

Traditional Knowledge and Local Institutions Support Adaptation to Water-Induced Hazards in Chitral, Pakistan

Aga Khan Rural Support Program, Chitral

Key messages

- Traditional water distribution and management practices have been the most effective strategy for efficient use of limited water resources and reducing vulnerability to climate extremes.
- Social capital has been the most enabling factor for collective action in both traditional management of common resources and acquiring services and development support from NGOs for strengthening adaptive capacity.
- Dependency on climate sensitive resources for livelihoods increases the vulnerability to climate variations unless households have multiple sources of income to help diversify their livelihoods.
- Community responses to climate extremes need to be strengthened through development and implementation of policies that strengthen or supplement adaptation practices.
- Provision of basic services like education, health, and physical infrastructure is instrumental in building resilience among the community.
- Women are the most vulnerable segment of society and policies and programmes aimed at empowering women need to be devised.

Introduction

The study examined adaptations to flash floods or droughts among marginal farmers and herders in a geographically, socially, and economically marginalised and isolated region – Chitral, District in the extreme northwest of the Northwest Frontier Province (NWFP) of Pakistan. The area is an interesting case because it has always had ‘too little or too much water’ as a dry, water insecure area that suffers flash floods. The local people are vulnerable economically and physically to water stresses and hazards.

Extreme terrain and isolation make its inhabitants more vulnerable. Chitral’s 14,850 sq.km (20% of NWFP) border on Afghanistan to the north and west, Gilgit-Baltistan of Pakistan to the east, and the districts of Dir and Swat to the south. The Chitral River and its numerous tributaries have carved deep, convoluted valleys into the mountainous terrain. Chitral’s inhabitants have very limited cultivatable land near their traditional settlements on old fluvio-glacial terraces or alluvial fans on the valley bottoms (Figure 3).

Livelihoods and socio-cultural context – Chitral has a population of about 385,000. Its 48,000 households have about 8 persons each on average. The overall literacy rate is 59 – 77% for men, 40% for women (AKRSP 2007). The population has diverse ethnicity, traditions, and customs due to past and present migration from outside. About 90% of the population engage in farming and 75% also get income from off-farm sources. Population increases have led to fragmentation of land holdings, thereby increasing cropping intensity and the vulnerability to water stresses (AKRSP 2007).

Dry rain shadow climate – Chitral is in the rain shadow of the Hindu-Kush and does not receive monsoon rains. The mean annual rainfall is about 650 mm in lower Chitral (Drosh) and 500 mm in the central valley. This precipitation falls mainly in spring and winter. Summer and autumn are dry, with 10-25 mm of rainfall per month. Further north into the rain shadow, in Upper Chitral, the annual precipitation of 200 mm comes mostly as snow at higher elevations. The only two routes into the district are via the Lawari Pass (3,200 masl) in

the south and the Shandur Pass (3720 masl) in the north; both are usually closed by heavy snowfall for at least five (winter) months of the year.

