountainous areas: A study of Roghani territory in Dir districts Northern Pakistan. M.Phil Thesis submitted to University of Peshawar, Pakistan.
- Haq, Fazlur-Rahman, Tabassum I, Nasir MJ, Khan AS (2012) Handling the scarce mountains' resources: Role of Indigenous tenure arrangements in land management in Roghani Valley, Northern Pakistan. *PUTAJ Science* (19):71-90.
- Harrison P (1992) *The Third Revolution: Environment, Population and a Sustainable World*. Tauris & Co. Ltd. London and New York.
- Hassan R, Scholes R, Ash N (Eds.), (2005) *Ecosystems and human well-being: Current state and trends. Volume 1: Findings of the condition and trends, Working Group of the Millennium Ecosystem Assessment*. Island Press, Washington USA.

- Helleman H, Stocking M, White R (Eds.), (2005) *Renewable natural resources management for mountain communities*. ICIMOD, Kathmandu Nepal.
- Herbers H (2000a) Why are mountain farmers vegetarians? Nutritional and non-nutritional dimensions of animal husbandry in high Asia. In: Ehlers, E & Kreutzmann, H (Eds.), *High Mountain Pastoralism in Northern Pakistan*. Stuttgart. Erdkundliches Wissen, 132:189-211
- Herbers H (2000b) Undernutrition and heavy workload in Northern Pakistan – consequences for production and reproduction. In: Dittann A (Ed.), *Mountain Societies in Transition. Contributions to the Cultural Geography of the Karakorum*. Cologne: Culture Area Karakorum Scientific Studies 6:103-130.
- Herbers, H (1998) *Arbeit und Ernährung in Yasin: Aspekte des Produktions-Reproduktions-Zusammenhangs in einem Hochgebirgstal Nordpakistans*. Stuttgart. (= Erdkundliches Wissen 123).
- Hoermann B, Banerjee S, Kollmair M (2010) *Labor migration for development in the Western Hindu Kush-Himalayas: Understanding a livelihood strategy in the context of socioeconomic and environmental change*. ICIMOD, Kathmandu Nepal.
- Hoermann B, Kollmair M (2009) *Labor migration in the Hindu Kush-Himalayas: Gender challenges*. ICIMOD, Kathmandu, Nepal.
- Horizon (2009) *Population Growth, Environment and Food Security: What Does the Future Hold? Pilot Issue*. Institute of Development Studies at the University of Sussex, Brighton, UK.
- Houghton RA (1994) The worldwide extent of land-use change. *Bioscience* 44:305-313.
- Huddleston B, Ataman E (2003) Towards a GIS-based analysis of mountain environments and populations, Environment and Natural Resources, Working Paper No. 10. Food and Agriculture Organization of the United Nations, Rome.
- Hunzai K (2010) *Labor Migration and Remittances in the Mountains of Pakistan*. ICIMOD, Kathmandu Nepal.
- Hyden G, Kates RW, Turner BL (1993) Beyond intensification. In: Turner B.L, Hyden G and Kates R (Eds.), *Population Growth and Agricultural Change in Africa*. Gainesville University Press, Florida.
- ICIMOD (2005) *Diversifying and enhancing livelihoods options in the Himalayan region*. Newsletter No. 18. ICIMOD, Kathmandu, Nepal.
- ICIMOD (2010) *Mountains of the World – Ecosystem Services in a Time of Global and Climate Change. Seizing Opportunities – Meeting Challenges*. International Centre for Integrated Mountain Development, Kathmandu, Nepal

- International Encyclopedia of the Social Sciences (2008) Extended family. Available online: http://www.encyclopedia.com/topic/Extended_family.aspx. (Accessed on 17 February 2013).
- IPCC (2007a) *Climate change 2007: The scientific basis, Working Group I contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report*. Cambridge University Press, Cambridge.
- IPCC (2007b) *Climate change 2007: Impacts, adaptation and vulnerability, Working Group II contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report*. Cambridge. Cambridge University Press
- Ispahani M (1989) *Roads and Rivals: The Politics of Access in the Borderlands of Asia*. IB Tauris and Co. London, United Kingdom.
