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PUBLIC HEALTH STATUS AND SOCIOECONOMIC CONDITIONS IN CLIMATE CHANGE- AFFECTED NORTHERN AREAS OF PAKISTAN

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ABSTRACT

The rural human communities of Northern mountains of Pakistan face multiple challenges due to climate change including social, health, economic, political and environmental issues. This research aims to identify socio-economic and health status of mountain dwellers along with climate impacts in Gilgit Baltistan (GB). About 1.8 million inhabitants of GB region are divided in different sects, speak a variety of local languages and have cultural diversity. In this research, 226 individuals were surveyed to identify demographic, socioeconomic, health and education status. Most of the interviewees belong to low income group. The public health quality of water samples (n=45) was determined for TCC, TFC, TFS indicate heavy microbial contamination. The study highlights climate change impacts on each sector by causing multiple issues like education losses, financial and life losses, traumas, health and diseases and infrastructure damage etc. There are issues of water and sanitation and solid waste and transportation. There is a need to implement on policies, conserve and manage environmental resources to upgrade social status of mountain communities.

Key-words: Climate change, Socioeconomics, Health, Water quality, Education

INTRODUCTION

It is estimated that mountain temperatures are increasing with longer summer spell but water sources are drying up seasonally (Chaudhry and Bawa, 2011). Climate change causes the modification of snow covers and glaciers in mountains with more seasonal melting having adverse impacts on vulnerable populations, agriculture, biodiversity and social life (Rahut and Ali, 2017). However, literature is scant on climate change impacts on mountain human communities and ecosystem

The influence of climate change on socioeconomic status of mountain communities include the economic and health losses due to frequent and intense disasters, events of extreme weather, loss of biodiversity and natural resources rendering the marginalized communities to thrive in extreme poverty. Himalayan population become more vulnerable to the impacts of climate change due to poverty, inadequate health and education services, poor infrastructure (like roads, transportation, water supply and irrigation etc.) lacking the adaptive capacity and resilience towards climate irregularities (Negi *et al*., 2012). Health consequences of climate change across Himalayan region include malnutrition due to low agricultural productivity, injuries and fatalities due to events of extreme weathers, gastrointestinal infections and water borne diseases because of poor water quality and spread of infectious diseases in changing temperatures and poor management of solid waste. Cardiovascular disease and respiratory illnesses are also common in mountain regions due to high air pollution in elevated areas (Kuniyal, 2002; Patz *et al*., 2005).

The change in weather pattern affect the livelihood of mountain community by excessive degradation of natural resources, scarcity of food and agrarian products, economic failures, social injustice and exclusion. The highland population is subjected to additional loads owing to events of extreme weathers and the situation is worst for already vulnerable and marginalized people forcing them to live in dire poverty (Gentle and Maraseni, 2012).

Literature indicates the relation of economic well being with infrastructure (Ali and Pernia, 2003). The poor infrastructure reflects the deprivation of mountain communities in education and literacy (Gerlitz *et al*., 2012). Poverty exacerbates in mountain communities as compared to other regions of a country due to lack of access to basic services and facilities. Household attributes such as socio-economic conditions, housing and lifestyle, resources and liabilities are linked to define poverty in an area (Davies *et al.*, 2007). Formerly known as Northern Areas, GB has always been distinguished for its unique economic, socio-political, ethnic, monetary structure with its exceptional topography and distinctive landscape (AKRSP, 2017). This region has world's largest deposits of glaciers with highest peaks and mountain ranges. The mountain dwellers' adaptive capability is low as they are less

resistant and more vulnerable towards natural calamities and disasters due to their dependency on natural environment (Gioli *et al.*, 2014). The purpose of this study is to identify the prevailing socioeconomic fissures and climate impacts in the study area.

MATERIALS AND METHODS

Study area

Situated at the north east of Pakistan, GB region comprised of an area of about 72496 square kilometres with three divisions and fourteen districts out of which four are newly formed in 2019. The administrative divisions are further divided into 25 tehsils and 566 villages. This area is famous for exceptionally beautiful landscape, rivers and lakes, glaciers and mountains covered with snow. Pre identified resource scarce areas have been selected for the present research. Study area is represented in Fig 1.