Study sites

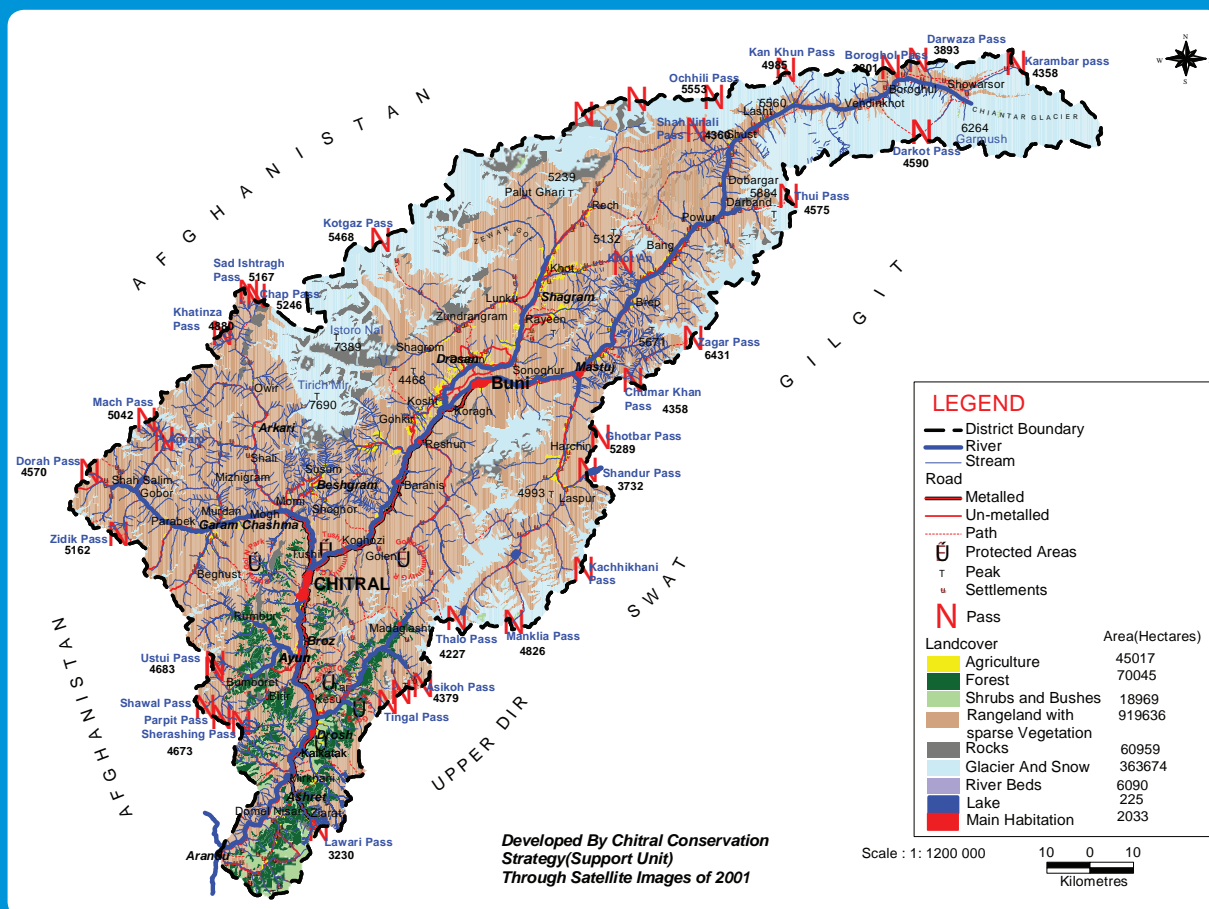
The study was conducted in two (of 24) Union Council areas in Chitral – Shishikoh and Mulkhow. Mulkhow (average elevation 1,600 masl) is in the north of the district about 85 km from the district centre. It is surrounded by mountains, including the permanently snow clad Terichmir peak (7,700 masl). The undulating terrain and steep slopes have lower, double cropping, and higher single cropping, zones. The 14,000 inhabitants belong to about 1,600 households.

Subsistence agriculture is the main source of livelihood. The average landholding of just less than a hectare allows for production of cereals and livestock. The people of Mulkhow are a single, ancient ethnic group, the Khaw. Historically, the area has been water deficient. Variations in the frequency and duration of rains are the main reasons for prolonged droughts affecting the socioeconomic conditions of the dwellers.

Shishikoh (1,400 - 4,000 masl) is a side valley in lower Chitral with a population of 12,400 (DCR 1998). It covers 56,586 ha, of which grazing land is 64%, forest is 26%, and cultivated land is 2%. The remaining 8% is glaciers and permanently snow-covered mountains (IUCN 2005a). These physiographic features create varied seasonal temperatures, colder at higher altitudes. The general climate is dry, temperate. Occasional summer rains may cause flash floods, which is exacerbated by rapid and continuous deforestation (IUCN 2005b).

Flash floods have been increasing in frequency, and have led to shrinking and erosion of the inhabited and cultivated land for decades. This has forced many people to migrate or build their houses higher up the slopes. With tenure problems and average land holdings on the sloping land as little as 0.45 ha per household (IUCN 2005b), the farmers are not investing to make it more productive. Consequently, the main sources of livelihood are forestry and livestock raising, complemented by daily, seasonal, and annual migration for labour.

Figure 3: Landcover map of Chitral (Source: Forest grazing lands and watersheds (2004) Chitral: IUCN, CN-CCS Support Unit)



Impacts of Water Stresses and Hazards

The main impacts of water stress and hazard involve drought in the Mulkhow study site and flash floods in Shishikoh. Recurrent droughts and flash floods in the study areas have eroded the assets of the local population, reducing their adaptive capacity and making them further vulnerable to the water induced hazards. In these remote areas with limited development interventions, the opportunities to diversify livelihoods are almost negligible, which further increases vulnerability to the impacts of water stress and hazard. Throughout Chitral, women are particularly vulnerable, regardless of the nature of the hazard.