- Israr-ud-Din, Fazlur-Rahman (2003) Growth of Population, Human Settlements and Pressure on Forest Resources in Chitral District. *Pakistan Journal of Geography* 13(1/2):1-22.
- Ives JD (1987) The Theory of Himalayan Environmental Degradation: Its Validity and Application Challenged by Recent Research. *Mountain Research and Development* 7 (3):189-199.
- Ives JD, Messerli B (1989) *The Himalayan Dilemma: Reconciling Development and Conservation*. Routledge, London and New York.
- Ives JD, Messerli B, Spiess E (1997) Mountains of the World - A Global Priority. In: Messerli B & Ives JD (Eds.), *Mountains of the World: A Global Priority*, 21, 1-15. The Parthenon Publishing Group, New York and London.
- Jian WU (2009) From a legal perspective to see the evolution and transformation of land tenure institutions in China. *Front. Law China* 4(4):568-600.
- Jodha NS (1992) Mountain perspective and sustainability: a framework for development strategies. In: Jodha NS, Banskota M, Partap T (Eds.), *Sustainable Mountain Agriculture*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India.
- Jodha NS (2007) Mountain commons: Changing Space and Status at Community Levels in the Himalayas. *Journal of Mountain Science* 4:124-135.
- Jodha NS, (1998) *Poverty–environmental resource degradation links: questioning the basic premises*. International Center for Integrated Mountain Development, Katmandu, Nepal.
- Jodha NS. Banskota M, Partap T (Eds.), (1992) *Strategies for the sustainable development of mountain agriculture: An overview*. Oxford and IBH, India.
- Johnson K, Olson EA, Manandhar S (1982) Environmental knowledge and response to natural hazards in mountainous Nepal. *Mountain Research and Development* 2:185-188.

- Kadiogullari AI, Baskent EZ (2008) Spatial and temporal dynamics of land use pattern in Eastern Turkey: a case study in Gumushane. *Environ Monitor Assess* 138:289-303.
- Kamal P, Nasir M. (1998) The impact of the Karakoram Highway on the landuse of the Northern Areas. In: Stellrecht I, (Ed.), *Karakoram–Hindukush–Himalaya: Dynamics of Change*, Part I: 303–338. : Rudiger Koppe Verlag, Cologne, Germany
- Keilman N (2003) The threat of small households. *Nature* 421:489-490.
- Khalid NA (2003) *Geography of Pakistan*. Muslim Printing Press, Lahore Pakistan.
- Khan FK (2006) *Pakistan Geography, Economy and People*. Oxford University Press, Karachi Pakistan.
- Khan RS, Khan RS (2009) Assessing poverty–deforestation links: Evidence from Swat, Pakistan. *Ecological Economics* 68(2009):2607-2618.
- Khan SR, Naqvi (2000) *The environment–poverty nexus: an institutional analysis*. Sustainable Development Policy Institute: Working Paper Series, vol. 49. Sustainable Development Policy Institute and Institute of Social Studies, Islamabad.
- Knoema (2015) Rupee devaluation against Dollar, 1947 – till date. Available online: [HTTPS://KNOEMA.COM/RYGEJHB/RUPEE-DEVALUATION-AGAINST-DOLLAR-1947-TILL-DATE](https://knoema.com/rygejhb/rupee-devaluation-against-dollar-1947-till-date). (accessed on, 28/05/2016).
- Körner C (2009a) Conservation of mountain biodiversity in the context of climate change. In: *Proceedings of the International Mountain Biodiversity Conference*, Kathmandu, 16-18 November 2008. ICIMOD, Kathmandu Nepal.
- Körner C (2009b) Global statistics of ‘‘mountain’’ and ‘‘alpine’’ research. *Mountain Research and Development* 29(1):97-102.
- Kozak J (2003) Forest cover change in the Western Carpathians in the past 180 years, A case study in the Orawa region in Poland. *Mountain Research and Development* 23(4):369-375.
