Climate Change, Rural Livelihood, and Sustainability: In Higher Himalayas of Kishtwar, Jammu and Kashmir

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Abstract

Mountains host rich cultural and biological diversity and generate different ecosystem services. It acts as a water tower and source of food, but at the same time suffers from poverty, risks, and vulnerabilities. Climate change is the biggest threat overshadowing living organisms negatively impacting the rural livelihood of people living in the Himalayas. The warming has accelerated surpassing the global average over the past hundred years. Receding glaciers are leading to water scarcity not only for drinking but also for agriculture and allied activities. The erratic rainfall results in frequent flash floods and landslides causing huge damage to public and private infrastructures, life, and property. The basic objective of the study is to identify and analyse the interdependence between climate change and rural livelihood in the higher Himalayas. Both primary and secondary data were used for data analysis while descriptive and ethnographic methods were applied to achieve the desired result. A household survey using purposive sampling was conducted in Gandhari valley of Kishtwar district, Jammu and Kashmir in the year 2019. It was concluded that climate change has brought multiple changes in their environment and affected their livelihood in many folds. Migration has become a natural phenomenon in the valley where mostly males migrate to cities in winter due to unemployment and unbearable climatic condition. The rural poor were the worst hit because they were the most economically backward and vulnerable to these changes. Adaption to climate change is quite necessary and there is more need to promote traditional practices to retain sustainability in the valley.

Introduction

Climate change is a naturally occurring phenomenon and always being a great cause of concern for the livelihood of people living in the Himalayas (United Nations Environment Programme, 2021). Global warming and climate change resulted in upward shifting of the snowline, causing glaciers to retreat thereby, the availability of water sources is moving in the same direction (Kumar and Sharma, 2014). Climate change has changed the normal cycle of natural phenomena in summers, springs, and winters (Tiwari and Joshi, 2015). The continuous human intervention in the fragile Himalayas has caused gigantic damage to the natural landscape and existing sources of livelihood (World Bank Group, 2021). The Himalayas have the least cultivable land, the lowest potential for agriculture-related activities and a few employment opportunities have forced locals to plain areas (Singh et al., 2021). The untimely snowfall and sudden torrential rainfall during the spring season are damaging their crops, harming their cattle and restricting vegetation to particular regions (Government of Jammu and Kashmir, 2022). Nomadic communities like Gaddis, Bakarwals and Gujjars with their sheep and goats come to Gandhari valley in search of fortified grazing grounds for their animals during June and July (Suri, 2014). Vast meadows are found at the foothills of Himadri after the end of Tun village, which is the last village of the valley (Romshoo, 2011). There are several gushing and rapid-moving water bodies that people crossed with intense care as it proved fatal many times when people lost their balance (Ramazan and John, 2019). Though, they have prepared natural bridges of stones, thatches and timbers to cross the water bodies (Allen et al., 2020). The valley receives heavy snowfall for almost six months which disrupts the normal life of humans and animals (Naik, 2020). During these six months, people migrate to lower regions to earn their livelihood (Singh, 2019).

The word Gandhari means a girl that was a renowned figure in Mahabharat and was the mother of Kauravas and wife of Dhritrashtra (Kalra, 2018). Two communities dominate the valley including Rajputs and Buddhists where Rajputs mostly dwell in the lower region while Buddhists dwell in an upper region of the valley for generations (District Survey Report, 2019). They store fodders in some caves to feed their cattle during emergencies, but caves fodders are not sufficient when the situation gets out of control (Sharma and Raina, 2021). The erratic weather condition leads to fodder shortage for their cattle and covers long distances in search of fodder (Yadav et al., 2017). Hence, Himalayan people start feeding willow tree branches and leaves to cattle during the spring season (Tashi et al., 2022). Non-availability of enough fodder and poor quality of fodder are affecting their animal health throughout the year (World Meteorological Organization, 2021). Further, there is a decline in animal products like milk and milk products including butter, curd, dry lassi and cheese due to the intake of non-fortified fodder (Sudesh, 2014). They celebrate their annual mountain festival locally known as Nagoohi where the entire mountain community participates with immense enthusiasm and fervour (Bala, 2020). The important temples of the

valley include Shiv temple, Nag temple and Chandi Mata temple at Chandi Paddar and one Buddhist monastery called Gompa monastery (Thakur, 2017). The natural beauty of Gandhari valley is amazing and unparallel to any other hill station across India (Romshoo et al., 2020). Rafting, trekking and traditional medicinal practice have attracted people from all walks of life (Gupta et al., 2013). The valley has a lot of potential for tourists, but many times it became a curse for natives that tourists were found contaminating the springs and littering garbage (Raj, 2020).

