



Identifying gender vulnerabilities in context of climate change in Indus basin



Saqib Shakeel Abbasi^{a,*}, Muhammad Zubair Anwar^a, Nusrat Habib^a, Qaisar Khan^a, Kanwal Waqar^b

^a Social Sciences Research Institute, National Agricultural Research Centre, Park Road, Islamabad, Pakistan

^b International Centre for Integrated Mountain Development (ICIMOD), Pakistan Office, Pakistan

ARTICLE INFO

Keywords:

Indus Basin
Gender vulnerability
Gender role
Scale

ABSTRACT

Changes in temperature and hydro-meteorological patterns in Indus basin due to climate change are believed to be impacting farming communities in different ways. From a gender perspective however, impacts of change vary from place to place, household to household and for individual members of the household due to a multiplicity of factors including expectation of individual members of a household to take additional responsibilities in difficult times. As an unavoidable coping strategy, the affected communities in upper Indus basin are compelled to send male members away from home in search of alternate sources of livelihoods. This compels women to take additional responsibilities at farm, household and community levels which ultimately increase the vulnerabilities of local women. However, scenario is different in mid-stream, where women have an additional workload to manage water requirements for household and livestock. While in downstream of the basin, women are culturally and socially dependent on men which increase their vulnerability many folds. Therefore, differentiated analysis of climate change impacts, based on gender roles and responsibilities, is crucial in climate change research. This paper presents gendered vulnerabilities at different scales in up, mid and downstream of the basin.

1. Introduction

As in other parts of the world, Pakistan also experiences changing climate. Increased frequency and duration of extreme climatic events has triggered natural disasters – aggravating erosion, land degradation, with consequent decline in soil fertility and crop yields. The capacity of people to deal with these growing stresses is limited – with negative impact on poverty (Wymann von Dach et al., 2017).

During the winter and spring, the Karakoram area is affected by broad-scale weather-systems, originating primarily from the Mediterranean or from the area of the Caspian Sea (Singh et al., 1995) from air mass convective storms in the pre monsoon season, and from monsoon systems during the summer. A study by Mueller et al. (2014) that spans over 21 years (1991–2012) claims that in rural Pakistan heat stress has consistently increased and had put a negative effect on the farm and off-farm activities, affecting lives of communities.

Women and men are affected differently by climatic shocks and extreme weather conditions in the Indus River Basin that is broadly classified into up-stream, mid-stream and down-stream (ADB, 2013). The gender vulnerabilities are different due to their

* Corresponding author.

E-mail address: saqib2985@gmail.com (S.S. Abbasi).

<https://doi.org/10.1016/j.envdev.2018.12.005>

Received 1 November 2018; Accepted 6 December 2018

2211-4645/© 2019 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

socially fabricated roles and responsibilities. Generally women suffer from inequality and they earn less, possess limited access to information and extension services, limited control over resources, less access to credit and decision making authorities (Jost et al., 2015). Women are often more vulnerable than men to climate change because they have less education than men, denied property rights and difficulty to access financial credit or extension agents (Gurung et al., 2010).

Women living along Indus basins are not only responsible for household activities but are also engaged in economic activities by rendering services in sub-sectors of Agriculture and livestock (Iftikhar et al., 2009). Similar findings also been reported by Kausar and Ahmad (2005) that in rural areas women are more efficiently involve in different crops production, protection, post-harvest livestock and poultry management related activities. They are among the millions of landless laborers who work in agricultural fields along with their male counterparts. In spite of extensive contribution of rural women in rural economic development in general and specifically in agriculture, they have least access to resources as well as other rural development services (Khan and Khan, 2015). Women face a number of social, economic and cultural constraints, which limit their contribution not only in household livelihood but also in overall agricultural development of the country. These also create hindrances in socio-economic empowerment of rural women. They are regarded as more marginalized and vulnerable to poverty and food insecurity during the events of climatic extremes (Luqman et al., 2013).

Majority of population in Pakistan depends upon agriculture which remains the dominant sector in its capacity of labor absorption and in employment creation for 44% of population. Agriculture contributes around 20% of country's Gross Domestic Product (GOP, 2017) and is believed to be the backbone of economy and one would not be mistaken to consider women as the glue force of this backbone for its effective performance (Begum and Yasmeen, 2011). Therefore, Pakistan is an agro-based economy in a way that the biggest chunk of economic resources are generated by agriculture sector (Butt et al., 2010; Mirza et al., 2015; Khan, 2008).

Increasing climatic pressures negatively impact the agricultural and its allied sectors and so with the livelihood of people dependent on it. These negative impacts consequently makes women and children more vulnerable as compared to male members. Agriculture is an economic sector that is particularly important for female employment in Pakistan. It is likely that women's engagement in agriculture is higher than male employment. Unfortunately these do not reflect women's unpaid work. Most of female farm workers are involved in 'subsistence-level farming under harsh conditions and with little or no economic security'. Literature indicated that the extent to which women are engaged in farming and livestock activities in Pakistan depends on a range of factors, including socio-cultural norms, agro-ecological conditions, and migration patterns.