- Kreutzmann H (1991) The Karakoram Highway. *Modern Asian Studies* 25(4):711-736.
- Kreutzmann H (1992) Development processes in the Hunza Valley, a case study from the Karakoram Mountains. *Pakistan Journal of Geography* 1(1/2):1-17.
- Kreutzmann H (1993) Challenge and response in the Karakoram: Socioeconomic transformation in Hunza, Northern Areas, Pakistan. *Mountain Research and Development* 13(1):19-39.
- Kreutzmann H (1998) Trans-montane exchange patterns prior to the Karakoram Highway. In: Stellrecht I, (Edt.), *Karakoram–Hindukush–Himalaya: Dynamics of Change*, Part II: 21-44. Rudiger Koppe Verlag, Cologne Germany.

- Kreutzmann H (2000) Livestock economy in Hunza: social transformation and pastoral practices. In: Ehlers E & Kreutzmann H (Eds.), *High Mountain Pastoralism in Northern Pakistan*. Stuttgart. Erdkundliches Wissen, 132:89-121.
- Kurien J (1995) collective action for common property resource rejuvenation: The case of people's artificial reefs in Kerala State, India. *Human Organization* 54(2):160-168.
- Lambin EF, Turner BL, Geist HJ, Agbola SB, Angelsen A, Bruce JW et al. (2001). The causes of land-use and land-cover change: moving beyond the myths. *Global Environmental Change* 11:261-269.
- Lesschen JP, Verburg PH, Staal SJ (2005) *Land-Use and Land-Cover Change (LUCC) Project. IV*. The International Livestock Research Institute, Nairobi, Kenya & LUCC Focus 3 Office, Wageningen University, the Netherlands.
- Liniger H and Lynden GV (2005) Building up and sharing knowledge for better decision-making on soil and water conservation in a changing mountain environment –the wocat experience. In: Helleman H, Stocking M, White R (Eds.), *Renewable natural resources management for mountain communities*. ICIMOD, Kathmandu Nepal.
- Liu D, Cai S (2012) A Spatial-Temporal Modeling Approach to Reconstructing LandCover Change Trajectories from Multi-temporal Satellite Imagery. *Annals of the Association of American Geographers* 102:6:1329-1347.
- Liu J, Daily G, Ehrlich P, Luck G (2003) Effects of household dynamics on resource consumption and biodiversity. *Nature* 421:530-533.
- MacDonald KI (1998) Rationality, Representation, and the Risk Mediating Characteristics of a Karakoram Mountain Farming System. *Human Ecology* 26(2):287-321.
- Malingreau JP, Eva HD, de Miranda EE (2012) Brazilian Amazon: A significant five year drop in deforestation rates but figures are on the rise again. *Ambio* 41:309-314.
- McMahon AH, Ramsay AG (1897) *Report on the tribes of Dir, Swat, and Bajour together with the Utman-khel and Sam Ranizai*. Saeed Book Bank Peshawar, Pakistan.
- Messerli B (2012) Global change and the world's mountains: Where are we coming from, and where are we going to? *Mountain Research and Development* 32(1):55-63.
- Messerli B, Ives JD (Eds.), (1997) *Mountains of the world – A global priority. A contribution to Chapter 13 of Agenda 21*. Parthenon, New York.
- Mottet A, Ladet S, Coque N, Gibon A (2006) Agricultural land-use change and its drivers in mountain landscapes: A case study in the Pyrenees. *Agriculture, Ecosystems and Environment* 114:296-310.

- Nafees M, Khan H, Jan MR (2009) Circulatory land tenure and its social and ecological impacts; a case study of the village Allahdhandheri in North Pakistan. *Mountain Research and Development* 29(1):59-66.
- Nancy BG, Chapin F, Bierwagen B, Gonzalez P et al. (2013) The impacts of climate change on ecosystem structure and function. *Frontiers in Ecology and the Environment* 11:474-482.