Data collection

The study covers resources scarce regions of GB that include 9 areas i.e. Astore, Chilas, Diamer, Ghanche, Ghizer, Nagar, Hunza, Skardu and Chital. Table 1 shows the sampling details. Overall 226 questionnaires were filled by residents of these districts through survey and focus group discussions. The responses were gathered and analysed to identify the impacts of climate change on socioeconomic and health conditions of Gilgit Baltistan.

Public health quality of drinking water

Water samples were collected from forty five different locations of nine districts in Gilgit Baltistan region. From each district five samples were collected (n = 45). All samples were grab and collected during 9.0 am to 12 pm. The public health quality of water samples was determined using following parameters; total coliforms count (TCC), total faecal coliforms (TFC) and total faecal streptococci (TFS). The above mentioned parameters were analyzed by the methods described in Standard Methods for the Examination of Water and Wastewater (APHA, 2005).

RESULTS AND DISCUSSION

Population, Gender and Age structure

The latest census of 2018 in Gilgit Baltistan represents a population of about 1.8 million. The present study covers 226 representative sample individuals belonging to areas that are environmentally resource scarce. Majority of respondents were male belonging to 16-65 years of age group and few over 65 years. The family background information shows their ancestral belonging to this region that shows more than hundred years of residence. Table 2 indicates the demographic and indicators of socioeconomic profile of the residents of GB.

Occupation status

The residents involve in agriculture, small businesses, private and government jobs (Table 2). Maximum individuals are associated with private jobs in our study area and more unemployed are found in Ghanche and Astore (Table 2). Income data is explained in Table 2 in which most of the individuals belong to a group of 11 to 20 thousand per month that show low social status.

Social profile

The communities in GB can be categorized on the basis of cultural diversity, sects and languages. Balti, Shina, Gojari, Wakhi, Domaki, Khowar and Burushasaki are the spoken languages in different areas of GB. There exists caste and tribal systems comprised of Balti, Dom, Wakhi, Kashmiri, Saadat, Yashkun and many others (AKRSP, 2017). Religiously, these people are divided into sects and strict in their beliefs. These include Ismailis, Imamia Shia, AhleSunnat and Nurbakhshis (Zain, 2010). Cultural dances are famous and attract tourists during festivals including Sword, Group, Markhor, Old man, Dakhon Karee and Cow Boy Dance. The traditional foods of this province are Sarpkhoor, Khurba, Marzan, Darba, Prapo, and Namkeen cha.

Economic features

This region contributes to less than a percent of country's economy due to unavailability of adequate funds, resources and income facilities make the people more vulnerable (AKRSP,2017). A significant change in economy is observed in last few years after technological advancement in the field of mineral, agriculture, transport and infrastructure. Minerals are the source of economy in this region that are of amazingly good quality whereas, small

business like of jewellery and market goods also contribute to the economy. These goods transported better through construction of roads and attract foreigners to invest and trade. Tourism industry and agriculture also play their role but due to low budget provided to this province these options need to be improved (Zain, 2010).

Table 1. Sampling details of the study area (GB).

S. No.	District/tehsil	Coordinates	Sample size (n)
1	Astore	35.2190° N, 74.8741° E	31
2	Chilas	35.4222° N, 74.0946° E	26
3	Diamir	35.4381° N, 73.9360° E	23
4	Ghanche	35.1611° N, 76.3319° E	32
5	Nagar	36.276776°N, 74.719566°E	31
6	Hunza	36.4604° N, 74.8946° E	25
7	Skardu	35.3247° N, 75.5510° E	32
8	Ghizer / Punial / Phander	36°22′15° N, 73°20′00° E	11
9	Chitral	35.7699° N, 71.7741° E	15
			N = 226

Table 2. Demographic and socioeconomic profile of survey participants from GB area.

