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Impact of attaabad landslide induce lake on livelihood of upstream population of upper Hunza, District Hunza-Nagar

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Abstract

Pakistan is located at the cross-roads of plate boundaries, experiencing multiple hazards of earthquake, flood, glacier lake outburst flooding, drought, salinization, water-logging and recurrent landslides. This paper attempts to examine the impact of 2010 Attaabad landslide on livelihood of upper stream population of upper Hunza, Pakistan. A total 128 questionnaires were filled in from the disaster affected victims. However, secondary data were obtained from the Geological survey of Pakistan, National disaster management authority and Focus Humanitarian Assistance for Pakistan. The upstream population of upper Hunza lost their major source of income from potato which is due to landslide induced lake and lake water inundated into agricultural land and submerged Karakoram highway. On other side the export and import of agricultural products, fruits and access to basic needs of life such as health care, electricity and education of students and children severely affected. The study findings revealed that the high uncertainty about their future, because of unintended creation of Attaabad Lake. The roadblock has limited the accessibility of these food supplies and inflated prices beyond what most people can afford. This has inflicted terrible damages to human lives, standing crops, housing, infrastructure and other properties. The landslide induced lake teaches important lessons about hazard assessment, disaster management and most importantly, public communication during crises.

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Introduction

Disaster is a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources. Natural disasters are result of sudden change in state of natural elements due to natural forces. Many natural disaster are not under the control of man and even cannot be predicted correctly when it occurs. Major natural disasters are floods, earthquakes, landslides and droughts. When natural disasters happen, it results, adverse effects on human life, livelihood, property, infrastructure, agriculture, education, communication and environment (Fort et al., 2011).

Landslides occur frequently in the northern areas of Pakistan, which comprised on mountainous ranges of Himalayas, Karakoram and Hindu Kush. Attaabad landslide was triggered on 4th January, 2010 at around 11:30 hours with a complex sequence of catastrophic sudden impact events, which killed 20 people and number of other injuries also occurred. During the early part of 2010 the key impact of the landslide on the local population was the loss of the Karakoram Highway (NDMA, 2010).

Initially the blockage was just for the 1.5 km stretch of the landslide mass itself. However, the road is located on a platform cut into the valley wall within 50 m of the valley floor, such that as the lake filled the highway upstream of the blockage was progressively inundated. Since then the road had been undergoing large-scale upgrading works, including carriage way widening and the construction of new culverts and bridges (Petley, 2010).

This population lost their major sources of income, which were passing trade on the road and the export of agricultural products, and access to basic needs such as health care and electricity was also severely impacted, for or example, there were no medical professionals located on the north side of the barrier. At the time of overtopping the maximum length of the lake was about 22 km, meaning that in excess of 25 km of road was buried or inundated (Petley, 2010).

The length of Slide across the river is 300 to 500 meter, and spread of slide material is about 1.5-2.0 km. The height of slide above river bed is 127 to 200m. The volume of the landslide mass has been estimated as 70 million cubic meters. The width of the lake is 300-700m, maximum depth is 106m, and length of lake is 24km (Frontier Work Organization Pakistan, 2010). The landslide material comprises of all possible grain sizes, from clay to silt, sand, gravel, cobbles and large boulders. One of the most striking features of this landslide is the presence of dark colored clay (black clay) in the mass in substantial quantity. It is blackish in color which is an indication of high organic content (FWO, 2010).

A lake has been formed behind the landslide, which has submerged a portion of the Karakoram Highway (KKH) and has also started to affect the upstream inhabitants of upper Hunza, Pakistan. The dam water has inundated five villages of upper Hunza, included Ainabad, Shishkat, Gulmit, Gulkin and Husseini. This landslide blocked the Karakoram highway and cut off upper Hunza villages from the rest of the country. And 25000 people are suffering due to lack of economic activity and inaccessibility to the items of daily sustenance. Due to inundation of landslide dam 240 house were damaged which included, 32 houses in Ainabad village, 130 houses in Shishkat village, 61 houses in Gulmit village, 10 house in Husseini village and 7 Houses in Gulkin village. The grand total damage of house is 381, which included Atta Abad, Sarat and five upstream villages of upper Hunza (NDMA, 2010). The disaster of Attaabad landslide illuminating massive losses due to submersion of agricultural lands, homes, fruit trees, infrastructure, loss of forest, biodiversity and immobility of goods and services nationally and internationally (Petley, 2010).Livelihoods usually lead to flows of income and consumption, the outcome of which are expressed in the household's standards of living (Khan et al., 2010).