Mulkhow – the impact of drought

Depletion of water resources – Agriculture has been severely affected by the drying up of water resources, mainly springs. Between 1998 and 2008, 53 natural springs in Mulkhow (about half the total) were depleted.

Poor agricultural production and crop failure – Shortage of water has reduced the area under

cultivation and crop yields. Many farmers have faced a serious problem of complete crop failure when the wheat crop did not mature. The crop has to be prematurely harvested and fed to animals, resulting in huge loss in terms of time, labour, and money. Despite being in a double cropping zone, the farmers of Mulkhow now cultivate only a single crop – mostly wheat. Maize and vegetable production is negligible.

Loss of trees – Similarly, loss of trees (fruit and non fruit) due to water shortages has become a serious problem in Mulkhow because household nutrition and fuelwood needs are supplemented by these resources. Walnut trees, which used to be a source of cash income have already disappeared. A key informant said the drought of 1998-2002 was so severe that his village lost almost 70% of the trees.

Shishikoh – the compounded effects of flash floods

Loss of land and infrastructure – The flash floods in Shishikoh have damaged households, destroyed communication and physical infrastructure, and eroded

Typical landscape in Mulkhow, Chitral district, Pakistan, showing settlements and fields





A very intense rainfall event triggered a flash flood in Shishikoh, causing substantial damage to agricultural fields

cultivable lands. Loss of productive land and poor productivity, due to flash floods and debris fall, have led to food insecurity.

Higher prices – The destruction of Chitral’s meagre communication infrastructure by frequent flash floods contributes to price increases for consumable items in village shops making the communities more vulnerable to potential hazards. Transporters charge more than usual during the flood season because, after flash floods, they usually repair and maintain the main communication road that passes through Shishikoh.

Loss of livestock – Both flash floods and drought affect livestock. Water stresses and hazards negatively affect the livestock sector due to a shortage of fodder. Animals, especially cattle and goats, are lost in flash floods or droughts and, after the extreme events, may become susceptible to various diseases, start losing weight, and die due to limited availability of fodder.

Less water for domestic use

Vulnerability of women – The depletion of water sources, such as springs and perennial streams in Mulkhow has seriously reduced the availability of water for domestic use, which has resulted in poor health and hygiene, especially among children and women. The shortage of water has also limited the social lives of women as they often cannot wash their clothes, which constrains their participation in social events and confines them to their households.

Responses to Floods and Droughts

The communities have always responded to water stress and have developed traditional responses that include irrigation structures, water harvesting, and community management mechanisms. Responses to water-induced hazards are more specific to drought in Mulkhow and to flash floods in Shishikoh. People at both study sites diversify their livelihoods with migration for employment, and have similar responses to impacts on livestock.

Mulkhow – adaptations to persistent drought

The communities of Mulkhow have ancient systems to deal with the historical shortage of water. Their traditional local institutions contribute to the fair distribution of irrigation water, the collective management of irrigation infrastructure, and the collective harvesting and storage of water. Individual farmers might also pool, borrow, swap, or purchase water for kind or services. As water shortages are intensifying, farmers are modifying their cropping systems to produce more drought tolerant crops.

Local systems for water distribution – Under the traditional distribution system, water is allotted according to the size of land of different groups – a person having more land has access to more water and vice versa. Similarly use of water between villages is also defined, i.e., some villages use water in the daytime, while some use it at night depending on the geographical location and potential evaporation losses.

The distribution of water is managed by a water distribution committee comprised of elders who develop

a water distribution schedule for the member households according to their water rights. There are no written rules or bylaws; the system is based on a social code of conduct that each beneficiary household has been following for generations.

Collective management of irrigation infrastructure

– Improving the efficiency of the limited irrigation infrastructure is another strategy adopted by the inhabitants throughout Mulkhow region. Maintenance and repair of irrigation networks to avoid water losses is undertaken under the system of ‘mirzhoi’ under which the community hires one or more persons (paid in cash or grain) for maintenance of water channels.