	Districts	Astore	Chilas	Diamir	Ghanche	Nagar	Hunza	Skardu	Ghizer	Chitral
Gender	Male (%)	87.1	73.1	73.9	71.9	83.9	76	78.1	100	100
	Female (%)	12.9	26.9	26.1	28.1	16.1	24	21.9	0	0
Age Group (%)	16-25	25.8	11.5	17.4	28.1	6.5	16	28.1	9.1	80
	26-35	29	42.3	26.1	25	12.9	16	28.1	36.4	13.3
	36-45	12.9	3.8	17.4	15.6	19.4	36	31.3	45.5	6.7
	46-55	16.1	26.9	8.7	15.6	25.8	12	12.5	9.1	0
	56-65	16.1	15.4	13	9.4	22.6	16	0	0	0
	Over 65	0	0	17.4	6.3	12.9	4	0	0	0
Family Background (%)	< 100 yrs	19.4	19.2	21.7	31.3	45.2	28	37.5	36.4	20
	100-500yrs	29	38.5	30.4	34.4	32.3	36	46.9	36.4	53.3
	500-1000yrs	38.7	30.8	43.5	15.6	9.7	32	15.6	9.1	0
	>1000yrs	12.9	11.5	4.3	18.8	12.9	4	0	18.2	26.7
Occupation (%)	Govt. Job	6.5	11.5	17.4	21.9	16.1	8	18.8	27.3	15.4
	Private Job	41.9	34.6	8.7	43.8	19.4	44	40.6	0	0
	Own business	22.6	15.4	21.7	0	9.7	16	9.4	27.3	7.7
	Agriculture	3.2	11.5	34.8	6.3	29	20	6.3	27.3	0
	Student	6.5	19.2	8.7	9.4	6.5	12	15.6	0	76.9
	Unemployed	12.9	7.7	0	15.6	3.2	0	9.4	0	0
	Retired	0	0	4.3	3.1	6.5	0	0	9.1	0
	Other	6.5	0	4.3	0	9.7	0	0	9.1	0
Income	1-10,000	12.9	7.7	34.8	6.3	29	16	6.3	36.4	54.5

status (%)	11-20,000	38.7	23.1	21.7	37.5	22.6	40	40.6	9.1	9.1
	21-30,000	9.7	42.3	26.1	18.8	32.3	32	21.9	9.1	9.1
	31-40,000	16.1	11.5	8.7	9.4	3.2	0	15.6	18.2	9.1
	41-50,000	12.9	7.7	8.7	15.6	0	12	9.4	0	9.1
	More than 50,000	9.7	7.7	0	12.5	12.9	0	6.3	27.3	9.1
Education (%)	Illiterate	3.2	0	17.4	0	9.7	0	6.3	0	0
	Primary	0	15.4	13	9.4	3.2	4	3.1	9.1	0
	Middle	29	0	30.4	0	19.4	0	0	0	0
	Matric/O-level	25.8	0	8.7	0	12.9	0	12.5	9.1	0
	Inter/A-level	25.8	23.1	13	12.5	6.5	8	21.9	18.2	0
	Graduate	16.1	42.3	0	25	22.6	40	25	18.2	86.7
	Masters	0	19.2	13	46.9	19.4	48	31.3	36.4	13.3
	M.Phil./ MS	0	0	0	6.3	0	0	0	0	0
	Ph.D.	0	0	4.3	0	6.5	0	0	9.1	0
Health Status (%)	Healthy	61.3	53.8	69.6	71.9	58.1	64	78.1	72.7	60
	Unhealthy	38.7	46.2	30.4	28.1	41.9	36	21.9	27.3	40
	Total healthy	n	148	%	65.4					
	Total unhealthy	n	78	%	34.5					

Table 3. Major Health disorders reported in the survey of GB area.

Disorders	**N**	**%**
Cardiovascular	45	19.91
Respiratory	59	26.11
Gastrointestinal	65	28.76
Diabetes	48	21.24
Visual impairment	32	14.16
Skin allergies	63	27.88
Seasonal viral/bacterial infections	51	22.57

Table 4. Preference to health care services by respondents from GB area.

Preferences to health care services	N	%
Govt. hospitals	29	12.83
Dispensaries	38	16.81
Hakim (Eastern medicine)	26	11.50
Private hospitals	53	23.45
Move to urban centers of province	48	21.24
Move to other provinces for better facilities	32	14.16

Table 5. Public health quality of drinking water in Gilgit Baltistan area.