Since agriculture is the hard hit sector of climatic stressors it is important to understand vulnerabilities of people with gender lens. The issues at different location of basins are different, hence it is also important to understand gender vulnerability issues at different scales according to elevation and location in up, mid and downstream so as to inform policy makers and planners involved in climate change and adaptation program. With this objective, this paper presents issues of gender vulnerabilities in Indus basin. Following this introduction, the paper highlights research methods and brief on study areas, followed by result and discussion.

2. Material and method

The research used qualitative analysis of field data together with a review of the relevant literature. Data was collected from the sites selected to conduct Hi-aware activities. These sites were selected during the base line survey, conducted to highlight situation analysis around Indus basin (Abbasi et al., 2017). At first step, field study took place to analyse the situation with respect to changing climate on five sectors i.e water, health, habitation, agriculture and energy, followed by another round of field study to understand socioeconomic drivers of climate change. The present study highlighted the gender vulnerabilities in Hi-aware selected area of study. Focus group discussion with homogenous group of women and men were carried out to understand gender vulnerabilities. The field visits took place between July to October 2017. For gender vulnerability analysis, data was collected from same villages that were selected during situation analysis part of study to conduct hi-aware field activities. Total 54 FGDs from three basin levels were conducted (Table 1) with participation of 8–10 persons of different age groups in each discussion. Average age of the participants ranged from 25 to 50 years in each FGD. Keeping in view the cultural practices and social norms at different study areas, separate FGD's were carried out for men and women.

Table 1
Selected villages and FGD detail.

Study area (Indus Basin)		Selected villages	FGD's for Low, Medium and High Income Groups (Male)	FGD's for Low, Medium and High Income Groups (Fe-Male)
Up-Stream	Hunza and Nagar Area	Minapin	3	3
		Ali Abad	3	3
		Gulmit	3	3
Mid-Stream	High Rainfall Soan Region Medium Rainfall	Dhok Chawaan	3	3
		Saroba	3	3
		Akwal	3	3
Down-Stream	Chaj Doab Area	Chak-7	3	3
		Sada Qabmo	3	3
		Bhalwal	3	3
Total (54 FGD's from three basin levels)			27	27

To understand and examine gendered vulnerabilities and capabilities, the Gender Analysis Framework (GAF) was used for collecting data and to analyse gender needs, activities, access and control of resources, and benefit and incentive analysis. The information collected were further analyzed to identify gender vulnerabilities and capabilities.

FGDs were carried out by researchers comprising two to three interdisciplinary social scientists with eight to ten respondents. The Hunza basin, which comprises the Hunza, Nagar, and part of Gilgit districts, was selected to represent the upstream area; the FGDs were carried out in villages of Minapin, Ali-Abad and Gulmit. The Soan basin, comprising the districts of Attock, Chakwal, Islamabad, Khushab, and Rawalpindi, was selected to represent the mid-stream in view of its diversity in livelihoods and high vulnerability to climate change impacts. There are three different rainfall zones in mid-stream Indus river basin due to variation in topography of the Soan Basin. Therefore, FGDs were carried out at three rainfall zones. Village Dhok Chawan was selected from high rainfall zone (Tehsil¹Murree area) while village Saroba was selected from Medium rainfall zone (Union Council¹ Chakri). Similarly from low rainfall zone of Soan Basin, village Akwal was selected for FGDs (Tehsil¹Talagang Area). The Chaj Doab, comprising the districts of Chiniot, Gujrat, Jhang, Mandibahuddin, and Sargodha, was selected to represent the downstream Indus basin. FGDs were conducted from three villages of Sarghoda, namely, Chak-7, Bhalwal and Sadha-Kambo from district Sarghoda (Fig. 1).

These villages were selected on the basis of topographic difference and temperature variation. In up-stam basin, village Gulmit falls under high temperature zone as compared to Ali-abad and Minapin Village and two major crops can be harvested in the area. The Gulmit village falls under the low temperature area and one major crop can be harvested, whereas Ali-abad has a moderate temperature among the other two villages and falls in between the low altitude area of Minapin and High Altitude area of Gulmit. Therefore, these villages from upper Indus basin were selected on the basis of variation in topography and temperature.

2.1. Socioeconomic profile of Indus basin

Socioeconomic profile of the Indus basin was collected through review of literature and during the situation analysis part of the hi-aware filed activity.

2.1.1. Upper Indus: Hunza basin

Communities living along the Hunza River are agro-pastoral, where their livelihood is dependent on natural resources including agriculture and livestock as major source of subsistence (Ishaq et al., 2015). Wheat, maize and potato are staple crops. According to the last population census of 1998, the population of Hunza-Nagar district was 99,000 which accounts for 13% of the total population of Gilgit-Baltistan.² Hunza Nagar district was divided into Hunza and Nagar district in 2002. Hunza district covers about an area of 7900 sq. km with total no of 12,779 households (AKRSP, 2007). More than 70% of the population depends on agriculture either directly or indirectly. Around 96% of households in Hunza-Nagar have access to agricultural land and cultivate both staple and cash crops (ICIMOD, 2014). Agriculture, livestock, and forestry together accounted for 41% of household income (AKRSP, 2007). About 95% of households owning more than one type of livestock such as yak, sheep, and goat (ICIMOD, 2014). Buffalo and poultry are also reared on a limited scale (AKRSP, 2007). The upper part of the basin has access to roads and better transportation facilities but sometimes due to weather extremities the communities face serious problems. Educational facilities are available up to the primary and middle level in the villages while for the secondary education or higher education the schools are at a distance of 5–10 km's and colleges/universities are located at district level.