Research Objective

The basic objective of the study is to identify and analyse the interdependence between climate change and rural livelihood in the higher Himalayas.

Database And Research Methodology

The study was conducted in Gandhari valley, which is a hidden and one of the most isolated valleys in the Himalayas. Database and research methodology are the backbone of the study, which is primarily focused on primary and secondary data. Two out of a total of six villages such as Batwas and Tun were selected for the primary survey. The respondents selected for the interview were all above 25 years above because they will have a wider understanding of the impact of climate change and its effects on their livelihood. The household survey was conducted using purposive sampling in Gandhari valley of Kishtwar district, Jammu and Kashmir in 2019. Both Rajput and Buddhist community were interviewed for a comprehensive and grassroots assessment of the study area. During the in-depth interviews, it was found that there were many villages where connectivity was a big challenge. In another in-depth interview, it was observed that the Himalayan communities are quite aware to make the valley climate change free, but they need adequate financial and infrastructure support for the execution. In focussed group discussion (FGD), some participants replied that the valley is facing an acute water crisis due to climate change and global warming (Fig. 2). In another FGD, respondents replied that the implementation of the Ujjwala yojana was merely based on bureaucratic ideas instead of a strategic vision.

During the household survey, it was observed that there was a wide division, that the community living in Himachal Pradesh was quite more prosperous than the community residing in Gandhari. Tun village of Gandhari is the last point and afterward Himachal Pradesh or lesser Himalayas starts and community living there have a good standard of living relatively. Ethnographic and empirical methods were applied to obtain the desired data. The data collected during the survey process were assembled and eventually computed before the final evaluation. Further, both qualitative and quantitative techniques were examined for analysis of insight outcomes of the study. Regarding secondary data, the district census handbook, India Meteorological Department and Inter-governmental Panel on Climate Change report on planning, World Bank Group, United Nations Environment Programme, climate change-related risks and management were synthesised and later interpreted. Apart from these, several newspapers, magazines, government websites, Journals and research articles were referred to obtain the desired outcome of the study.

Study Area

Gandhari Valley lies at the foothills of Himadri, which is renowned as the greater Himalayas (District Census Handbook, 2011). Gandhari is a sub-valley in Padder valley or Padder tehsil of Kishtwar district, in the union territory of Jammu and Kashmir (Fig. 1). Gandhari is located 33°11'28.9"N to 33.19'13.5"N latitude and 76°22'02.5"E to 76.36'73.6"E longitude (District Census Handbook, 2011). Gandhari valley borders the Zaskar range and Himachal Pradesh from the south, the union territory of Ladakh from the east. It consists of six villages including Muthal, Chug, Batwas are Rajput villages while Tun, Aliah Khijroni are Buddhist villages (District Survey Report, 2019). It is located in the southernmost part of Jammu Kashmir and from there onwards Himachal Pradesh starts. The valley is situated at 9500 feet above the mean sea level (Central Ground Water Board, 2016-17).

Results And Discussions

Climate change is not a recent phenomenon being experienced the world over and the Himalayas are no exception. Gandhari valley is still untouched by the outside world to a large extent. The Sansari nallah, which is one of the prominent sources of water in the valley is one of the major sources of water supply in the valley. Mostly melting glaciers, springs and the summer rainwater feed the nallah. The flow of the nallah is very fast, bumpy and a bit dangerous while crossing it.

a. Retreating Glacier

The Himalayas are renowned as the third pole after north pole and south pole, it encompasses the ice water stores outside poles. Glaciers are retreating rapidly in upper Himalayas due to increased temperature causing mountain slopes unstable, floodings, frequent occurrence of landslides and avalanches in the valley (Fig. 3). In Gandari, people are attached closely to mother nature, but the adverse impact of climate change is changing the valley's morphology over the past few decades. Constant and higher vulnerability to flash floods have damaged several life-supporting infrastructures and households, jeopardising poor, marginalised, downtrodden and voiceless families.