Attaabad landslide and landslide induced lake is a unique event in the history of northern areas of Pakistan. This disaster badly effect up and downstream communities and also disturbed between Pak-China international trade which as Karakoram highway passing through the study area. The overall aim and objective of the present study was to evaluate pre and post livelihood status of the communities and make recommendations for formulation of disaster preparedness, mitigation and policy making.

Materials and methods

Study Area

Geologically the Karakorum is also considered as the highest desert in the world. However, the water ways and the glacial add greenery to the valley before joining up with the Indus River. Within this contrasting geographical setting situated along the

ancient Silk Route is the Gilgit City. Gilgit City is the biggest commercial hub, trading centre from pre British times, and beyond which there is no big town or city within a distance of about 450 Kilometers in any direction. This aspect adds to the strategic economic, political and social hub of the Gilgit-Baltistan (GB-EPA, 2013).

Gojal is a sparsely populated arid high mountain area spread over 8,500 km². See fig. 1. Villages are situated at an altitude between 2,000 to 3,000 meters. The population of Gojal is around 40,000 people. The main valley was connected by the KKH which runs alongside the Hunza River and crosses into the Chinese Province of Xinjiang over the Khunjerab Pass at an altitude of 4,690 m. Economy in the area is largely based on agrarian.
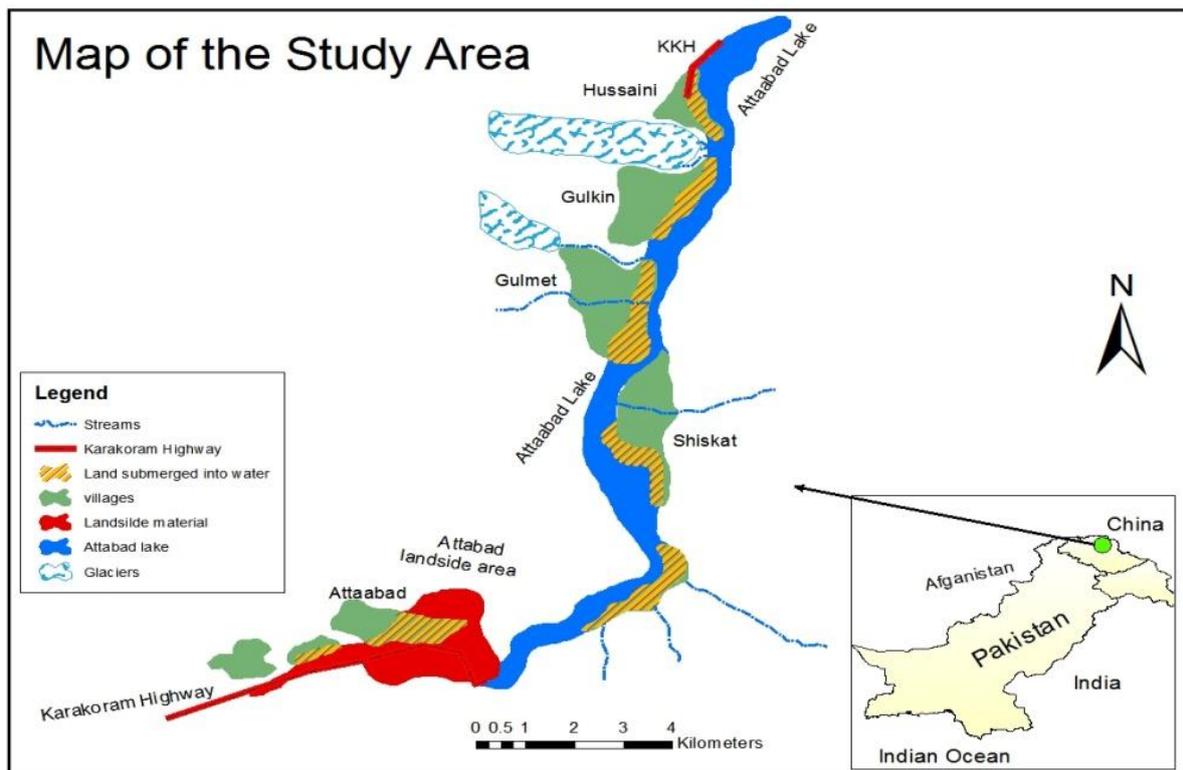
Fig. 1. The above map showing study area.