2.1.2. Midstream: the Soan basin

The Pothohar plateau covers an area of about 15,830 km² comprising the districts of Rawalpindi, Attock, Chakwal, and Jhelum, and the Federal Capital Territory of Islamabad. However for this study only district Chakwal and Rawalpindi were considered due to climatic changes and vulnerabilities, highlighted during the situation analysis report. Livestock and poultry are main source of livelihood in this area. Dairy products like milk, butter, cream, eggs and meat are the main source of income. The practice of calf-fattening is also increasing in the area along with value addition of agriculture produced for good returns. Women play a critical role both in livestock and agriculture. Grazing is the sole responsibility of men, women only graze animals on fallow lands at the periphery of the village. The study villages in the Soan basin were all well established and there is no seasonal migration for work except for transhumance. The road network infrastructure is also well developed and maintained. The districts in the study area were well connected with main railway stations at Rawalpindi, Islamabad, Fateh Jang, Attock, and Gujar Khan.

2.1.3. Downstream: the Chaj Doab

The Chaj-Doab region is located between the river Ravi and Chanab. People of this area by and large are connected with the agricultural practices. Majority of the people living in rural areas of this region own agriculture land. The most common crops of this area are wheat, rice, sugarcane, fodder and orchards. Livestock is an integral part of their farming system. Almost all basic facilities are provided by the government such as basic health units, schools, agriculture and livestock offices are available even in the rural

¹ Administrative Units in Pakistan: Country-Province-Division-District-Tehsil-Union Council. There are five provinces in Pakistan and one federal Capital city, Islamabad. The provinces are divided into divisions and further into districts. Each district have tehsil units and in each tehsil there are union councils. Number of Divisions, Districts, Tehsils and Union Council, keep on changing with the changes in population.

² GilgitBaltistan is a semi-provincial state that is neither an independent state nor is complete constitutional province. In 2009, it was granted limited autonomy and renamed to Gilgit-Baltistan via the Self-Governance Order.

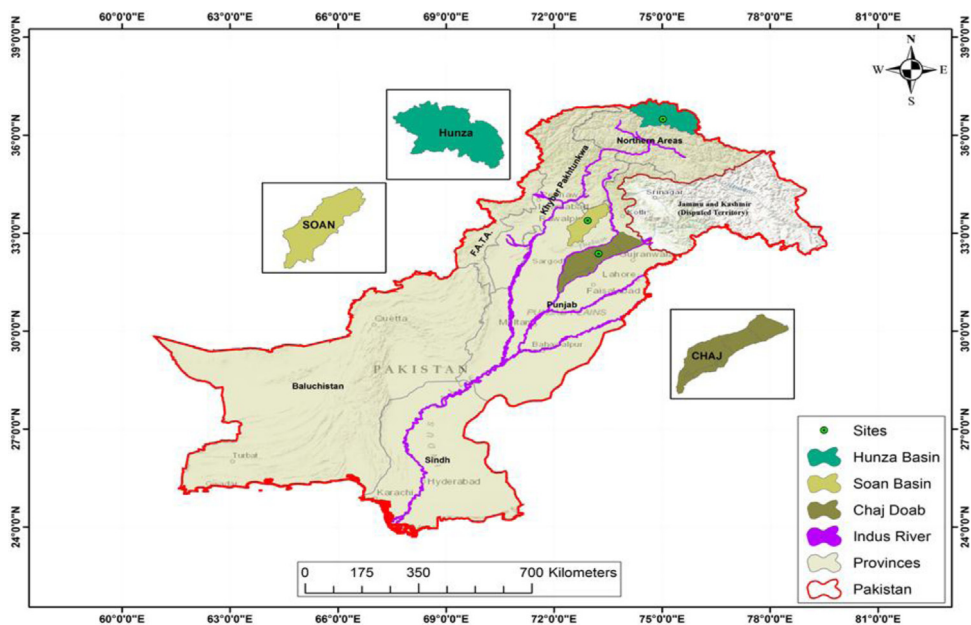


Fig. 1. Study area at Up-stream, Mid-stream and Down-stream of Indus River Basin.

areas. People preferred to educate their children and up to matriculation (10th grade), educational facilities area available in the villages or to near about villages. The Chaj Doab region is densely populated with rich agricultural resources and water is sufficiently available for agriculture purpose during monsoon season, while early summer farmers experience water stress. Agriculture is still the single largest sector in rural areas, and the majority of the population depend on it for survival. The large, medium and small scale industry, business and trade dominate the urban areas. The plains are characterized by gentle slopes, facilitating transportation and good road network from farm to market. Majority of the respondents reported poverty as one of the main issue in the study area which is similar to finding by Waqar et al. (2005). Comparatively, Gujrat and Mandi-Bahauddin districts have the lowest annual income of among all the districts of Chaj Doab region.