b. Flash Floods

Flash floods are localised events of a short period with the high peaks usually less than 6 hours which damaged several public and private properties. It includes road blockade, disruption of communications and electricity supply, poles and trees are uprooted putting the entire valley under the grip of danger. Landslides are quite frequent during spring as it is the best time. The hospital facility is available around 100 km away from the valley and reaching there is a big challenge. There were several cases where people lost their life, pregnant women lost their babies because they were not reached the nearest hospitals either due to inundation of roads or landslides on the way to the hospital. It is an irreparable loss to the valley which is not just for the community, but for the entire nation because they were human assets to our country. The absence of infrastructure and logistic support is one thing, but in the Himalayas, people don't have the access to these infrastructures when they need them due to weak political will and natural hazards.

c. Migration

Gandhari valley lacks in quality service sector facilities like a properly equipped hospitals, modern education institutes, sports grounds, and mandis. There is always a shortage of employment opportunities in the valley. In addition, tough physiography has compelled both the Rajput and the Buddhist communities to migrate to other regions in search of better economic opportunities. The valley is covered with snow for about five to six feet during winters. The migration is mainly male-oriented as male members of their family don't have any work during winters. The elder population migrate to cities for their regular health check-ups, purchase of medicines and better weather. Seasonal migration is prevalent in the valley where people migrate due to harsh climatic conditions during winters (Fig. 4). Small landholdings, low productivity and limited crop sowing season are not enough to sustain the quality life for the extended families and better education for children. They get some jobs in the cities where they work as street vendors, construction workers, run petty temporary and portable shops to support their livelihood. They are engaged in selling shawls, woolen socks, gowns, saffron, zeera, heeng, and ornaments. They sell milk and milk products, even sheep and goat to buyers during festive seasons. The demographic dividend of the valley is now turning into a demographic disaster as it becomes a ghost valley during winters.

c. Shortage of Firewood

Firewood plays a vital role in their daily life such as cooking food, bonfire, heating water and other work. The collection of firewood from the nearby forest is a hectic and time-consuming task, which the community performed as their routine activity. Both male and female members of their families equally participate in firewood collection. Recent developmental activities are boosted in Gandhari valley like several construction works. Locally available resources are exploited to construct infrastructures including check dams on the Chenab River where deforestation reached its peak than ever. Erstwhile, they travelled a quite short distance to collect firewood, but now have to travel more distances to obtain better quality of firewood.

d. Loss of Livelihood

The condition of infrastructures particularly transportation facilities like roads is in a dilapidated position in Gandhari. The terrain is very steep, which doesn't allow any kind of motorable transport service in the valley. Slipping in the valley will lead to the loss of human and livestock assets of the valley. There is the frequent occurrence of snowfall in springs results in complete damage to standing crops. The loss of livelihood due to erratic rainfall is affecting more marginalised sections because they don't have any insurance for their crop damage (Fig. 5).

The increased temperature causes unnatural death of livestock as they are not used to bearing such increased temperature. The livestock including sheep, goat, dzo and dzomo are everything to them and their loss is putting their livelihood under threat. Further, the shortage of fodder to feed their animals, especially during winters has become a major challenge (Fig. 6). There are several incidences where their livestock died due to rainfall and cold because they keep their livestock in the meadow. The comprehensive provision of on-time and in-situ veterinary services to cattle and alternative sources of fodder during winters is a cause of concern. The valley became a ghost valley due to migration from November to March. The normal life remains continue from April to October in the valley.

e. Water Disputes between Villages

Springs and rivulets are common property that must be accessible to all without any kind of discrimination based on region or community. The flow of spring has declined due to the increased burden and high mass consumption over the past few years (Fig. 6). The flow of water is good in early summers and with increasing Sun's heat, the flow starts shrinking in later months. Thereafter, the irrigation time will start, which requires more water to irrigate the land for sowing new crops of the season. The spring is changing its natural course due to artificial diversion at several places in the Himalayas.

It has resulted in acute drinking water shortages in the recipient villages. Water disputes between the villages have intensified as each village wants a good amount of drinking water supply for its people, which is not possible with very limited leftover springs. The population in the valley has increased, but the flow of springs and rivulets has decreased. It leads to more people's dependence on the same natural resources to meet their daily drinking water and allied activities needs (Fig. 7). Anthropogenic activities like diverting the natural channel of springs and rivulets result in the shrinking of the flow.