Household survey

Conducting interviews is considered one of the preferred ways of data collection because interviews accumulate better data in a cost effective way (Guba

et al., 1981). The aim of an interview is to provide an opportunity for the participants to discuss things of interest to them and to cover matters of importance to the researchers in a way that allows the

participants to use their own concepts and terms. Researcher used a standardized interview protocol that consists of a set of questions carefully worded and arranged with the intention of taking each respondent through the same sequence and asking each respondent the same question with essentially the same words. A survey method of data collection was used. Primary data were collected from 128 adult respondents (35 from Shishkat, 55 from Gulmit, 24 from Gulkin and 14 from Hussaini village) by means of a structured questionnaire. Villages formed the basis of study units (clusters) and the subjects were selected using stratified random sampling technique. The data was analyzed and presented through the method of descriptive statistics

Table 1. Household survey.

Sample sites	Total Households (N_i)	%	Sample sizes	Sampling interval (K)
Gulkin	121	19 %	24	5
Gulmit	272	43 %	55	5
Hussaini	69	11%	14	5
Shishkat	175	27%	35	5
	637		128	

Results and discussion

Throughout the mountainous part of Gilgit – Baltistan most villages are considered to host the worst slide-affected areas (Khan and Rahman, *2006*). The analysis shows that Attaabad disaster has worse impacts on socio-economic conditions of upper Hunza. Attaabad disaster destroyed their homes, agricultural lands, forests; livestock's which created many problems for the whole population of upper Hunza. The blockage of Karakoram Highway (KKH) is a serious problem in the study area. The blockage of KKH also affected the imports and exports between Pakistan and China. The upper Hunza is a of the famous region for potato and apricot production in Gilgit-Baltistan. The huge market of potato and

apricot business is badly affected after 2010 Attaabad disaster. Attaabad disaster mostly effect agricultural land, livestock, and business activity along KKH, and stopped their major income sources of earning of the inhabitants. All these factors caused financial crisis in upper Hunza and people have unable to pays for their basic needs like food, shelters, cloths, health and education.

Losses and Damages

Losses and damages due Attaabad landslide is presented in table 2.The total number of deaths were 13, injured 06 and 06 persons missing. The landslide also destroyed 54 houses in Attaabad and Sarat village. After the disaster 1325 people were displaced and 156 people directly affected. The landslide also blocked the Hunza River and Karakoram High.

Table 2. Losses /damages Due to 2010 Attaabad landslide.

1	Dead	13
2	Injured	06
3	Missing	06
4	Houses Completely destroyed (27 Attaabad,27 Sarat)	54
5	Live stock	300
6	Population displaced	1325
7	Affected household	156
8	Blockage of KKH	3km
9	Blockage of Hunza River	

Landslide consequences

After Attaabad landslide consequences are presented in table 2.The extent and severity of the Attaabad disaster has increased substantially which have seriously endangered the people and their property in the area. Loss of homes in the study area was 28%, submerged of land was 32%, submerged shops were 5%. While, fruit trees were 5%, fruitless trees 2%, jungle 17% and 10% people indirectly affected.

Table 3. 2010 Attaabad Disaster Consequences.

