

**RESEARCH PAPER****Effects of Climate Change on the Lives of Mountain Communities in Gilgit-Baltistan: A Case Study of Bubar village District Ghizer****¹Saira Abid, ²Zubair Ahmed and ³Ehsan Ullah**

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Corresponding Author: sairasyed1144@gmail.com**ABSTRACT**

This study examines the local perceptions of climate change and its impacts on the socio-cultural economic and psychological well being of residents in Bubar valley District Ghizer, Gilgit Baltistan. The valley a highly literate and agriculture dependent community experienced severe floods in 2022, highlighting its vulnerability to erratic rainfall glacier melt and other climate related hazards. A qualitative approach include in depth interviews focus group discussions and participant observation was employed to capture community experiences. Finding show that climate change has disrupted livelihoods agriculture water resources infrastructure education health and social cohesion leading to economic hardship trauma and displacement. The study recommends implementing disaster risk reduction strategies promoting sustainable agriculture and reforestration enhancing climate education and fostering collaboration with international institutions to strengthen long term resilience and adaptation in Bubar valley District Ghizer.

KEYWORDS Mountain Community, Climate Catastrophe, Economic Activities, Climate Change**Introduction**

Bubar Valley, located in District Ghizer Gilgit Baltistan is an ancient and historically rich settlement located about 10 kilometers from the district headquarters with a population of over 6000 people. Once influenced by Hindu, Buddhist, and Sikh traditions, it is now predominantly Ismaili Muslims. With a literacy rate exceeding 80%, and strong support from the Aga Khan Education service, particularly for female education the community successfully balances, relies mainly on agriculture, livestock and fruit cultivation, while many residents serve in the military and education sectors. Situated around 6000 feet above sea level and surrounded by glaciers, the valley is abundant in wildlife and natural resources such as Salajit, yet faces increasing threats from deforestation and climate change. Currently, the Bubar village is facing erratic rain falls like in 2022, which destroyed every possible means of live in the village. This study is evaluate the level of destruction, and possible solutions, and community resilience against the natural calamities. The study also aims to understand the issues faced by local people as a result of changing climatic conditions and to identify the governmental assistance provided to those affected.

The effects of climate change on water resources are a major global concern as well. Karst springs in Wallonia, southern Belgium, are the subject of monitoring programs aimed at examining river flow patterns and the effects of climate change on groundwater resources because of the estimated 0.4-degree Celsius increase in temperature between 2007 and 2012 (Meus *et al.*, 2014).

Climate change-induced fast glacier melt has disrupted various migratory species' paths and resulted in the loss of habitat for numerous floral and fauna species (Khan and Ali, 2011). The effects of climate change on fish productivity worldwide are based on ecological attributes (Jennings *et al.*,2008).

In many places, large numbers of people live with little to spare. Climate change is likely to make their situation worse and put many of the world's hungry at even greater risk (Gregory *et al.*, 2005).

Climate change affects different parts of the world in different ways. The Arctic is warming much faster than other places, so we need special plans for each area to deal with climate change (Stocker *et al.*,2013). The climate change in the north pole specifically is hard to understand as compare to global changes, due to vulnerability of natural disasters, also data available about the mountain regions are limited. (Flato *et al.*,2014).

Pakistan is fifth more vulnerable state in the world, every year receives droughts, devastating flash floods, impacting its agricultural products on large scale. The country is losing cultivable land, which is negatively impacting its economy, and affecting negatively in the already economically depressed nation, (Shah Fahad, 2019). Pakistan is a under developing country, having least resources with large population now in more danger to natural calamities, (Schilling *et al.*, 2019). the people perception about the climate change is archaic, governments are not well prepared which is more problematic,(Xie *et al.*, 2019)

The central government's approach in dealing with climate change is insufficient, and flawed. The monitoring, and enforcement methods are outdated, (Adnan *et al.*, 2021)

Pakistan's distinct approach to climate change is also imperfect due to insufficient monitoring and enforcement mechanisms (Adnan *et al.*,2021). Climate change is just one of many delicate factors that can affect ecosystems and human health while also being influenced by a range of social, political, economic, environmental, technological, and demographic factors (Haines A,2006).