f. Shifting of Traditional Watermills

The communities living in Gandhari valley being used watermills to grind grains for a very long time. The working of watermills depends on the flow of spring's water, which is managed through naturally made check dams. Further, tapped water is diverted to the watermill through canals of around 1–2 km. Erstwhile, these canals were made up of mud and stone, nowadays, concrete is used in canal construction. The more the flow of water, the higher would be the efficiency of watermills and vice-versa. The drying of springs has adversely affected the operation of watermills due to the non-availability of alternative water sources to ensure an uninterrupted water supply. The springs' flow is sufficient in early summers, but in July there is a deficit in water supply due to intense summer. Thereby, the watermill's operation is impossible in peak summers while the existing water divides melting glaciers between irrigation and watermill purposes. It leads to a water crisis as both play a vital role in the valley's sustainability.

g. Threat to Himalayan Species

A very limited source of transportation is available, accessible and affordable in Gandhari valley. People mostly prefer their traditional means of transport such as yak, ponies, dzo and dzomo. These animals used to carry luggage, food grains, cash crops, and human beings from one place to another because these animals have an intimate and organic relationship with the valley. They are rear for milk and milk products and their meat is used during festivals and auspicious occasions. The

erratic rainfall, landslides and avalanches are leading to wide-scale death of the animals (Fig. 8). These animals are kept in meadows and many of them die due to snowfall as are unable to find safe shelter for their safety. The intense heat proved curse for animals because they can't bear excessive heat for a longer period. The animals are not used to bearing more heat beyond a certain limit,

h. Landslides and Avalanches

Sapphire is found in the mountains of Gandhari valley. It is a rare earth mineral that has a huge market world over. Rock testing to construct hydropower projects and sapphire mining have triggered the frequency of landslides and avalanches in the valley. When engineers blast a targeted spot of the Himalayas as their routine activity, then it causes earthquake-like events throughout the valley. It disturbs their sleep as during the day the trigger is not so powerful, but during the night, the intensity and frequency are proved very dangerous. Though blasting is happening several kilometres away from the valley, and the trigger is felt in their households. The terrain is completely virgin and not feasible for either big or small hydropower projects. The environment is highly fragile and blasting will further damage the natural ecosystem in the valley. It results in the melting of glaciers, erratic rainfall, and snowfall as different harmful chemicals being used in mining and dam construction.

i. Climate Change

Earlier, the average snowfall in the month of February and March was 3–4 feet. Now, the significant amount of snowfall has reduced, it is evident that Aliah village barely receives 1 foot of snow which rarely happened before. The village is located at a higher altitude than other villages of Gandhari except for Tun. The reduced snowfall means less water availability in the water bodies which are mostly tributary. Nallahs of the Sansari River are dominant, which eventually join the Chandrabhaga River. The reduction in snowfall has sequential consequences like low harvest for the local produce including potatoes and peas all of which depend on good water availability and timely rains. Thereby, decrease in the number of natural herbs and medicinal plants " jhaddi bhuti" that the environment produces annually. Animals like snow leopards and the Himalayan ibex have been pushed away from their natural habitat due to climate change. It is important for wildlife and plants to be able to co-exist for a sustainable environment to flourish. The symbiotic relationship between the flora and fauna in the valley has been disturbed due to the adverse impact of climate change and global warming. The rising mercury has totally dried a spring that was flowing between Batwas and *Akhri Mod* (last turn) earlier in the valley.

j. Loophole in the System

The union government's aim for the Ujjwala yojana is highly appreciable indeed. The yojana is a watershed step to protect the lungs of the people from smoke to those involved in cooking. The yojana puts control over deforestation with an alternative source of Liquified Petroleum Gas (LPG) for cooking. The regular use of LPG cylinders will keep them healthy and get rid of several respiratory diseases because, during the conventional method of cooking, they used to inhale harmful smoke. Female members of the community were distributed free chulha and LPG cylinders under the Ujjwala Yojana, but it didn't work out in Gandhari. These cylinders and chullahs are given in plain regions and carrying LPG cylinders of 14–16 kg. to the valley are beyond their capacity. There is the complete absence of any better mode of transportation except ponies. Ponies take around three hours from the foothills to reach the valley if all goes well. They follow a very narrow path and ponies can't carry such a heavyweight cylinder.