Extent of Disaster	Shishkat	Gulmit	Gulkin	Husseini	Total	%age
Loss Of Life	0	0	0	0	0	0%
Loss Of Home	15	17	2	2	36	28%
Submerge Of Land	15	18	4	4	41	32%
Loss Of Shop	4	3	0	0	7	5%
Loss Of Fruit Trees	2	2	1	1	6	5%

Extent of Disaster	Shishkat	Gulmit	Gulkin	Husseini	Total	%age
Loss Of Fruitless Trees	0	2	0	1	3	2%
Loss Of Jungle	6	10	1	5	22	17%
Loss Of Cattle House	0	0	0	0	0	0%
Indirectly Effected	5	2	3	3	13	10%
Total	47	54	11	16	128	100%

Opinion major losses

Opinion of respondents on single major loss due to Attaabad disaster is presented in table 4. There are different opinions of the respondents when we asked about the single major loss caused by the Attaabad disaster. 16% of the respondent's opinion health is the major problem in area. 10 % of the respondent's opinion business restrictions are the major problem in the area. 9 % of the respondent's opinion agricultural loss is the major problem in the area 3%

of the respondents opinion livelihood is the major problem in the area. Communication is one the major loss caused by the disaster, as 32 % of the respondents opinion is communication between upper and lower area which became very difficult after the disaster. 4 % of the respondent's opinion destruction of homes is a big problem in the area after the disaster. 8 % of the respondents opinion quality of education is became an important problem after the disaster.

Table 4. Opinion against Single Major Loss Caused by the Disaster.

Major Loss	Shishkat	Gulmit	Gulkin	Husseini	Total	%age
Health	9	5	2	4	20	16%
Business Restrictions	7	5	0	1	13	10%
Cut Off From The Country	2	4	2	3	11	9%
Agricultural Loss	3	10	3	2	18	14%
Livelihood	1	1	1	1	4	3%
Decrease Prices Of Potato	1	1	0	0	2	2%
Communication	17	16	3	5	41	32%
Destruction Of Home	2	3	0	0	5	4%
Mental Stress	1	1	0	0	2	2%
Education	3	6	1	0	10	8%
Ruined	2	0	0	0	2	2%
Total	48	52	12	16	128	100%
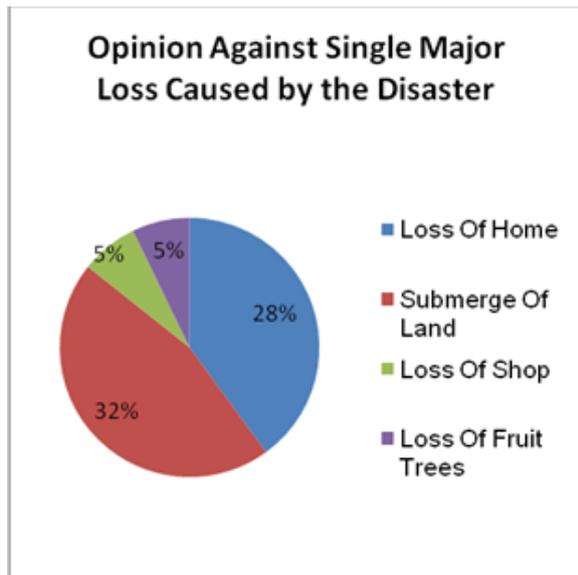
Fig. 2. Opinion against single major loss due the disaster.

Fig. 3. The above picture showing landslide location & human activities after disaster.

Crops before the Disaster

About 86% of the respondents stated that before the disaster their major crop was potato. Out of the

respondents, about 6% believed that their major crop was wheat. However, 5% respondent mentioned that their major cultivation was vegetables. Major crops before the disaster is presented in fig. 4.

Table 5. Major Crops before the Disaster.

Crops	Respondents	Percentage
Potato	110	86%
Wheat	8	6%
Vegetation	6	5%
Other	4	3%
Total Respondents	128	100 %
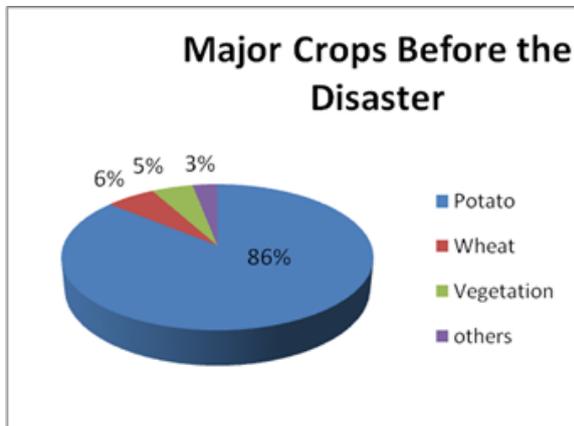
Fig. 4. Major crops before the disaster.