The system ensures regular maintenance and repair of irrigation infrastructure and creates employment. Larger repairs such as re-excavation are carried out under a collective system called ‘mone’ (service by turn) where each beneficiary household contributes its share of labour material or cash depending on the resources available to them. Similar kinds of arrangements have also been made among villages when the scale of

Traditional water distribution and control structure (nirwalu) in Mulkhow for dividing water in equal portions for two downstream users



work is beyond the capacity of one village. Equitable distribution of water is also ensured through a traditional water control structure called 'nirwalu' (a round-shaped hole in the middle of pairs of stone or wooden planks with an equal dimension that is installed on the two corners of a small dug pond).

Traditional water harvesting – In Mulkhov, the traditional water harvesting reservoirs have been very useful for tapping meagre water resources from perennial streams and springs and using the water according to a predefined distribution arrangement. Water harvesting is done mainly for irrigation and drinking, however, some microstructures constructed by the women were used to provide water to livestock on a regular basis.

The water reservoirs are innovative; they reduce water losses and lessen the workload of the farmers. For example, people with turns to get water at night, store their share of water in the reservoirs to use during the day. The strategy has been helpful especially for female-headed households because the women cannot go outside at night. In addition, the transformation of these traditional structures into concrete water reservoirs with the support of GOs and NGOs has further institutionalised the use of water in the area.

Pooling of water – When less water is available, the farmers at the tail end of the irrigation system may not receive their allocated amount of water due to evaporation and seepage/leakage in the distribution system. To deal with the situation, two or more farmers pool their water and equally divide the time of irrigation.

Borrowing and swapping water – The system of borrowing and swapping water for farming is a common strategy to supplement irrigation water needs in some villages. Key informants revealed that borrowing and swapping water is an ancient practice to address water shortages. The system works well for all, especially for poor farmers and those located at the tail end of the water distribution system.

However, population increases and changing rainfall patterns have led to acute water shortages since the early 1990s. The system in Mulkhov has evolved into a commercial practice with trading of water for kind (like fodder, fuelwood, and poultry), services (weeding, harvesting, irrigating land, household work, and others), and cash. Earlier people did not buy or sell water – farmers with an immediate need for water would ask

their relatives and tribes with major water rights for free-of-cost water support. Now, farmers in Mulkhov use a mixture of these coping strategies.

Modifying crop systems and land tenure – Farmers in Mulkhov are modifying their cropping systems to adapt to water shortages. The crop management practices include use of improved agricultural inputs, planting earlier, and agroforestry. The farmers also plant fruit and non-fruit trees on the borders of cultivable land to reduce the intensity of sun, increase land productivity, and supplement household firewood needs. Drought tolerant and early maturing poplar and rubinia are the most common trees planted in the region. Households with limited or no land rent fields from large landlords on a contract basis such as a 50/50 profit or loss. Farmers with less water prefer to do contract farming with a farmer who has more water rights to provide deficit water for their own lands as well.

Shishikoh – adapting houses, settlements, and land use to cope with flash floods

The design and location of houses and settlements are critical in protecting people from flash floods. In Shishikoh, the majority of people make their houses from stone (instead of mud brick) so that they are more resilient to water damage. The increasing rate of flash floods has compelled them to leave the valley bottoms and construct their houses on slopes. Local people consider the nature of soil, vegetative cover, grazing routes, and previous history of flash floods while constructing houses on slopes. However, this strategy may not be practicable for everyone due to limited land holdings, the high cost of construction, and their emotional attachment to the land.

Adaptations in Livestock Raising

The communities in both Mulkhov and Shishikoh depend heavily on livestock in their livelihoods. Being the custodians of livestock, women have a lead role in responding to climate variations in the livestock sector.

Lending livestock to avoid selling – Lending or borrowing domestic cattle is a major strategy employed to avoid livestock losses due to water shortage. Since the shortage of fodder makes rearing animals impossible for households with limited resources, they lend their animals to well-off households, especially relatives, instead of selling or slaughtering them. Two types of lending systems were documented in Mulkhov and Shishikoh.

In the first, animals, mostly cows, are lent to relatives, neighbours or any other household in the village for a certain period with an agreement to take care of it, the recipient household utilises the products of the lent animal and returns it when the agreed time finishes. The agreement can be extended with mutual consent. The second type of lending is called 'zhawki' – long-term lending of a young animal in an agreement under which the recipient household rears the animal and uses the products, but returns it once the lent animal gives birth to a calf, which the recipient household keeps.