The valley is located in a very remote corner of the Kishtwar district wherein ensuring the regular supply of one cylinder to each household every month is another challenge for the concerned authority. There is no particular distribution point for LPG cylinder distribution in the valley. Conventional firewood is a better option for cooking as its smokes play a vital role in keeping their house worm free. These worms died due to suffocation when inhaling firewood's smoke. Ujjwala Yojana is a

bit failure of the government as the hardship of carrying a cylinder and its regular supply is much more than collecting fuel from the forest. Hence, the yojana is mismanaged in the case of the valley

Way Forward

Having fresh air, fresh water, a fresh environment and mental peace are very rare to find in the 21st century, but these are possible in Gandhari valley indeed. The mountains surrounded the valley from all sides making it a heaven on earth. India has set the target of net-zero emission by 2070 which is called as pro-planet people movement. The movement is crucial to combat the harmful effects of climate change and connects every individual with climate. Government focus is on both fusions of back to basic and marches to future to protect the community from climate change in their respective regions. The government has focused on both lifestyle and environment simultaneously.

a. Household Morphology

Gandhari communities construct their household with locally available building materials like timbers, thatches, mud, lime, stones, gravel and others. They normally have single-floor households where entry doors and windows are quite small to minimize the intensity and flow of cold waves (Fig. 9). They themselves reside on the first floor of their house. They keep their domestic animals like goats, sheep and fodder, food grains and firewood on the ground floor.

The valley is blessed with rural areas and there is a complete absence of urban areas. The housing structure of the valley is divided into three categories permanent, semi-permanent, and temporary (Table 1). The semi-permanent housing structure represents the highest share of structure, followed by permanent and temporary. Wooden doors and windows are used due to their insulating properties (Fig. 10). Although, they have a good stock of firewood, but they went to the jungle every alternate day to collect firewood that could be used in an emergency. The extra stock is used to ensure a daily supply of cooking fuel. These woods are also used for bonfires, especially during winters.

Table 1 Housing Structure in the Valley

Structure	Total	Rural	Urban
Permanent	260 (6.14%)	260 (6.14%)	0 (0%)
Semi-permanent	3907 (92.21%)	3907 (92.21%)	0 (0%)
Temporary	59 (1.39%)	59 (1.39%)	0 (0%)

Source District Census Handbook, 2011

b. Alternative Opportunities

Climate change has some positive impacts such as creating new sources of livelihood in cash crops plantation like apples and walnut (Fig. 11). These crops were not ripening within time earlier, but now ripening within time due to changes in climatic conditions of the valley. The increased temperature in the valley is supporting cash crops, which are growing on a large scale. Erstwhile, the production of wheat was not good, but now it has become better and the community started growing maize in their field to sustain their livelihood (Fig. 11). The yield and productivity of these cash and food crops have increased due to climate change causing longer summers than before in the valley. Locally manufactured handicraft products in cottage industries will provide better livelihood opportunities in the Himalayas.

c. Local Practices

The community daily went to the Himalayas where they collect herbs, grim and other materials for their basic needs (Table 2). Grim, barley and maize are mainly used to prepare sattu and liquor naturally. This is part of their culture and being practiced for a very long time. They prepare liquor during winter to keep their body warm. During the harvesting and sowing

season, they were quite busy in harvesting beans, peas, wheat, and maize. Rivulets and springs play a critical role in their routine life such as agriculture, operating water mills and irrigation purposes (Table 3).

Table 2 Socio-Economic Elements of Gandhari Valley

Elements	Numbers
Name of Community: Buddhist and Rajput	2
Major Religion: Hindu and Buddhist	2
Languages: Boti, Pangwal, Pahari.	
Distance of Block headquarters: Around 30 km by road and Trek 10 km.	40 km
Type of road: Initially pucca road and 10-15 km trekking and pony road.	02
Banking Institutions	00
Schools: Primary	02
Self Help Groups (SHGs) Functioning at Village	00
Number of Health Centres	01
Major land Use Type: Agriculture, Forest Land and Meadows	03
Major crops: Barley, buckwheat, wheat, rye, maize etc.	05+
Major River: Gandhari Nala a tributary of Chenab which connects at Sansari valley.	01

Source Primary Survey, 2019

Table 3 Rivulets and Springs

Rivulets	Location	Natural Springs	Locations
Tun Tollum	Between Tun and Aliah	Alia	Below Rabtans House
Aler Tollum	Close to Aliah	Sinot	Sinot Thang
Mulchae	Between Aliah and Khijroni (bigger)	Khijroni	Between Mulchong and Khijroni
Mulchong	Between Aliah and Khijroni (smaller)	Batwas	Between Batwas and Akhri Mod
Anad Nena	Between Muthal and Chug		
Chaal Longma	Between Batwas and Chug		

Source Primary Survey, 2019

All household have solar panels to meet their basic electricity supply due to the non-availability of installed electric poles throughout the villages. They keep solar panels either on their terrace or windows to absorb maximum sunlight throughout the daytime. At some places in the valley, the electric poles have been installed since 2018, but no electricity supply so far.