- Naughton-Treves L, Day C (2012) Introduction Lessons from Early Efforts to Secure Land Tenure within Forest Carbon Management Projects. In: Naughton-Treves L & Day C (Eds.), *Lessons about land tenure, forest governance and REDD+ Case Studies from Africa, Asia and Latin America*. Madison, Wisconsin: UW-Madison Land Tenure Center.
- Nautiyal S, Kaechele H (2009) Natural resource management in a protected area of the Indian Himalayas: a modeling approach for anthropogenic interactions on ecosystem. *Environmental Monitoring and Assessment* 153:253-271.
- Nichols R (2001) *Settling the Frontier: Land law and society in the Peshawar valley, 1500-1900*. Oxford University Press, Karachi, Pakistan.
- Nichols R (2008) *A history of Pashtun migration, 1775-2006*. Oxford University Press, Karachi, Pakistan.
- Ning W (1997) Indigenous knowledge and sustainable approaches for the maintenance of biodiversity in nomadic society: Experiences from the Easter Tibetan Plateau. *Die Erde* 128(1):67-80.
- Njegac D, Toskic A (1999) Rural diversification and socio-economic transformation in Croatia. *Geo-Journal* 46(3):263-269.
- Nogues-Bravo D, Araujo MB, Erra MP, Rica JP (2006) Exposure of global mountain systems to climate warming during the 21st Century. *Global Environmental Change* 17:420-428.
- Nüsser M (2000) Change and Persistence: Contemporary Landscape Transformation in the Nanga Parbat Region, Northern Pakistan. *Mountain Research and Development* 20(4):348-355.
- Nüsser M, Clemens JR (1996) Impacts on Mixed Mountain Agriculture in the Rupal Valley, Nanga Parbat, Northern Pakistan. *Mountain Research and Development* 16(2):117-133.
- Nyssen J, Frankl A, Haile M, Hurni H, Descheemaeker K et al., (2014) Environmental conditions and human drivers for changes to north Ethiopian mountain landscapes over 145 years. *Science of the Total Environment* 485–486:164-179
- Ojima DS, Galvin KA, Turner BL (1994) The global impact of land-use change. *Bioscience* 44:300-304.
- Oldfield F, Messerli B (Eds.), (1999) *Global Change and mountain regions. The mountain research initiative*. IGBP, Stockholm, Sweden.
- Olimova S, Olimov M (2007) Labor migration from mountainous areas in the Central Asian region: Good or evil? *Mountain Research and Development* 27(2):104-108.

- Owen OS, Chiras DD, Reganold JP (1998) *Natural resource conservation; Management for a sustainable future*: PrenticeHall, A division of Simon & Shuster. Inc. New Jersey, USA.
- Pan D, Domon G, de Blois S, Bouchard A (1999) Temporal and spatial patterns of land use changes in Haut-Saint-Laurent (Quebec, Canada) and their relation to landscape physical attributes. *Landscape Ecology* 14:35-52.
- Peco B, Sánchez AM, Azcárate FM (2006) Abandonment in grazing systems: consequences for vegetation and soil. *Agriculture Ecosystem and Environment* 113:284-294.
- Pestalozzi H (2000) Sectoral fallow systems and the management of soil fertility: The rationality of the indigenous knowledge in the High Andes of Bolivia. *Mountain Research and Development* 20(1):64-71.
- Pichon JF (1997) Colonist Land-Allocation Decisions, Land Use, and Deforestation in the Ecuadorian Amazon Frontier. *Economic Development and Cultural Change* 45(4):707-744.
- Pilardeaux B (1997) Agrarian transformation in Northern Pakistan and the political economy of highland-lowland interaction. In: Stellerecht I & Winiger M (Eds.), *Perspectives on history and change in the Karakoram, Hindukush and Himalaya*. (Vol. 3, pp. 43-57). Koln: Culture Area Karakoram Scientific Studies.
- Pilardeaux B (1998) Surviving as a mountain peasant - innovation, development and dynamic of global change in a high mountain region (Punial / Northern Pakistan). In: Stellerecht I & Bohle HG (Eds.), *Transformation of social and economic relationships in Northern Pakistan*. (Vol. 5, pp. 355-424). Koln: Culture Area Karakoram Scientific Studies.