Sample No.	Coordinates	MPN/100 mL				Remarks	WHO Guidelines (1996)
		District	Total coliforms count	Total faecal coliforms	Total faecal streptococci		
GB-1	75.60842 E 34.64402 N	Skardu	36	16	<3	Unfit for human consumption	<3
GB-2	75.287251 E 34.791841 N	Skardu	36	16	<3	Unfit for human consumption	<3
GB-3	75.60605 E 35.196266 N	Skardu	16	<3	<3	Unfit for human consumption	<3
GB-4	75.548682 E 35.308432 N	Skardu	43	36	<3	Unfit for human consumption	<3
GB-5	75.858422 E 35.255321 N	Skardu	16	16	<3	Unfit for human consumption	<3
GB-6	74.83634 E 35.353959 N	Astore	240	210	16	Unfit for human consumption	<3
GB-7	74.950511 E 35.196008 N	Astore	240	53	<3	Unfit for human consumption	<3
GB-8	74.663698 E 34.934471 N	Astore	1100	240	16	Unfit for human consumption	<3
GB-9	75.079576 E 34.788387 N	Astore	210	16	<3	Unfit for human consumption	<3
GB-10	75.078366 E 35.058349 N	Astore	36	16	<3	Unfit for human consumption	<3
GB-11	74.061873 E 35.6248 N	Chilas	1100	1100	16	Unfit for human consumption	<3
GB-12	74.10378 E 35.417328 N	Chilas	240	43	<3	Unfit for human consumption	<3
GB-13	74.575554 E 35.386451 N	Chilas	210	53	43	Unfit for human consumption	<3
GB-14	74.50545 E 35.489583 N	Chilas	1100	240	16	Unfit for human consumption	<3
GB-15	74.375543 E 35.39682 N	Chilas	240	53	<3	Unfit for human consumption	<3
GB-16	73.682636 E 35.818712 N	Diamer	1100	210	43	Unfit for human consumption	<3
GB-17	73.625333 E 35.663405 N	Diamer	1100	240	16	Unfit for human consumption	<3
GB-18	73.433814 E 35.668357 N	Diamer	240	210	43	Unfit for human consumption	<3
GB-19	73.233045 E 35.843218 N	Diamer	210	53	16	Unfit for human consumption	<3
GB-20	73.864026 E 35.69914 N	Diamer	240	210	53	Unfit for human consumption	<3
GB-21	76.270369 E 35.203732 N	Ghanche	53	36	16	Unfit for human consumption	<3
GB-22	76.720382 E 34.93707 N	Ghanche	36	<3	<3	Unfit for human consumption	<3
GB-23	76.325059 E 35.167162 N	Ghanche	43	36	<3	Unfit for human consumption	<3
GB-24	76.79785 E 35.155351 N	Ghanche	16	<3	<3	Unfit for human consumption	<3
GB-25	76.69598 E 35.293278 N	Ghanche	16	<3	<3	Unfit for human consumption	<3

GB-26	74.749721 E 36.231796 N	Nagar	<3	<3	<3	Fit for human consumption	<3
GB-27	74.714959 E 36.268833 N	Nagar	<3	<3	<3	Fit for human consumption	<3
GB-28	74.285908 E 36.385793 N	Nagar	16	<3	<3	Unfit for human consumption	<3
GB-29	74.271285 E 36.267776 N	Nagar	<3	<3	<3	Fit for human consumption	<3
GB- 30	74.377086 E 36.241399 N	Nagar	36	16	16	Unfit for human consumption	<3
GB-31	75.333835 E 36.441159 N	Passu	<3	<3	<3	Fit for human consumption	<3
GB-32	75.163635 E 36.876474 N	Passu	<3	<3	<3	Fit for human consumption	<3
GB-33	74.42476 E 36.831768 N	Passu	<3	<3	<3	Fit for human consumption	<3
GB-34	74.650967 E 36.342241 N	Passu	<3	<3	<3	Fit for human consumption	<3
GB-35	75.010686 E 36.535684 N	Passu	16	<3	<3	Unfit for human consumption	<3
GB-36	73.341145 E 36.372122 N	Ghizer	36	16	,<3	Unfit for human consumption	<3
GB-37	73.399157 E 36.226275 N	Ghizer	16	<3	<3	Unfit for human consumption	<3
GB-38	73.009591 E 36.176197 N	Ghizer	<3	<3	<3	Fit for human consumption	<3
GB-39	72.748233 E 36.177384 N	Ghizer	<3	<3	<3	Fit for human consumption	<3
GB-40	73.170908 E 36.403449 N	Ghizer	<3	<3	<3	Fit for human consumption	<3
GB-41	75.742226 E 35.42292 N	Shiger	16	<3	<3	Fit for human consumption	<3
GB-42	75.447828 E 35.666884 N	Shiger	<3	<3	<3	Fit for human consumption	<3
GB-43	75.400737 E 35.907056 N	Shiger	<3	<3	<3	Fit for human consumption	<3
GB-44	76.013561 E 35.648995 N	Shiger	16	<3	<3	Unfit for human consumption	<3
GB-45	75.726563 E 35.682947 N	Shiger	<3	<3	<3	Fit for human consumption	<3