The wires of these poles are used for drying clothes and other purposes. The people are quite happy, but hopeless because apart from minimal farming, they don't have job opportunities to feed their families.

d. Basic Amenities

Gandhari valley is almost inaccessible during winters because all people residing in the valley migrate downstream due to the harsh cold during the aforesaid period. Their cattle are still there in the valley which is a great cause of concern for their life safety. The health centre, administrative offices are completely shut down during winter and all services are suspended till the summer. The source of water supply and lightning are limited in the region. The community is forced to drink tap water from an untreated source which constitutes around 75% of the total drinking water supply in the valley (Table 4). The proportion of tap water from treated sources accounts for less than 1% of the total available source of drinking water. Springwater accounts for around 10% of the drinking water supply and its percentage is going down at a rapid pace due to overconsumption and exploitation for other purposes.

Table 4 Source of Drinking Water in Atholi (Paddar)

Paddar	Tap water from Treated Source	Tap water from Untreated Source	Tubewell/Borewell	Spring	River/Canal	Other Sources
Total	40 (0.95%)	3178 (75.01%)	70 (1.65%)	401 (9.46)	117 (2.76)	431 (10.17)
Rural	40 (0.95%)	3178 (75.01%)	70 (1.65%)	401 (9.46)	117 (2.76)	431 (10.17)
Urban	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source District Census Handbook, 2011

Table 5 Source of Lightning in Atholi (Paddar)

Paddar	Electricity	Kerosene	Solar	No Lightning	Others
Total	1234 (29.12%)	1337 (31.56%)	1097 (25.89%)	72 (1.7%)	487 (11.73)
Rural	1234 (29.12%)	1337 (31.56%)	1097 (25.89%)	72 (1.7%)	487 (11.73)
Urban	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source District Census Handbook, 2011

Kerosene oil accounts for the highest proportion of lightning sources in Gandhari valley. The regular supply of kerosene is not ensured due to either landslides or erratic rainfall in the valley. The community was given solar panels to meet their basic lighting needs. Solar source of lightning accounts for around $1/4^{th}$ of the total source of lightning in the valley (Table 5). There are several villages, which don't have access to any source of lightening, but their percentage is less than 2%. The government is making no stone unturned to provide some sources of lightning very soon in these leftover villages.

e. Minimum Income Inequality

Mass-scale migration has bridged the income gap in Gandari valley. Erstwhile, few people used to migrate resulting in wider income inequality. The increased awareness, people-to-people linkages, improved education standards and know-how about new avenues have played a crucial role in this direction (Fig. 12). The inequality has shrunken because almost everyone in the valley migrates to surroundings cities from November to March. They return back to the valley in April and continue to

live there till October in the current scenario. It has become a level playing field based on the efficiency and effectiveness of the community. The standard of living among all communities has improved with the opening of new employment opportunities.

f. Medical Tourism

Gandhari valley is centred around several herbs, which are very helpful in curing several acute and chronic diseases like cough and diabetes. Tourists and patients are keenly interested to take away kara from the valley as it maintains metabolisms and keeps their bodies healthy. Amchi medical system of the valley is world-famous and every tourist wants to have its experience at least once. It is also renowned as Sowa-Rigpa which is the living medical tradition being practiced since ancient times. The practice cures tourists and patients of skin disease, hypertension, arthritis, and many others. Patients are undergoing treatment in the valley at quite a marginal rate. Locally available different plant species, mineral stones medicinal plants and foliage are used to give long-lasting rid of multiple diseases. Ayurvedic products like various kinds of juices, immunity boosters, and skincare supplements are famous among tourists. Doing yoga and meditation attract people from every corner of the world to Gandhari.

Tourists from all walks of life visit the valley with great enthusiasm and fervour. It generates a source of income for the natives because these tourists hire locals as a tourist guide and their ponies carry tourists' luggage including tents, and food items from one place to another. They enjoy trekking, but trekking with heavy luggage is very tough that's why they take the help of ponies. They charged a reasonable rate from tourists per ponies to make everyone happy. They follow ponies' paths for trekking because the valleys are surrounded by very dense forests. It would be totally unsafe to go anywhere without any tactics, by doing this their life will be in danger. Tourists enjoy indigenous culture, food, and routine activities, and eye-catching scenic beauty throughout their excursion in the valley. The hospitality of locals are overwhelming and tourists cum trekkers are invited from every household for a drink and a tea.