Borrowing fodder – Borrowing fodder and weeding others' crops for fodder is also popular among poor households to meet fodder shortages. In addition, women collect wild shrubs to supplement the livestock fodder needs.

Pooling and shifting herds – To address the shortage of fodder, households in Mulkhow shift their cattle to high pastures to graze freely without any caretaker, but villagers make regular visits to the pasture to check the status of animals. Under the traditional system of sotsiri, households pool their animals for grazing attended by one or two members of each concerned household on a rotational basis for agreed periods, mostly daily. A traditional system called pajal (shepherds) is also intact in Mulkhow in which local men or boys are paid in kind or cash to graze the animals in high pastures and protect them from predators at night.

Modification of livestock breeds – To cope with fodder shortages due to water stress, people in Mulkhow rear local breeds of cattle because they require less feed due to their small size and are also acclimatised to the local climatic conditions. Women might shift from goat to sheep rearing in order to minimise the loss of animals because the local breed of sheep is more resilient to drought and provides quality wool for the production of local carpets and traditional woolen fabric (shu).

Mobility is an adaptation to diversify livelihoods

People at both the Shishikoh and Mulkhow study sites have been coping with water stresses and hazards through mobility – through seasonal migration, for employment, seasonal movement of herds to areas with more water and fodder, or permanent migration to places where they have better opportunities for livelihoods.

Seasonal migration of the labour force – The impact of water induced hazards in Shishikoh and Mulkhow

compels a significant proportion of the male workforce (skilled and unskilled) to migrate to other areas for better livelihood opportunities. They migrate out both individually and in groups. Households with limited resources are more willing to migrate.

Social networks play an important role in facilitating the migration process. Migrant communities in Pakistan's major cities assist new arrivals to get accommodation and jobs. The migrants also help and support each other in case of mishap. Internal lending is a common practice among the migrants to purchase rations for home, pay school fees, and arrange travel expenses. Migration takes a heavy toll on women as it leads to an increase in their workload when they have to take over the household chores of the migrant men.

Seasonal movement of families and herds for water and fodder – The dwellers of Mulkhow practise short-term intra-rural migration to overcome water shortages. In summer, almost half of the dwellers shift their families, belongings, and livestock to temporary houses at high altitudes. They return to their permanent settlements in November.

Permanent migration – In addition to seasonal migration, permanent migration is used as a strategy to deal with the persistent drought in Mulkhow. Between 1998 and 2008, approximately 195 (10% of total) households permanently migrated from Mulkhow to different localities in Chitral. Though men make the final decision, women play a key role in mobilising and convincing their male partner to migrate permanently and settle somewhere else.

Factors Influencing Local Adaptation

Several factors in Chitral may either enable or constrain the capacity of the local communities to build their capacity to adapt to water stresses and hazards. These factors combine social, economic, geographic, and political issues.

Strong, inclusive social capital – Social networks and organisations play a key role in shaping adaptation strategies and reducing vulnerability of the local communities in the study areas. Strong social capital promotes active participation of community, a sense of responsibility, and cooperative action among the communities, which is key for sustainability of the adaptation strategies. In addition to this, it allows the community to collectively defend their interests and organise access to the services of development agencies.

Strong social capital among the communities in Mulkhow has kept alive the centuries-old traditional resource management systems. However, in Shishikoh, in some instances, conflict over common resources has divided the communities into rival groups, weakening the social networks and resulting in forest degradation.

Traditional knowledge and systems – Traditional knowledge and systems are inherent in the communities of Chitral, but with the passage of time, these traditional systems have been eroding. The systems are still very strong in Mulkhow and play a vital role in strengthening the adaptive capacities of the communities. The traditional water distribution and management system not only ensures optimum utilisation of meagre water resources but also promotes collective action for the difficult maintenance, which is key for sustainability of adaptation strategies.

Economic situation – The capacity to adapt to the climate variability and extreme weather events depends highly on the economic condition of the communities. Economically well-off households with multiple sources of income are more resilient to the adverse affect of climate variability as they have better access to quality health services, educational institutions, and employment. Households whose livelihoods are based solely on natural resources are affected more by the climate-induced hazards, which may result in maladaptive practices such as selling off livestock, valuable assets, and lands; or further exploitation of forests; that make them more vulnerable.