Table 6. Descriptive statistics of drinking water bacterial load of GB area.

Basic statistics	Total coliform count (TCC)	Total faecal coliform count (TFC)	Total faecal Streptococci count (TFS)
Mean	208.2	118.5556	80.24444
Minimum	16	16	16
Maximum	1100	1100	101
Range	1084	1084	85
SD	327.6591	162.7513	33.99275
SE	48.84453	24.26153	5.06734
Skewness	2.314166	5.201911	-1.23577
SE skewness	0.353732	0.353732	0.353732
Kurtosis	3.979898	31.30473	-0.33505
SE of kurtosis	0.694544	0.694544	0.694544

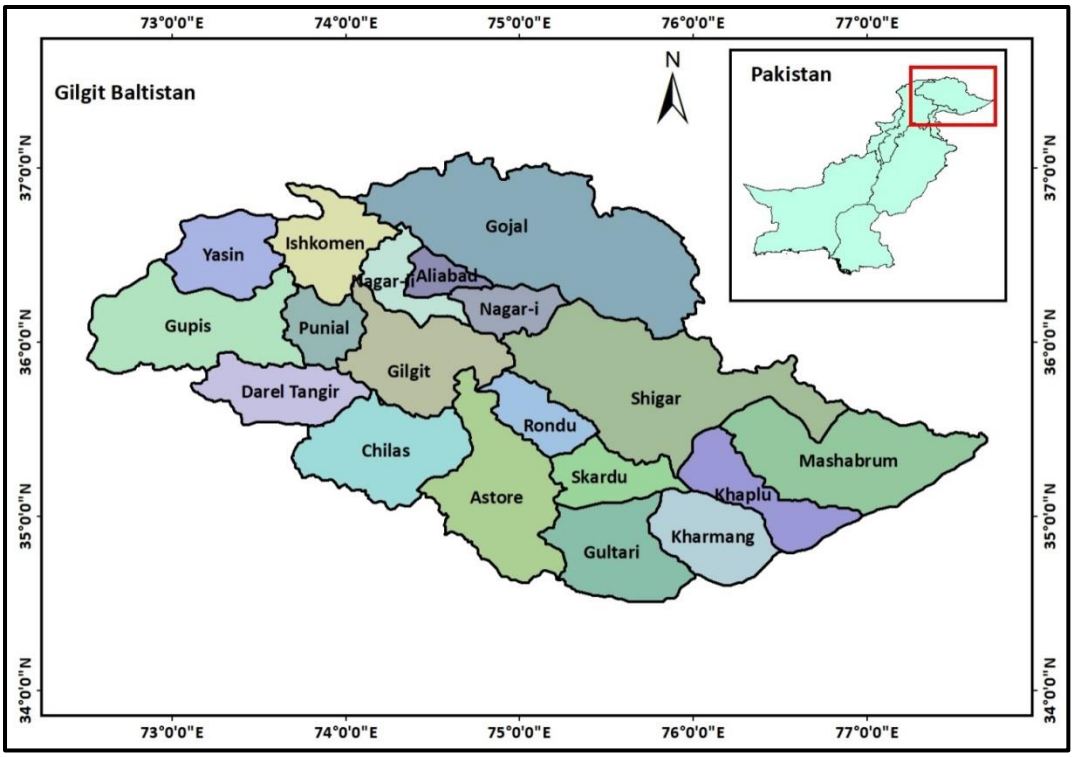

Fig.1. Map of the Study area (GB) showing districts.