3. Results and discussion

3.1. Gender vulnerabilities

It is a fact that vulnerability is a dynamic condition produced by existing inequities in distribution and access to resources, individual's choices and opportunities, which are shaped by the history of social domination and marginalization. Thus, vulnerability is not experienced, but rather embodied, based upon personal circumstances.

Generally, people's vulnerabilities are 'clustered,' and shaped not just by one deficiency but by several overlapping ones. These include tangible insufficiencies, such as the absence of money, credit, an inadequately built house located too close to a river that tends to flood, a degraded natural resource based on which subsistence livelihoods depend, illiteracy and lack of adequate access to information and knowledge. These vulnerabilities often have harsher implications for women for reasons spelled out above.

In Pakistan, climate induced vulnerabilities are affecting both genders. It was mainly due to socially constructed roles and responsibilities of male and female. Further, these vulnerabilities and capacities differ on the basis of gender, location, time, resources, social positions and geophysical locations. This section focuses on feature of vulnerabilities and capacities among the study areas located in upper, mid and lower Indus basin.

The livelihoods of the people living along the Indus basin are based on agriculture, livestock raising, and management of natural resources, migration, labor-intensive household management, and income generation through small scale trade, and wage and casual labor (Leduc and Shrestha 2008). In addition to this, remoteness and under developed communication system within geographical area are a concern. For example, village Dhok Chawaan is well connected to the national road network, however, with in this village there are areas where only a person can walk / climb to commute from one place to other. In such areas, major barrier for the overall socio-economic progress and prosperity of the villages are the poor communication network, which deprives people from using modern tools and practices. During our FGD discussions, it was reported that due to climate change and extreme weather conditions, the phenomenon of soil erosions, landslides and river bank erosions severely affected families and communities. The major catastrophes depriving of their lands, homes and other livelihood assets. During such extreme events, almost all household responsibilities are attributed on women while men were tasked to salvage shelter and food items. Moreover, major catastrophes severely effect education system and create difficulties for children specially girls to gain education as parents become reluctant to let them travel to schools at distance. Such circumstances aggravate the vulnerability of women, early marriages so as to get rid of

responsibilities of protecting daughter.

Another implication of climatic hazards was on physical infrastructure of the farmers living in the Indus basin. Particularly in the upper Indus basin areas, floods and erratic rains results in creating problem of soil erosion and land degradation. The re-establishment of degraded agricultural fields required sufficient financial resources which is difficult to manage by poor farmers. Further, in this area availability of heavy machinery and their mobility is difficult due to mountainous terrains. So local people are bound to use traditional tools instead of tractors, shovels, excavators, etc. This results in increase risk to their lives, risk of losing arable land and crops. In comparison, people in the middle and lower basin, they are relatively in better position. They have access to and have been using modern tools and machinery in the event of flood and other disasters. The recovery time for people living in lower and middle basin in the event of natural calamity is much lower than the upper basin.

3.2. Gender analysis of livelihood capitals

The provisioning and availability of monetary solutions to the people is referred to as financial capital. This includes availability of money, financial solutions-savings/investments, loans, capital for starting businesses, etc. The availability of financial capital varies as per the geo-physical location of the study areas. The study confirms that like the physical assets, population in the upper basin has poor financial capital as compare to people living in the middle and lower basins. The financial institutions and credit facilities are relatively more in the lower and middle basins, whereas in the upper basin they are limited. However, both women and men are active in using these financial institutions whereas, in mid and low stream women are not using credit facility, only men have easy access to take;loans from the formal and informal institutions. Among the formal sources i.e. commercial banks and micro-finance, families of small land holders preferred to get loans from the microfinance institutions. They preferred this source due to easy procedure and flexibility in repayments. While, non-conventional modes of financial transaction, theoretically should be similar in all areas, however, due to poor internet and mobile phone technologies these solutions are less effective in up-stream areas.

Across the study areas, majority of the people have their own agricultural lands. However the people belonging to rich and middle class families are having more land than the poor and very poor families. There were also landless household in the villages and they usually worked as farm labor. Some landless families rented land or do farming on shared cropping. This class is deprived of natural capital like land and in this group, women are more vulnerable compare to men as the land arrangement and property ownerships are usually attributed to men. Hence women in this class are dependent on men for any resources. Also, in the study areas, people consciously deprive their girls in hereditary transfer of property and land ownership. These people think that they have paid female share in term of her dowry at the time marriages. Since women lack capitals to respond to climatic stressors compare to men, they become more vulnerable to climatic shocks. The study reveals that one of the major challenges of the poor is that they don't have savings to cope with natural hazards and their other emergency needs.