- Pouliot M, Treue T, Obiri BD et al., (2012) Deforestation and the Limited Contribution of Forests to Rural Livelihoods in West Africa: Evidence from Burkina Faso and Ghana. *Ambio* 41:738-750.
- Preston D, Montaña R, Condori R (2005) Stimulating locally initiated and sustainable livelihood change – new relationships between local professionals and rural communities in the central Andes. In: Helleman H, Stocking M, White R (Eds.), (2005) *Renewable natural management for mountain communities*. ICIMOD, Kathmandu Nepal.
- Pretty J (2003) Social capital and collective management of resources. *Science* 302:1912-1914.
- Price MF (1998) *Mountains: globally important ecosystems. An overview of the importance of mountains in sustainable development and their place on the global political agenda*. FAO Repository. Available online: [HTTP://WWW.FAO.ORG/DOCREP/W9300E/W9300E03.HTM](http://www.fao.org/docrep/w9300e/w9300e03.htm). Accessed on 23/10/2014.
- Price MF, Weingartner R (2012) Introduction: Global Change and the World's Mountains—Perth 2010. *Mountain Research and Development* 32(1):3-6.

- Qasim M, Hubacek K, Termansen M, Khan A (2011) Spatial and temporal dynamics of land use pattern in District Swat, Hindu Kush Himalayan region of Pakistan. *Applied Geography* 31:820-828.
- Rahman A, Duncan AJ, Miller et al., (2008) Livestock feed resources, production and management in the agro-pastoral system of the Hindu Kush - Karakoram - Himalayan region of Pakistan: The effect of accessibility. *Agricultural Systems* 96(1-3):26-36.
- Rahman F, Haq F, Tabassum I, Ullah I (2014) Socio-economic drivers of deforestation in Roghani Valley, Hindu-Raj Mountains, Northern Pakistan. *Journal of Mountain Science* 11(1):167-179.
- Ravnborg HM (2003) Poverty and environmental degradation in the Nicaraguan hillsides. *World Development* 31(11):1933-1946.
- Repetto R (1986) Soil loss and population pressure on Java. *Ambio* 15(1):14-18.
- Rhoades RE, Thompson SI (1975) Adaptive strategies in Alpine environments: Beyond ecological particularism. *American Ethnologist* 2:5-35.
- Robertson G S (1895) *The story of minor siege*. Reprinted by Oxford University Press, Karachi: 1977.
- Ruiz-Labourdette D, Fe Schmitz M, Pineda FD (2013) Changes in tree species composition in Mediterranean mountains under climate change: Indicators for conservation planning. *Ecological Indicators* 24:310-323.
- Sati PV (2009) Population and sustainability issues in mountains: A case for the Uttaranchal Himalaya. *ENVIS Bulletin* 14(2):1-8.
- Schickhoff U (1995) Himalayan forest-cover changes in historical perspective: a case study in the Kaghan valley northern Pakistan. *Mountain Research and Development* 15:3-18.
- Schmidt EM (2000a) Pastoral systems in Shigar/Baltistan: communal herding management and pasturage rights. In: Ehlers E & Kreutzmann H (Eds.), *High Mountain Pastoralism in Northern Pakistan*. Stuttgart. *Erdkundliches Wissen* 132:121-151
- Schmidt M (2000b) The utilization of mountain forests in the Bagrot Valley. In: Dittmann A (Ed.), *Mountain Societies in Transition. Contributions to the Cultural Geography of the Karakorum*. Köln, Germany (= Culture Area Karakorum Scientific Studies 6):211-234.
- Schmidt M (2004) Interdependencies and reciprocity of private and common property resources in the central Karakorum. *Erdkunde* 58:315-330
- Schmidt M (2005) Utilization and Management Changes in South Kyrgyzstan's Mountain Forests. *Journal of Mountain Science* 2(2):91-104
- Serneels S& Lambin EF (2001) Proximate causes of land-use change in Narok District, Kenya: a spatial statistical model. *Agriculture, Ecosystems & Environment* 85(1):65-81.