Gilgit-Baltistan's mountain regions provide vital ecosystem services but are highly vulnerable to climate change. Marginalized communities there face growing socioeconomic and livelihood challenges due to climate-related impacts and disasters (Aliya, 2018). In Gilgit-Baltistan, the 2010 flood destroyed over 7900 hectares of agricultural land, damaged 3157 homes, and swamped low-lying sections of 347 communities, resulting in 183 fatalities (Hashmi *et al.*,2012).

Literature Review

Due to climate change, many people around the world are facing health issues and are unable to do their work properly (Costello *et al.*,2009).

In recent years, flood damage has increased in less developed countries. Even after the waters recede, many people are left homeless, crops are destroyed, and diseases such as measles spread (Choudhury *et al.*,2006).

Mountain systems are very fragile and are easily damaged whether by climate change or anthropogenic activities (Munoz *et al.*,2015). These are the people who are most likely to be affected because they are more affected by the change in the environment (Nikolaishvili *et al.*,2015). It is difficult to know what impact climate change will have on mountains because the weather is uncertain and complex. Studies show that mountain system are more vulnerable to climate change. (Solar *et al.*,2013).

Climate change is happening rapidly because humans are emitting too much greenhouse gases into the atmosphere. These gases trap heat which stabilizes the climate around the world (Hari *et al.*, 2009).

Now the wind also affects crops production. Now sudden changes in the wind greatly affect crops yields. Various studies that have examined the causes of these changes have concluded that greenhouse gases which slowly accumulate in the atmosphere and ultimately increase the atmosphere are the causes of these changes (Aydinalp and Cresser, 2008).

Pakistan is highly vulnerable to climate change because it is prone to drought, earthquakes and heatwaves. Climate change will intensify extreme weather and accelerate glacier melting (Chaudhry, 2017).

Factors that increase the impact of climate in Pakistan include poverty, geographical tension and border conflict. This vulnerability is an important concept in risk assessment that describes the vulnerability of individuals and communities (Khan and Salman 2012).

Pakistan was very concerned about climate change because it threatened its vital agricultural sector which meets the nutritional needs of its growing population. Rice, a major food and export crop, significantly contributes to farmers' income, 6.7 of value added and 1.6 of GDP (Memon, 2013). Counting the effects of climate change on agronomic production is a difficult task because of the uncertainty and uncertainty surrounding the prediction of regional climatic changes and the response of crops to environmental changes (Roudier *et al.*, 2011).

Socioeconomic problems and competing development objectives make Pakistan's climate change strategies even more difficult to implement (Khan & Roberts, 2020).

In Gilgit Baltistan, climate change causes habitat loss, species extinction, fewer pastures, and glacier melting. It also brings floods and damage to water systems (Ali, 2010). Many Markhor in Chitral are dying due to changes in the local environment. These disturbances are likely caused by climate change (Ishaq *et al.*, 2016). Elders in Gilgit Baltistan say that about a decade ago, many birds and animals were common. Now most of them have disappeared or are rarely seen (Ahmed, 2010).

Climate variations that impact the comfort and safety of travelers and destinations include heat waves, cold temperatures, droughts, storm surges, floods, and severe rainfall (N. us saqib *et al.*, 2019).

Material and Methods

The qualitative approach has been used in this study, a systematic research design consisting of in-depth interviews, focus group discussions, participants observation, and audio recordings to develop a rich, and significance apprehension of community perceptual experiences. Formal, and informal interviews were part of the study, with a diverse group of people including teachers, community leaders, and individuals from different educational backgrounds. Four focus group discussions, with 5, 6 participants each have been recorded, Six individual interviews with rich informants like Lumbardar, and community chairman were conducted. For conducting participants observation, a good relationship was built with the respondents for better results. The age of the key informants were between 45 to 55 years, having good educational backgrounds.