The communities living along Indus basin has socio-cultural differences. In the up-stream cultural norms, value and even in genetics they are different from the communities living in mid and low stream. They have gender egalitarian relationship, with progressive nature, more educated and agriculture mainly perform by women both as laborer and decision maker. It is due to small land holdings size and trend of men's migration to other cities. Thus, the overall environment for women and their participation in social activities appear to be much open minded as compare to down-stream and mid-stream basin. Since women are the sole manager of farming, women in upper Indus tend of maintain social capital than in mid and downstream to meet their needs. Due to this social capital, women in the area have their own businesses, jobs and take part in commercial activities. This is due to the strength of this social capital that women in the upper Indus basin are more qualified and highly educated as compared to the women of mid and low streams. In the face of climate change, due to this characteristics women in upper Indus are relatively less vulnerable than women in mid and downstream, where women's dependency on men is high.

Political capital is also a male dominant exercise in the overall study area. At local government level, there are special seats for women and they do get elected on these seats but practically their role is limited to a signatory and not more. The decisions, funds and development work are under the control of men. In very few cases, women are active politically and are playing their role in development and needs of women related issues in their respective constituencies. Secondly, during the general elections or at the time of resource distribution in the area, the needs of men are highlighted and very less is given or shared with women. In case of disasters, mostly women's saving and her gold asset is compromised but if government at any stage come up with financial assistance, it goes to the men and women again remain deprived of it. Women are even deprived of their right of vote and have to vote for the candidate where the male counterparts are supporting. This is because the decision making power rests with the male members of the society.

Table below shows climatic and socioeconomic stressors shaping gendered vulnerabilities (Table 2).

3.3. Gendered adaptation to change

As river Indus flows from mountains to plains, the communities living around it have different livelihood sources, cultures and environment. The people living in up, mid and low streams of Indus basin have different coping strategies against climatic extremes and shocks. Living in unpredictable and harsh environments has compelled communities to develop ways of coping with excesses and shortages of water. Coping strategies to deal with limited or too much water have thus been built into subsistence strategies, whether in terms of diversification of livelihoods or adopting various short-term and long-term strategies to help 'cut one's losses.'

Culturally there is a clear gender division of labor in responding to disasters too. The roles and responsibilities have differences between men and women in preparation, responding, and recovering from disasters. The case studies from northern areas of Pakistan

Table 2
Climatic and socio-economic stressors at three basin levels.

Up-Stream	Midstream	Downstream
Farming as women's responsibilities	Water scarcity	Salinity
Climate hazard disturb natural resources	Poverty	Fog
Land degradation	Small land holdings	Smog
Soil erosion	Smog	Unskilled female workers
Fruits and forest plants destruction	Fog	Not involved in decision making
Livestock effected	Hail storm affect vegetables and fruits	Less female re-creational activities
Water channels disturbed	Low yielding animals	Over-burdened female responsibilities
Difficult to re-establish agriculture land	Increased temperature	
Increased insects, pests and disease attacks	Restrictions on female Mobility	
Malnutrition among human and animal population		
Work load of female increased		

record (Livelihood Options for Disaster Risk Reduction, ITDG, 2000 cited in Fordham 2001) that in preparation for floods women take action to preserve food items and seed material for continuity of livelihoods. The domain of raising the bunds to prevent flood waters entering homesteads, taking women and children to safety seems to be the responsibility of men. In the up-stream of Indus basin, flood-prone communities create structures made of clay or mud, raised off the ground which ensures safe and dry storage of fuel wood, dry food, animal fodder and medicines. Women also engage in preparatory measures in advance of floods to stock up on essential items such as grains, oil and kerosene, as well as drying vegetables and fruits for future use. In the situation of flash flood and heavy rains or in acute crisis situations, families take their belongings and animals and move temporarily to safe places that are more elevated than their own, or use safe public buildings such as schools or offices that have been allocated as public shelters (Dankelman, 2008).

In upper Indus basin Livelihood diversification activities both on and off the land is a common response to dealing with the vagaries of floods. For men in most of the northern areas of Pakistan, off-farm seasonal migration has become an important adaptation strategy. In contrast, women who are left behind have changed cropping pattern to reduce the risk of crop failure. While in mid and up streams men and women have access to different range of opportunities, more so for the men. In these areas, male and female have shown varied coping strategies to deal with changing climatic patterns on agriculture and food systems. As pointed out above one of the main adaptation practices for young men has been outmigration to urban areas or foreign countries for employment opportunities (Gioli et al., 2014).

Due to this strategy in upper and also in mid basin level agriculture is mainly female dominated. Consequently, leaving all the farming and non-farming responsibilities to women members of the respective households. Thus, feminization of agriculture and rural livelihoods in many parts of the Indus basin is a reality and highlights how rural women are already situated at the forefront of mitigation and adaptation activities. However, it is also a fact that across the basin women's continue to face differential access to resources, ownership and control over critical natural resources, a reflection of the limited impact evidence-based data in helping to transform legal and institutional supports to address existing skewed gender power relations.