- Shams FA (2000) *Land of Pakistan*. Kitabistan Publishing, Lahore Pakistan.

- Sharma CM, Gairola S, Sunil K, Suyal S (2009) Forest resource use patterns in relation to socioeconomic status; a case study in four temperate villages of Gharwal Himalaya, India. *Mountain Research and Development* 29(2):308-319.
- Sharma P, Banskota M (1992) Population dynamics and sustainable agricultural development in mountain areas. In: Jodha NS, Banskota M, Partap T (Eds.), *Sustainable Mountain Agriculture*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India.
- Sharma S, Jodha NS (1992) Mountain farmer's response to development efforts: Comparative perspectives from the countries of the Hindukush-Himalayan Region. In: Jodha NS, Banskota M, Partap T (Eds.), *Sustainable Mountain Agriculture*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India.
- Siddiqui KM, Mohammad I, Ayaz M (1999) Forest ecosystem climate change impact assessment and adaptation strategies for Pakistan. *Climate Research* 12:195-203.
- Simon J (1981) *The Ultimate Resource*. Princeton University Press, New Jersey USA.
- Simon J (1990) *Population Matters: People Resources, Environment and Immigration*. Transaction Publishers, New Brunswick, New Jersey USA.
- Simon J (1996) *The Ultimate Resource 2*. Princeton University Press, New Jersey USA.
- Skole D, Tucker C (1993) Tropical deforestation and habitat fragmentation in the Amazon: satellite data from 1978 to 1988. *Science* 260:1905-1910.
- Somanathan E (1991) Deforestation, Property Rights and Incentives in Central Himalaya. *Economic and Political Weekly* 26(1):37-46.
- Sonesson M, Messerli B (Eds.), (2002) *The Abisko Agenda: Research for mountain area development, Ambio Special Report 11*. Stockholm: Royal Swedish Academy of Sciences. URL: [HTTP://WWW.JSTOR.ORG/STABLE/25094565](http://www.jstor.org/stable/25094565). ACCESSED ON 22/10/2014
- Southgate D (1988) *The economics of land degradation in the Third World*, World Bank, Environment Department Working Paper No. 2. World Bank. Washington, D.C.
- Southgate D (1990) The causes of land degradation along "Spontaneously" expanding agricultural frontiers in the third world. *Land Economics* 66(1):93-101.
- Spain WJ (1963) *The Pathan borderland*. Indus Publications, Karachi, Pakistan.
- Spain WJ (1973) *The Way of the Pathans*. Oxford University Press, Karachi Pakistan; First Edition. 2nd edition.
- Spain WJ (1995) *The Pathans of the latter day*. Oxford University Press, Karachi Pakistan.
- Steins AN, Edwards VM (1999) Synthesis: Platforms for collective action in multiple-use common-pool resources. *Agriculture and Human Values* 16:309-315.

- Stellerecht I (1997) Dynamics of highland-lowland interaction in Northern Pakistan since the 19th century. In: Stellerecht I & Winiger M (Eds.), *Perspectives on history and change in the Karakoram, Hindukush and Himalaya* 5:3-22. Koln: Culture Area Karakoram Scientific Studies.
- Stellerecht I (Ed.), (1998) *Karakorum - Hindukush - Himalayas: Dynamics of change*. (4/1 & 2). Koln: Culture Area Karakoram Scientific Studies.
- Stober G, Herbers H (2000) Animal husbandry in domestic economies: Organization, legal aspects and present changes of combined mountain agriculture in Yasin (Northern Areas, Pakistan). In: Ehlers E & Kreutzmann H (Eds.), *High Mountain Pastoralism in Northern Pakistan*. Stuttgart. Erdkundliches Wissen, 132:37-59
- Stocking M (2005) Living at the margin in hills – people building sustainable livelihoods based on renewable natural resources. In: Helleman H, Stocking M, White R (Eds.), *Renewable natural resources management for mountain communities*. ICIMOD, Kathmandu Nepal.