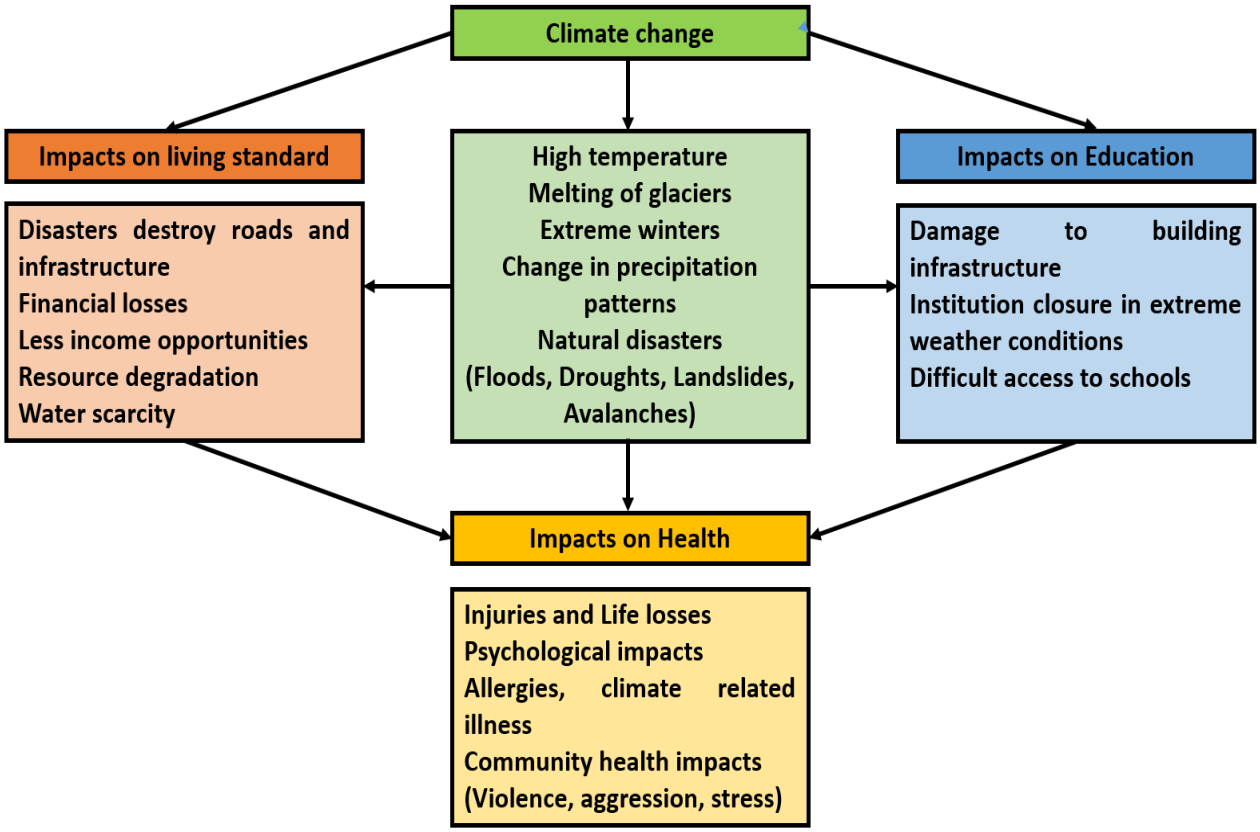

Fig. 2. Conceptual framework for climate change impacts on socioeconomic status of mountain communities.

Fig. 3. Roads and transportation issues in Gilgit Baltistan area.

Climate change and mountain communities

Climate change impacts mountain areas of Pakistan by frequent and intense disasters. In the northern areas, the one most disastrous effects of climate change are the events of Glacial Lake Outburst Floods (GLOFs) that are responsible for causing mudflow and debris hence life and economic losses occur (Rasul *et al*., 2011). The inhabitants of mountains are forced to migrate due to natural calamities that happen after increased events of GLOFs. There is rapid glacier receding in the high altitudinal regions that is resulting in unequal water distribution in upper and lower riparian system. It can be observed that natural resources are not fully conserved and managed in Pakistan that creates a burden over environment due to over exploitation (Ishaq *et al*., 2016). Climate anomalies are intensifying with frequent landslides and avalanches in mountain regions that are caused due to deforestation and climate change. Literature indicates that summer precipitation in northern areas of Pakistan distributes more nutrients in sediments and soil whereas the effect of climate change can be seen in winter rainfall and decline in the snow cover that is eventually upsetting mountain inhabitants' lives. Rise in temperature and erratic rainfall induce glacier receding and heavy floods in spring months and droughts are observed in winters (Raza *et al*., 2015).