It is evident from the literature and empirical evidences suggests that in many areas women are adapting to environmental changes, developing shifts in their crop varieties in order to adjust their cropping pattern and crop calendar. Results also indicated that how poor and highly vulnerable women are also able to articulate and prioritize what they need in order to be able to sustain their livelihoods, whether it be safe places to live and to store their harvests and livestock during the monsoon season; better access to services such as agricultural extension; training and information about adaptation strategies and livelihood alternatives; and access to resources to implement effective strategies and overcome constraints (Mitchell et al., 2007). Diversification of production is a common strategy, with changing cropping patterns and/or growing different types of grains, vegetables or fruits. In the rural Pakistan females belonging poor households are actively involved in the promotion of kitchen gardening, water ponds, off-seasonal vegetables, alternative energy technologies such as biogas, improved cooking stove, and also participate in promoting sustainable soil management by protecting farmyard manure from sun and water. In some places farmers have integrated legumes with cereal crops to diversify their cropping patterns (Mitchell et al., 2007).

In mid basin level and high altitude communities have a major strategy is out-migration of men, resulting in an increase in women's work burden. Apart from this, the communities are resorting to other various adaptation strategies too. The people living in up-stream and at mid-stream of Indus basin have ensured strong adaptive strategy in high altitude agro-pastoralism such as timing of farming, rotational grazing, movement of animals and fodder production for the lean season - they have designed a coping strategy by regulating the number of herd animals, sharing of grazing pastures for a pre-determined period of time and diversification of agriculture crops. At the same time, the evidence is that often innovative attempts, localized adaptation strategies and extensive local knowledge of the local resource base may not always be sustainable or adequate, especially when the floods (and droughts) are intensified. All too often, strict gender roles or caste practices, economic destitution or the lack of access to information and resources come in the way of women learning new skills and using new tools to diversify their livelihood strategies.

3.4. Role of institution during climatic hazards

Government of Pakistan has started numerous state programs aimed at facilitating climate change local adaptation, disaster

preparedness as well as for improving agriculture and conservation of natural resources like water, forests, soil etc. Although these programs and projects are addressing the climate related issues but it is also a fact that most of the national policies do not give much consideration to gender issues despite the growing evidences of gender-differentiated local adaptation practices to climate change.

Climate change has imposed multifarious problems on the communities living across the Indus basin. In upper Hunza the intensity of flash floods are increasing every year and it becomes a regular feature. In addition to this erratic rainfall and increase in temperature are effected their crops, animals and even human health. During these extreme events local communities faced heavy economic losses and even some time their houses and food situation comes under serious conditions. So to tackle their problems some basic public institutions are their but capacity of most of these institutions is limited to handle the disaster of large scales. Most of the time government department provides food and shelter to the local communities. During the FGDs farmers were asked about the facilities provided by these government institutions during the floods or other disasters. Responding to our questions there was a general consensus among the people they do receive assistance in shape of finances and in shape of day to day consumables and food etc. Although they were highlighting institutions but at the same time they have raised the questions about the quality of services they are providing to them. Again women's were of the view that government institutions not give much consideration to women's needs despite the growing evidences of gender-differentiated local adaptation practices to climate change.

Non-formal institution of the studied communities do exist across the Indus basin and both male and female take benefit from the available informal institutions such as youth groups, community centers, mosques and religious committees etc. Mostly these social institutions helped effected communities during and after the flood and disasters. Mostly they provide food, fodder for animals and to some extent also provide them financial help to the poor household. So after the floods usually they are providing them farm inputs like seed, fertilizer and technical knowledge to reestablish the farming activities. Most of the government institutes are located away from the localities and people have to travel for long distances to contact them. The government institutions are accessible for both male and female but comparatively males have easy access to them due to social and cultural practices on mobility. Most of the departments are run by males and women mostly do not feel comfortable visiting there.

The situation of educational institutions (both male and female) also available. The trend of education was increasing over the years. Due to the topography and climatic changes now parents preferred to educate their children's just to diversify their livelihood resources. Comparatively, situation of education in both male and female was higher in up-stream of Indus basin (Hunza Area), the trend of education in mid and low stream was also found encouraging. The gender segregated analysis of the data indicated that from the formal and informal institutions male members have more benefits as compared to the female members. There were no recreational activities for female across the region. They only confined to their household and farm related activities. Only they have option to watch TV in the evening. The issues of social mobility even in the situation of natural hazards is also limited in low and mid-streams of the Indus while in up-stream women's mobility was not so restricted, they can move even in the major cities to fulfil their needs. The institution of local Government is supposed to provide basic facilities in both normal and emergencies conditions. Mainly during the floods and other climatic shocks helped farmers in food items, reconstruction of infrastructure and providing financial help to the local peoples. Similarly, the religious institutes in the area specifically in upper Indus basin (Hunza) also provide services and benefits to the affectless. But they have limited resources and cannot help all the community members. Again the benefits of their services are limited to male members of the society. The departments like, agriculture extension, veterinary services etc. are available in almost all areas but they are not accessible to every people due to long distances and difficult terrain. The quality of their services was also questioned by male and female members of the respective communities. There was also an issue that local communities don't have much awareness about their rights and privileges. Actually, the household having influence in at the local level or well off in the society are the major beneficiary of all facilities provided by the Government. A common complaint highlighted by the FGD participants that even during the flash floods, natural disasters or extreme weather conditions Government institutions helped these influential household first and then approached the common man. It is good that across the Indus basin almost all basic institutions are available and to some extent communities are also getting benefits from these institutions. Anyhow keeping in view the changing climatic scenarios, majority of the farmers were of the view that they lacked institutions like skill development, flood management and early warning systems. In downstream of Indus, government has initiated a project to computerize the land records and the benefits of this new institution were lauded by the participating members of the FGDs.