Result and Discussion

Arrival of climate change in Buber Valley

The indigenous people noticed the changing weather patterns in 2022. On the 26th of August, around 10:45 am, a severe flood hit the population from an unexpected location. This event of consecutive nineteen days of rain wiped out the fields, killed several children, and women who were working in their homes. Eight people from a single family were among the deceased. In the past Buber village experienced seasonal patterns with cold winters and hot summers. However, climate change has disrupted these natural rhythms, altering temperature levels, precipitation patterns, and accelerating glacier melt in the valley. This climate shift is significantly effecting agriculture, water origins, and biodiversity. Eventually, the mountain community now facing challenges like unprecedented rain falls, cropping seasons, water scarcity, and fluctuating temperatures feat frequent natural disasters.

People's experiences regarding Climate Change

A respondent explain climate perception like “ We were waiting for the summers, because we were migrating to green pastures, our summer places. Unfortunately, from a decade our land has been destroyed by cruel floods, roads are destructed, livelihood opportunity related to our livestock is no more existing”. A school teacher stated that, People are traditional, they are not understanding the science of climate change, they consider the floods, erratic rainfall as a punishment from the God, its God's displeasure so we need to be more obedient to Allah Almighty, Once the God forgive us, our difficulties will come to end”. The lumbardar of the Bubar valley stated that, “ 2022s floods were historic, it was unprecedented, it killed our beloved one, now we are in trauma, every coming summer is a new news of fear for our children, when the thunder storm roars the sleep in the eyes of mountain communities disappears”. A local resident added that, I don't know what is climate change, who is brought it to us, our educated community is always talking about this shift but they are unable to save us from the wrath of floods, and rains”.

Depleting water sources in mountains due to Climate Change.

One of the participant said that “ water in mountain is only source to live in hard region like our Bubar Village, but the floods of 2010, and now in 2022 increase the depth of water ways, while the water channels on surface remain elevated. As a result water is not reaching to land. Consequently, patches of land which were cultivable before 2022s flood has now become barren due to the lack of water access, leading to the significant decline in our annual incomes”. Another respondent added that, I am visiting our pasture areas from last three decades, “ the lakes which were source of our water are now burst every year in summers, causing GLOF events, we do not have proper glaciers in our mountains. It is water which comes from lakes, if they are bursting in current pace, soon we will be out of water in our village”. The villagers stated that drinking water supply from WASEEF worth of 10 million was destructed by the 2022s floods, now we don't have drinkable water supply.

Agricultural devastation due to Climate Change

The mountain communities largely dependent on agricultural activities, like fruit orchards, vegetables, and crops. Flood of 2022 intercept the agricultural economy, destroyed orchards, and vegetable farms completely. The aftermaths of floods also affect the quality of fruits, and vegetables, consequently we face more harsh implications of climate produced challenges. The cropping season shifted from one cycle to another, our products are ready before the or sometime became late, in either case we are unable to reach on time. To adapt, some farmers have resorted to using insecticides and sprays, further degrading the land, while others have turned to greenhouses to control temperatures for sensitive crops. Fruit production such as apricots has also been impacted by heavy rains heat and pests leading to spoilage and pests leading to spoilage and reduced yields. Overall, climate change has led to diminished soil fertility, limited crop variety, and disrupted traditional farming practices, threatening the livelihoods of farmers in Buber.

Severe consequences of climate change for mountain communities

Climate change is intensively affecting the social life in Babur valley, the irregular weather patterns are causing stress, disrupting the routine livelihood opportunities. The villages in the whole Gilgit-Baltistan are closer to nature, which makes them more exposed to natural calamities. Similarly, in 2022, the nature's close Bubar valley was hugely ravaged by flash floods, compelling people to migrate to nearby safe places. More interestingly, now the natural calamities are striking the population from unexpected places; those houses that are near streams and waterways are already in danger, but the people who are living away from the vulnerable areas are also not safe. The valleys are surrounded by mountains, so expected rainfall can cause harm to these mountain communities at any time, like 70 families in Bubar village have been displaced due to a recent spike in floods. Economic activities in mountain regions are related to farming, fresh and dry fruits. Unfortunately, every livelihood activity in Bubar valley no longer exists. The village educational institutions were wiped out by the floods, so the education activities for students are more prone to climate change. This climate change is changing the lifestyle of local people; now they are more reluctant to live in a temporary house due to fear and anxiety.