g. Role of Women

The role of women is highly appreciable in Gandhari where both young and elder women are involved in the collection of daily needs materials from the forest including fodder and firewood. They went to the forest in a group, to tackle any kind of problem like an attack by wild animals that could be easily avoided. They took their cattle to grazing grounds for grazing and meanwhile collect fodder for them and fuelwood for themselves. They travel several kilometers for water collection as the nearby springs have dried up due to climate change and several anthropogenic activities. The hardships of carrying water from long distances to the household is a very challenging task that they are doing as they are left with no other option. They represent around 50% of the total population while their representation in terms of total workers is quite meagre in Gandhari (Fig. 15). The actual number of female workers in the industrial category is more than the given figure as these are registered with government authorities. Female workers many times are given work on a daily basis, which is not recorded in the formal data set.

h. Cropping Pattern

Gandhari valley exists in severe physiography, which is one of the remotest parts of the greater Himalayas. The valley is blessed with tough relief and unfavourable extreme climatic conditions making the agriculture activity challenging work during the winter season. Agriculture is the main occupation in the valley where rice is the staple crop and maize is the second most important crop. The small size of fertile landholdings resulting subsistence production of crops as mechanisation is impossible in the valley. Good quality saffron is cultivated in the month of June, July, August, and September where saffron plants require dry and hot summer and extreme cold during winter. Saffron cultivation is providing a good source of income to the involved community. Though, the valley allows growing limited crops in one season due to the absence of HYV seeds, modern machines like tractors, harvesters, fertilizers and others.

Recommendations

There is a demand to develop new and attractive employment opportunities in the Himalayas. Enabling sustainable use of natural resources together with government initiatives to provide irrigational facilities to the community. Developing a bottom-up approach and baseline information. Rapid assessment of community-level awareness center and program simultaneously. Blending indigenous knowledge with modern techniques to cope with new challenges of climate change in the future. Making the valley self-reliant and resilient are quite important and the need of the hour. The galaxy of stakeholders from all walks of life including geographers, planners, environmentalists, and engineers, masses are desire to come forward and protect the valley from the adverse impact of climate change.

Conclusion

The incredible beauty of Gandhari will inspire years and decades to come for collective partnership and collective ownership. Climate justice to be kept at the centre of all phenomena as marginalised, weaker, downtrodden and voiceless sections of the society are the ultimate bearers of climate change impacts. There is an urgent need for more efficient canals which are locally called Yura to stop the loss of water during summers. Further, water gets evaporate during the supply process from the water source to the destination which is from the Himalayas to the valleys which should be addressed. Sustainable mini-hydropower projects and rooftop solar panels and solar plants are a must to provide electricity supply in different remote villages. The challenges entail not only meeting the dynamic needs of the community but also finding out alternative ways to reduce levels of risk. It is the need of the hour to make long-term and concrete arrangements for livelihood.

Declarations

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Conflict of Interest

There is no conflict of interest.

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Prepared by Author, 2022

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Monthly Average Rainfall and Temperature Distribution in Kishtwar (Adopted from Central Ground Water Board, 2016-17 and Prepared by Author, 2022)

Figure 4

Migrated Families from Gandhari Valley (Primary Survey, 2019)