Socioeconomic conditions of Gilgit Baltistan and impacts of climate change

Education, health and standard of living show deprivation of mountain population but climate irregularities and event of extreme weather enhance marginalization of the communities. Climate disasters affect the infrastructure, cause human and financial losses and making them poor to focus on education. The health status of disaster victims got neglected because of low social status and lack of funds allocation and distribution. A conceptual framework for climate impacts on socioeconomic profile is illustrated in Fig 2. Following are the status socioeconomic profile along with climate impacts on each sector.

Education

The overall education status is explained in Table 2 in which graduates and masters are high in all districts and illiterate people are found more in Diamer and Nagar i.e. 17.4% and 9.7%, respectively. The major issues involve distantly present educational institutions, teacher's absenteeism and lack of higher education facilities for which they

have to move to urban centres. The literacy rate was 37.85% in 1998 and predictable as 60% in 2013 (GBFC, 2013). This province shows a combined public and private urban 333 and rural institution 1751 in numbers. The girls' enrolment (10835) in urban centres is far greater than boys (9143) and this situation is reversed in rural areas (PES, 2018). More work on education policy is required in this province and a need to promote higher education.

With more frequent and intense disasters, the building infrastructure got affected in the past few decades that directly disturb the education system in mountain areas. The events of extreme weather such as cold wave, heavy snow, avalanches and erratic rainfall cause the closing of institutions for many days. The respondents also shared their views on education losses in events of extreme weather as it is difficult to access schools in heavy snow and precipitation in rugged terrain.

Health

In society's well-being health sector plays an important role but in GB, this sector has suffered from multifaceted issues that are highlighted by the respondents. These include unavailability of paramedical staff, distantly existing hospitals poor healthcare facilities and lack of surgical equipment. Table 2 indicates five districts that represent more unhealthy individuals with leading diseases as cardiac, respiratory, gastric, high blood pressure, diabetes, visual impairments and skin allergies as shared by respondents. The frequency of healthy persons did not differ significantly with the district (Chi-square =7.63, ns.). However, the percentage of unhealthy (diseased) individuals is highest in Chilas area (44%) while the least percentage of diseased individuals is in Skardu (22%). This is perhaps because improved or greater health care facilities are available in Skardu compared to other districts. On an overall basis a high percentage of people are suffering from Skin and gastrointestinal diseases. Surprisingly, about 14% people suffered from visual impairment. The highest number of cases were those of skin allergies (skin diseases), followed by those suffering from gastrointestinal diseases (Table 3). Cardiovascular cases were also remarkably high in number. Most of the interviewees prefer private hospitals due to better facilities (Table 4).

The drinking water quality was analysed from the entire GB area with respect to enteric bacterial load (Table 5). Three samples from Nagar were found to be fit for drinking water while four out of 5 samples from Passu qualified as drinking water. Three water samples were fit for drinking from Ghizer while four from Shigar. Generally the range and variance of the different bacteria were high. Kurtosis was significantly high for total coliform and total faecal coliform bacteria while skewness was significantly high for total faecal coliform. The descriptive statistics is shown in Table 6.

Literature specifies recent health indicators representing fertility (4.7), method use for family planning (39%), maternal health care (62%), neo natal mortality (47 deaths per 1,000 live births), infant mortality (63 deaths per 1,000 live births) and underweight children (18%) (PDHS, 2018). These areas require lady health workers and hospitals to deal with maternal health that is being subjected to risk through untrained females that perform deliveries using traditional methods (Asif, 2017).

Climate induced disasters causes life loss as well as injuries that cause trouble for individuals of remote areas specifically with no medical facilities. Climate change also generates spread of pathogenic diseases in the areas, increase epidemics and water-borne diseases. The respondents of this research also told the mental trauma they faced during disasters and the stress due to financial and human losses in the past decade.