Role of NGOs – In the relative absence of government investment in the development of the area, NGOs are playing a key role in the socioeconomic development of the communities, which enhances their adaptive capacities. However, in some communities, especially Shishikoh, cultural traditions prohibit the participation of women in public spaces, which prevents them from accessing development interventions undertaken by NGOs that stipulate the participation of women as a requirement for implementation of development activities. In Mulkhow, the educated youth have played a key role in mobilising communities to work with NGOs.

Isolation and poor geographical access – Communities in the study area are hindered in their adaptive capacity by the geographic isolation that limits their access to the information and technical skills necessary to diversify their livelihoods. For example, microfinance is used as an effective coping and adaptation strategy among many communities, but limited physical access, lack

of information about products/services, and complex procedures, limit the widespread use of this option. Limited access to markets for labour, business, and other sources of income generation prevents diversification of livelihoods.

Government policies and governance – The lack of proper implementation of policies and poor governance limit the capacity of people to adapt to extreme events. For example in Shishikoh, large-scale forest harvesting by the government through contractors is making the locals more vulnerable to flash floods. Similarly, in the absence of a policy on land settlement and use, the communities are constructing their houses in areas that were hit previously by flash floods. Limited investment by the government in social (health, education) and economic (energy, employment, access to market) sectors is another factor that prevents the communities from building their adaptive capacities.

Conclusions, Recommendations, and Policy Implications

Climate induced hazards in the form of flash floods and water scarcity have negatively affected the livelihoods of the inhabitants of the study areas. Negative impacts of extreme events are evident in the form of depletion of water resources, loss of agricultural land, poor agricultural productivity, loss of livestock, and destruction of the meagre physical infrastructure. Extreme events have also increased the workload, limited the social lives, and created poor health and hygiene conditions for women. The prevailing gender roles further exacerbate these impacts and make the women more vulnerable.

The long history of drought and flash floods in Chitral has equipped local communities with the knowledge and skills to cope with changing, climate-induced situations. Traditional water management, pooling of resources, crop diversification, traditional livestock management, and migration are major responses to these water hazards. These indigenous mechanisms focus mostly on reducing vulnerability to climate hazards through effective and efficient utilisation of resources.

The major factors affecting adaptation were identified as strong social capital, existence of traditional knowledge and systems, economic situation, isolation and poor geographical access, acceptance of or resistance to NGOs, and government policies and governance. Livelihood strategies traditionally used to reduce climate risks can enhance resilience to water stress as long as

the social contacts withstand the social and economic changes. It is uncertain how the traditional strategies will manage to adapt and facilitate adaptation to a drier or wetter climate in the future. The following recommendations are based on the aspirations of the community respondents.

Improving traditional irrigation infrastructure –

Strengthening traditional irrigation and water harvesting structures will reduce communities' vulnerability. Lining irrigation channels and up-grading traditional reservoirs into concrete structures will promote efficient utilisation of water resources. With large irrigation projects, the effects of adding large quantities of water into the fragile soil and increasing the cropped area should be investigated to prevent further degradation and loss of the limited soils.

Livelihood diversification – The livelihoods of the people in the study area are based generally on climate sensitive resources and there is an urgent need to provide them with alternative sources of income. Diversification of livelihoods through development interventions in capacity building, facilitating off-farm income generating activities, and creating job opportunities through major development interventions should be promoted by decision makers and development actors (both government and NGOs) to reduce the vulnerability of the communities in these areas.

Fostering social capital – Social networks and institutions help communities adapt to changing environmental

conditions through collective management of resources. Proper institutional building measures will further strengthen the social capital within the community that maintains efficiency, effectiveness, and sustainability of adaptation measures.

Enabling environment – Community responses to climate extremes need to be strengthened through the development and implementation of policies that supplement and strengthen the current practices. Policies on forest and land settlement and use need to be reviewed to reduce vulnerability and enable adaptation.

Access to basic services – Basic services, like education, health, electrification, and communication, will be instrumental in building adaptive capacities and catalysing strategies for income diversification. Fulfilling the basic development deficit is a very cost effective measure for increasing resilience. Thus, government policies should target factors that enable adaptation rather than waiting for funding of large-scale infrastructure.

Gender mainstreaming – Women in the study were identified as the most vulnerable segment of the society. Therefore, special measures are needed to develop policies/programmes that target this most vulnerable section of the community through the relative empowerment of women instead of setting absolute minimum standards.

Herding is an important part of livelihoods in Chitral