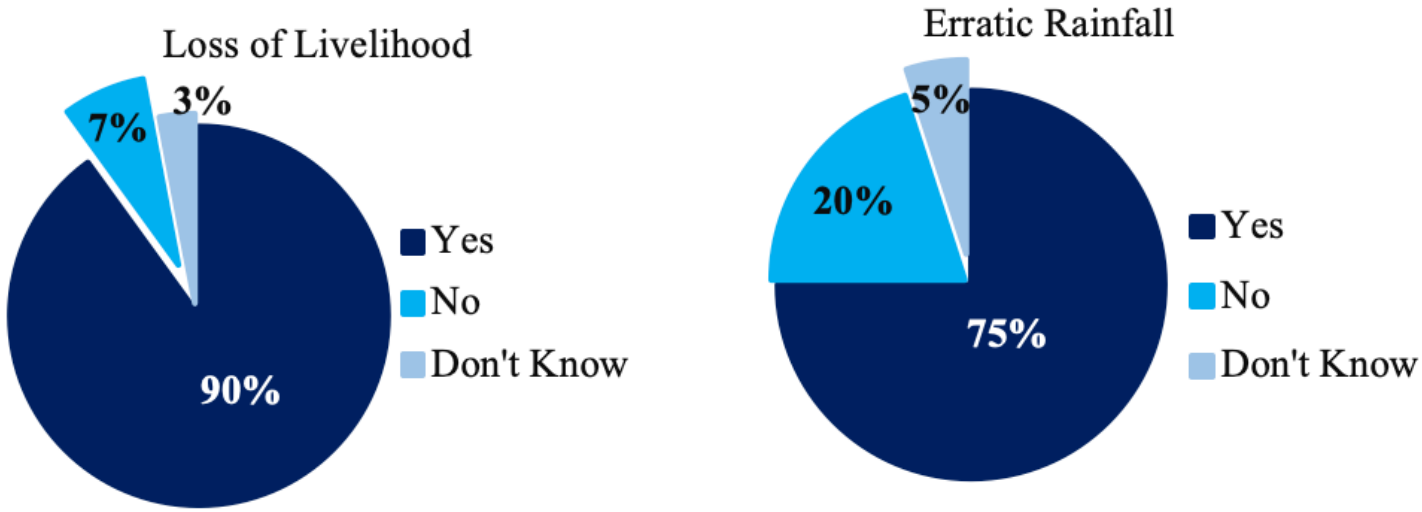

Figure 5

The Community Faced kinds of Challenges in Gandhari Valley (Primary Survey, 2019)

Figure 6

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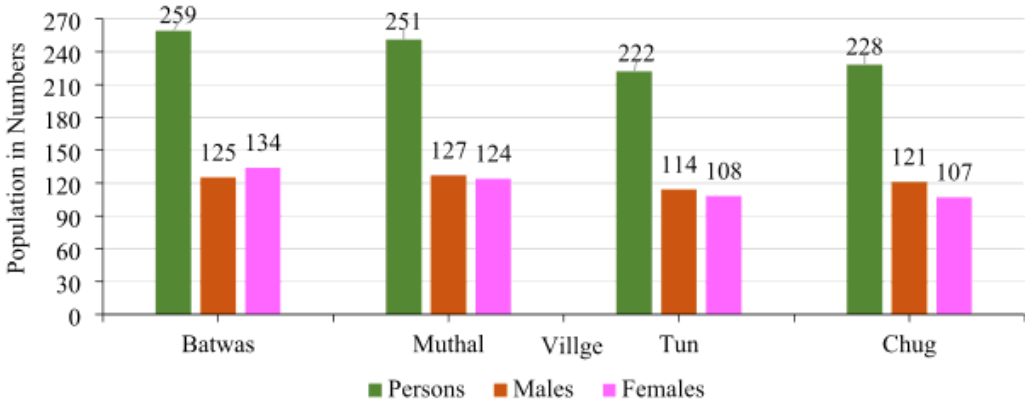

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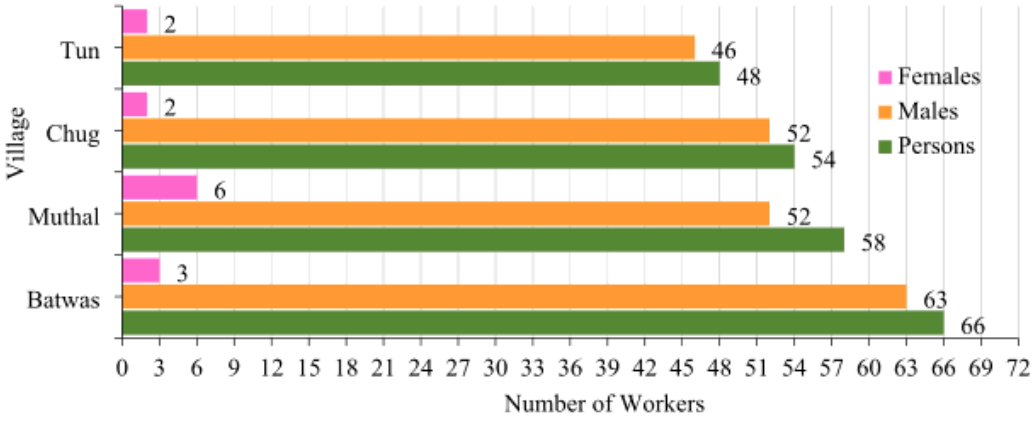

Figure 13

Fig. 15 Industrial Category of Total Workers in Gandhari (Compiled from Adopted from District Census Handbook, 2011 and Prepared by Author, 2022)