- Sultan-i-Rome (2005) *Swat state under the Walis*. PhD Thesis submitted to the Department of History, University of Peshawar
- Sultan-i-Rome (2007) Pukhtu: The Pukhtun Code of Life. *Available online*: <http://www.valleyswat.net/literature/papers.html>. (Cited 20 September 2011).
- Sultan-i-Rome (2008) Land ownership in Swat: Historical and contemporary perspective. *Available online*: <http://www.valleyswat.net/literature/papers.html>. (Cited 20 September 2011).
- Swinton SM, Escobar G, Reardon T (2003) Poverty and environment in Latin America: concepts, evidence and policy implications. *World Development* 31(11):1865-1872.
- Sydenstricker-Neto J (2012) Population and deforestation in the Brazilian Amazon: a mediating perspective and a mixed-method analysis. *Population and Environment* 34:86-112.
- Tabassum I, Haq F, Rahman F (2012) The flood event of July, 2010: Socioeconomic disruptions in Lower Dir district. *Journal of Humanities and Social Sciences* XX(2):57-76.
- Templeton SR, Scherr SJ (1997) *Population pressure and the micro-economy of land management in hills and mountains of developing countries*. International Food Policy Research Institute, Washington, D.C. USA.
- Thomas CD, Ohlemüller R, Anderson A, Thomas H et al., (2008) *Exporting the ecological effects of climate change*. EMBO Reports 9(1):46-74.
- Tulachan MP (2000) *Mixed farming systems*. ICIMOD, Katmandu Nepal.
- Tulachan PM and Neupane A (1999) *Livestock in Mixed Farming Systems of the Hindu Kush-Himalayas: Trends and Sustainability*. ICIMOD, Kathmandu Nepal.

- Uhlig H, Kreutzmann H (1995) Persistence and change in high mountain agricultural systems. *Mountain Research and Development* 15(3):199-212.
- UNFPA = [United Nations Population Fund] (1991) *Population, Resources and the Environment: the Critical Challenges*. Banson, London.
- United Nations (1973) *The Determinants and Consequences of Population Trends: New Summary of Findings on Interaction of Demographic, Economic and Social Factors*. Population Studies, Vol. I. United Nations, New York USA.
- United Nations (2001) *Population, environment and development. The concise report*. United Nations, New York USA.
- Verburg PH, de Groot WT, Veldkamp A (2003) Methodology for multi-scale land-use change modelling: Concepts and challenges. In: Dolman AJ, Verhagen A, Rovers CA (Eds.), *Global environmental change and land use*. Kluwer Academic Publishers, Dordrecht, the Netherlands.
- Verdon M (1998) *Rethinking Households*. Routledge, London.
- Weinzettel J, Hertwich EG, Peters GP, Steen-Olsen K, Galli A (2013) Affluence drives the global displacement of land use. *Global Environmental Change* 23:433-438
- Wikipedia (2013) Nuclear family. On webpage. Available online: http://en.wikipedia.org/wiki/Nuclear_family. (Accessed on 17 February 2013)
- Wood G, Malik A (2006) Sustaining livelihoods and overcoming insecurity. In: Wood G, Malik A, Sagheer S (Eds.), *Valleys in Transition: Twenty Years of AKRSP's Experience in Northern Pakistan* 54-119. Oxford University Press, United Kingdom.
- World Bank (1992) *World Development Report 1992: Development and the Environment*. New York: Oxford University Press.
- Wright, Duncan (2005) *Livestock, Fodder, Pastures and People: An Integrated Study in the Northern Areas of Pakistan*. ICIMOD, Kathmandu Nepal.
- Wyman MS & Stein TV (2010) Modeling social and land-use/land-cover change data to assess drivers of smallholder deforestation in Belize. *Applied Geography* 30:329-342.
- Zarin MM & Schmidt LR (1984) *Discussion with the Hariq; Land tenure and transhumance in Indus Kohistan*. Center for Southeast Asia Studies, University of California.
- Zurick DN (1990) Traditional knowledge and conservation as a basis for development in West Nepal Village. *Mountain Research and Development* 10(1):23-33.