3.5. Capability and vulnerabilities

In some areas of upper, lower and mid basin, Government of Pakistan has also promoted tunnel farming for drying of fruits and vegetables. However, some communities have alter their cropping patterns, growing off-season vegetables and fruits, and other more marketable crop varieties that can be harvested before the flood season (Mitchell et al., 2007). In the low stream of Indus basin there are some examples of households residing in district Sargodha, selling surplus milk and milk products as a common practice to generate extra income to meet their emergency needs. A study by Dankelman (2008) also highlights the selling off livestock in order to meet emergence needs.

4. Conclusion and recommendation

The Indus network is extremely large and the topography of the areas over which it extends is highly varied. The current study was undertaken in three sub-basins of Indus – Hunza, Soan, and Chaj Doab, representing the upstream, midstream, and downstream – on aspects of identifying gender vulnerabilities in context of climate change. The study also documented people's responses to the changing climate and adaptation potential with regard to different climatic shocks in different locations of Indus Basin. Upstream is

characterized by snowmelt, which increases the flow of the river in the summer and sometimes causes flash floods in the monsoon, but the winters are often dry and the resultant water crisis is extreme. In the mid-stream area, where rainfed agriculture was predominant, faces a water crisis during winter as a result of the reduced rainfall and often suffers from drought-like conditions. The lower basin is rich in agricultural, but salinity problems are increasing. These areas have also been facing moderate floods over the years, but their intensity is increasing which creates havoc, as the floods damage crops and other assets.

It is well documented in literature that climate change will have huge and largely negative impacts on the respective communities residing along the Indus basin. However, it is a bitter truth that comparatively children and females are main sufferer in any disaster. It is also a fact the livelihood of the rural communities are mainly dependent upon agriculture and livestock activities. So any positive or negative impacts of climate change has direct effect on natural resources, livelihood and health of the people living in these harsh environment. Moreover, status of gender inequalities further aggravated in terms of social status, access and rights, education, decision-making power. In addition to this, climatic shifts are contributing to changes in gender roles and power relations. For example, in Up-stream, men migration caused partly by climate variability leads to women assuming new roles and responsibilities which further increase their working load. Gender inequities ranging from divisions of labor to lack of ownership of land and access to critical resources, differentially shape coping strategies and ability to adaptation. However, women play a vital role in maintaining the biodiversity upon which subsistence livelihoods depend, there are still serious gaps in our understanding of their skills, capacities, knowledge and the range of competencies that they bring to bear in their day-to-day tasks. As a subordinate position in the family and in the society women are always discriminated in terms of decision making power, freedom of choice and equal participations as consequences they are backward group in the society. They are working, earning, savings but cannot control over their income money. During disaster period poor women are more insecure and vulnerable compare to those women who were from rich families due to limited access towards resources. Women with restricted mobility conditions face more vulnerabilities as they are unable to cope with them.

Major activities of women during disaster period are cooking, looking after family members, managing firewood for the family and to look after livestock. In livelihood context men can easily migrate to other places whereas women are restricted in limited spaces. Moreover, women are not allowed in all types of works in outside because of restricted norms and practices that are correlated with their social prestige and status. However women in the study areas are found as active agent at household level by doing multiple adaptation strategies to mitigate their poverty level and make comfort during disaster days. Agha Khan Rural Support Program set up built strong network of saving for women in upstream which helps them to use that saving money during disaster. Similar saving schemes were taken by National Rural Support Program in Mid and Lower Stream Indus Basin. Women in low stream were participating in labor market however, they were still unable to bargain in terms of their wages. Though women are fighting with their prevailing social structure by accessing limited space and capacity. Based on the above discussion, it is recommended that there is need to improve their capacities and skills like, early warning systems, credit facility for both men and women, availability of heavy machinery for up-stream area, women skill improvement program, increased investments in building reservoirs and other rainwater harvesting structures, introducing cost effective technologies for small farmers along with micro-finance schemes, and focus on improved varieties and the introduction of heat and moisture resistant species for mid-stream and low stream crops potential areas.

Acknowledgements

This work was carried out by the Himalayan Adaptation, Water and Resilience (HI-AWARE) consortium, under the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA), with financial support from the Department for International Development, United Kingdom (DFID), and the International Development Research Centre, Ottawa, Canada. This work was also partially supported by the core funds of the International Centre for Integrated Mountain Development (ICIMOD) contributed by the governments of Afghanistan, Australia, Austria, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Switzerland, and the United Kingdom. The views expressed in this work do not necessarily represent those of the ICIMOD, DFID, the International Development Research Centre, Canada, or its Board of Governors.