The Impact of climate change on social bond

A respondent from the village shared that "People now are more concerned for personal safety, they want to live apart but in safe places, as compared to the earlier times when we were living together, and protect each other from natural calamities or odd times. The social bond is now weakening, our neighbors are scattered, friends are migrating, and our strong social cohesion has been shattered by climate change". The sense of the village's social connections that once bound the whole village has become more fragile now.

Educational degradation due to climate change

Climate change is equally a disaster for the education sector. Children are more exposed and in danger due to sudden changes in weather patterns worldwide. One of the respondents shared that, "School infrastructure has been wiped out, students losing their class fellows in floods, they are in trauma, in such a state of mind, they cannot be able to focus on their studies. Our children are facing a crisis that is risking their future. The echoing mountains due to thunder are now a symbol of fear for our dears. We are in huge trouble, and our world is changing entirely.

Another participant shared his thoughts that," roads leading to schools are no more, bridges which connects valleys with schools have been wiped out by the floods, our children face more difficulties for reaching the nearest schools, their education system is deeply affected, I as a father is now more concerned for their safe return when they left their homes for getting education in far flung locations."

Climatic Impact on Recreational Activities

Climate change is vanishing the picnic points. A respondent stated, " *Ucho Gah*, a favorite summer picnic spot, was once a lush green area where people on weekends visit with families, and make memories, but the recent floods of 2022 destroyed the roads, took away its beauty, and now the whole spot is people-less. The economic activities related to the small hotel industry for locals have vanished, and our people are jobless now".

Consequences of climate change on physical and mental health

Climate change is causing physical health constraints across the world, a valuable participant elucidated that, " once the floods hits the communities, it is not only suffer them economically but left a series of diseases like diarrhea, cholera, skin allergies, typhoid, and

in extreme hot weather heat stroke are taking the innocent life". Another school teacher shared his experiences that, floods overcome drainage systems polluting the drinking water, and increase the risk of infectious diseases". This sudden shift puts a huge burden on the health care system in already deprived regions, especially in susceptible areas with limited resources. Also, the people living near vulnerable areas have mental issues like stress, anxiety, and trauma in their daily lives.

Economic challenges

The local economy is the backbone of mountain communities, they earned from fruits, vegetables, livestock, etc. In Bubar village, the flood takes away every existing livelihood opportunity from the locals. Vegetables like onions, tomatoes, and potatoes are spoiled by the rain. One of the participants shared that, "the floods destroy our crops, and the aftermath of climate change affects the fertility of our land. Our fruit trees stop growing, our animals decrease the milk, and different climate change causes diseases that affect their health". Another respondent said that, due to floods, the roads get washed away, causing our vegetables, fruits, milk, and other perishable goods to not reach the market on time. As a result, they rot at home. When our only source of livelihood is destroyed in this way, then there is no benefit in living among these mountains. Consequently, we will have to migrate from these hilly areas". A woman respondent said, "My son's only tailor shop in the valley has been wiped out by the floods of 2022. He was supporting his family, but now he is jobless and waiting for support from the government and NGOs.

Conclusion

The Bubar village, a densely populated region in the district Ghizer, is among the most literate villages of Gilgit-Baltistan. The residents of the valley provide equal educational opportunities to both genders, but over the last decade, the villages have been receiving unprecedented climate catastrophes. In 2022, a harsh flood troubled the population in the middle of the village, killing children and women, and causing the forcible displacement of 70 families. The unpredictable, devastating floods destroyed the livelihood, roads, health, and hygiene of the already deprived mountain community. Due to the high literacy rate, the residents of the valley understand the phenomenon of climate change, which is a global issue where locals of the region have zero contribution to carbon emission, water pollution, and industrial waste, etc. Unfortunately, climate change is targeting the mountain communities with wrath. The village people advocating for the sustainable solution of climate change, which is not possible without climate justice. Their lives, livelihoods, education, and health care can be saved through targeted planning from the government and international institutions.

Recommendations

The government and relevant agencies should implement targeted disaster prevention strategies that include the construction of sustainable infrastructure proper water management systems and early warning systems to protect communities. Additionally sustainable agricultural practices reforestation programs and environmental education initiatives should be promoted to increase resilience and secure livelihoods. Collaboration with international organizations is essential to provide technical financial and policy support for long term environmental sustainability.

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