Standard of living

Housing characteristics and lifestyle: The inhabitants of mountain areas have a mind-set of good houses with more facilities and compete with each other in luxuries but this only happens in rich class. The individuals of low social class only try to survive in limited resources and harsh weather with less available services. The occurrence of disasters in the last few years become so frequent that cause damage to infrastructure creating financial losses and making the individuals poorer.

Water, irrigation and drainage: Public health is highly affected due to low quality drinking water. As pointed out above, as the treatment facilities are insignificant or lacking in whole province with treatment used only in 3.2% among 6000 population (MICS, 2017). Surface water, shallow wells and man-made channels are used as a source of drinking water in GB. With the changing climatic conditions, water borne diseases spread along with many other epidemics in the area.

Sanitation: There are varied sanitation issues if we separately consider rural and urban centres of GB. Collection pipes made of RCC are used and some areas have open drains in urban zones which contaminate the water bodies, However, some places do not have a proper collection system as a consequence ground water contamination is observed. Rural areas are deprived of collection services. Sewage management in northern areas is also lacking due

absence of operation and great energy charges (Ahmed and Joiya, 2003). Disasters induce infrastructure damage in the study area can be seen and spreading with time.

Solid waste: The management of solid waste is a known issue in this region due to inappropriate dumping and unavailable management options. The residents throw garbage on open lands and water bodies or simply burn it. Waste collection is performed manually and shortage of vehicles is observed. Hussain et al. (2016) noticed waste burning commonly in this area that give rise to emission of GHGs in mountain areas. GBEPA reported the waste burning in urban centres of GB with a proportion of 35%, 15%, 40%, 30%, 35%, 40% and 45% in Astore, Chilas, Ghizer, Gilgit, Hunza-Nagar, Khaplu and Skardu, respectively (GBEPA, 2012). The waste burning induces more warming conditions.

Domestic fuel: The residents of northern areas use wood for cooking purpose especially in winters due to lack of gas facilities where firewood usage was found to be increased in winter time i.e. 14741 kilograms from 2083 surveyed population as reported by (Khan and Joiya, 2003).The frequent use of wood cause excessive deforestation that give rise to warmer temperatures in this region. The branches of trees, shrubs, dried herbs and even bark is used for burning purposes.

Roads and transportation: This region is historically important and suffered most with conflicts that occurred during indo-Pak separation (Hussain et al. 2016). The opening of Karakorum highway and construction of roads changed the history with two airports, four hundred bridges and about two thousands metal roads (AKRSP 2017). Church *et al.* (2000) studied transportation as a foremost obstacle in accomplishing social inclusion, improved education, economic equality, good health services and social activities. GB has lowest road density i.e. 0.06 km/km^2in contrast to average of country i.e. 0.32 km/km^2 (AKRSP 2017).

Narrow roads, frequent landslides, mudslides, avalanches and heavy snow are some climatological and anthropogenic travel hindrances along with steeper slopes and no roadside barriers that threaten the lives of public. Transport issues are highlighted in Fig 3.

Future aspects: From present research, it can be summarized as the mountain communities are affected most with climate induced natural disasters and overexploitation of natural resources that is responsible for lowering of their social status. The first step is to manage the environmental resources by conservation and restoration and to equally distribute among population regardless of their social status. Ban on pollution of water and solid waste will be a good option to secure natural resources. Next is to work on education and health sector by implementing on existing policies and where necessary, form new provincial sectoral policies because these two sectors are important to upgrade people's status. More livelihood opportunities and support of agriculture and livestock must be provided through easy loans. The need of time is to work on infrastructure, roads, transportation system and water supplies, making new constructions climate resilient and disaster proof in the vulnerable areas.

CONCLUSION

The above profile shows how the people of GB surviving in less resources along with natural disasters that affect them throughout the year. The villages have moderate to low infrastructure with low available utilities, education, health and transport facilities. Open drains, dumping and burning of solid waste are the main issues prevailing in this society that ultimately lead to water, air and soil pollution. Climate change impacts each sector by causing multiple issues like education losses, financial and life losses, traumas, infrastructure damage etc. There is urgent need to work on sectoral and provincial policies by identifying vulnerable areas and specifying budget for climate related disaster victims and building resilient infrastructure. People should be trained for disaster management

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