References

- Abbasi, S.S., Ahmad, B., Ali, M., Anwar, M.Z., Dahri, Z.H., Habib, N., Hussain, A., Iqbal, B., Ishaq, S., Mustafa, N., Naz, R., Virk, Z.T., Wester, P., 2017. The Indus Basin: A glacier-fed lifeline for Pakistan. HI-AWARE Working Paper 11. Kathmandu: HI-AWARE.
- ADB, 2013. Indus Basin Floods: Mechanisms, Impacts, and Management Mandaluyong City. Asian Development Bank, Philippines.
- AKRSP, 2007. Rural Poverty, Annual Report. Aga Khan Rural Support Programme, Karachi, Pakistan.
- Begum, R., Yasmeen, G., 2011. Contribution of Pakistani women in agriculture: productivity and constraints. *Sarhad J. Agric.* 27 (4), 637–643.
- Butt, T.M., Hassan, Y.Z., Mehmood, K., Muhammad, S., 2010. Role of rural women in agricultural development and their constraints. *J. Agric. Soc. Sci.* 6 (3), 53–56.
- Dankelman, I.E.M., 2008. Gender, Climate Change and Human Security. Ghana and Senegal, Lessons from Bangladesh.
- Gioli, G., Khan, T., Scheffran, J., Aneel, S., Haroon, U.T., Niazi, I., 2014. Gender and Environmentally-induced Migration in Gilgit-Baltistan. Sustainable Development in South Asia: Shaping the Future, Sustainable Development Policy Institute, Islamabad and Sang-e-Meel Publishers, Pakistan, pp. 355–378.
- Government of Pakistan, 2017. Economic Survey-2016–2017. Finance Division, Economic Adviser Wing, Islamabad.
- Gurung, G.B., Pradhananga, D., Karmacharya, J., Subedi, A., Gurung, K., Shrestha, S., 2010. Impacts of Climate Change: Voices of the People. Practical Action, Kathmandu.
- ICIMOD, 2014. Results of vulnerability and adaptive capacity assessment (VACA), unpublished internal report.
- Iftikhar, N., Ali, T., Ahmad, M., Maan, A.A., Haq, Q., 2009. Training needs of rural women in agriculture: a case study of district Bahawalpur. *Pak. J. Agric. Sci.* 46 (3), 200–208.
- Ishaq, S., Khan, M.Z., Begum, F., Hussain, K., Amir, R., Hussain, A., Ali, S., 2015. Climate change impact on mountain biodiversity: a special reference to Gilgit-

- Baltistan of Pakistan. *J. Mt. Area Res.* 1, 53–63. <<http://journal.kiu.edu.pk/index.php/JMAR>>.
- Jost, J.T., Hennes, E.P., Lavine, H., 2015. “Hot” political cognition: its self-, group-, and system-serving purposes. In: Carlson, D.E. (Ed.), *Oxford Handbook of Social Cognition*. Oxford University Press, New York, pp. 851–875.
- Kausar, T., Ahmad, S., 2005. Social stratification in the participation of women in agricultural activity: a case study of district Khushab, Punjab, Pakistan. *Pak. Geogr. Rev.* 60 (2), 80–86.
- Khan, A., 2008. Agriculture and agri-food sector – Pakistan. *Agric. Agri-Food Can* (Accessed on 13 June 2016).
- Khan, A.A., Khan, K., 2015. Women’s role in livestock economy of Cholistan Desert, Pakistan. *Glob. J. Hum. Soc. Sci.* E 15 (3–1), 28–39.
- Luqman, M., Shahbaz, B., Khan, I.A., Safdar, U., 2013. Training needs assessment of rural women in livestock management: case of Southern Punjab, Pakistan. *J. Agric. Res.* 51 (1), 99–108.
- Mirza, F.M., Najam, N., Mehdi, M., Ahmad, B., 2015. Determinants of technical efficiency of wheat farmers in Pakistan. *Pak. J. Agric. Sci.* 52 (2), 565–570.
- Mitchell, T., Tanner, T., Lussier, K., Burton, A., Khamis, M., Ross, S., 2007. *We Know What We Need: South Asian Women Speak Out on Climate Change Adaptation*. Action Aid International, Saxonword 2132, Johannesburg, South Africa.
- Mueller, V., Gray, C., Kosec, C., 2014. Heat stress increases long-term human migration in rural Pakistan. *Nat. Clim. Change*. <https://doi.org/10.1038/NCLIMATE2103>.
- Singh, P., Ramashastric, K.S., Kumar, N., 1995. Topographic influences on Precipitation distribution in different ranges of the Western Himalayas. *Nord. Hydrol.* 26, 259–284.
- Waqar, A.J., Hussain, I., Ashfaq, M., Mudasser, M., 2005. Poverty Across Districts in Irrigated Punjab, Pakistan. Retrieved from: <<http://publications.iwmi.org/pdf/H033299.pdf>> (Accessed 11 August 2016).
- Wymann von Dach, S., Bachmann, F., Alcántara-Ayala, I., Fuchs, S., Keiler, M., Mishra, A., Sötz, E. (Eds.), 2017. *Safer Lives and Livelihoods in Mountains: Making the Sendai Framework for Disaster Risk Reduction Work for Sustainable Mountain Development*. Centre for Development and Environment (CDE), University of Bern, with Bern Open Publishing (BOP), Bern, Switzerland.