Crops after the disaster
Major crops after Attaabad disaster is presented in fig. 5. However, some of the respondents (44%) mentioned that their major crop after disaster is potato. Similarly, 35% respondents said that their major crop is wheat after disaster. While 15% of the respondents mentioned that after the disaster they started growing vegetables because of low cost and high return instead of potato.

Table 6. Major Crops after Disaster.

Crops	Respondents	Percentage
Potato	55	44%
Wheat	45	35%
Vegetables	20	15
Other	8	6%
Total Respondents	128	100 %
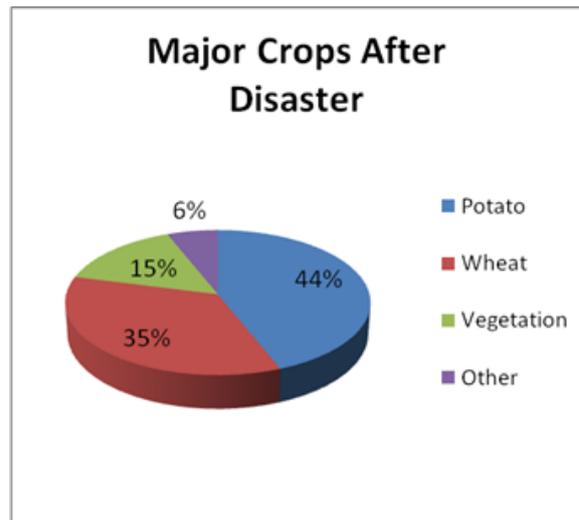
Fig. 5. Major Crops after the Disaster.

Source of income
According to the respondents about 65% engaged in agricultural sector, 16% in business, services 13% and retired army 5.5%. Gojal is no more a self-sufficient subsistence economy. Although most families still produce part of their food themselves, economy and life depend largely on monetary income. Income opportunities, however, were badly affected by the disaster.

Table 7. Main source of Household Income.

Sources of Income	Respondents	Percentage
Agriculture	84	65%
Business	20	16%
Services	17	13%
Retired army	6	5.5%
		100%
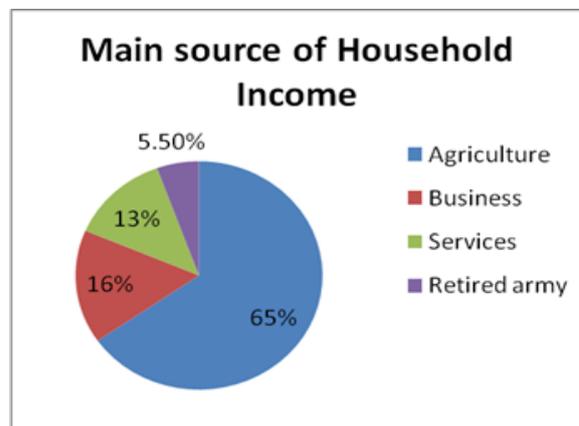
Fig. 6. Main Source of Household income.

Fig. 7. Attaabad landside induced lake inundated in agriculture land.

Yearly income from potato before and after the disaster

After the landslide and it induced lake the farmers anticipated on one hand great difficulties for marketing of their crops and on the side facing problems for bring food into the area. One būri (bag) of potato holding 100 kg for more than 2,000 PKR before the disaster, while after the disaster farmers were initially offered only 700 PKR buri of potato (100kg). The traders argued that they were not in a position to pay more because they had to bear the much increased transport rates. The farmers were not in a bargaining position. At that time many of them had spend most of their savings and were desperate in need of cash; they were forced to sell their produce at almost any rate. Some farmers who were able to wait a little longer until selling their crops got around 1,200 PKR per būri. Because of low cultivation of potato and low rates, the income derived from potato decreased dramatically as pre and post yearly income shown in table 8.

Table 8. Yearly income of from potato before and after disaster.

S.NO	yearly income from potato	PK rupees
1	Before the disaster	25,600,000/Rs
2	After the disaster	85,00,000

Recommendation

• Support to reactivation of markets for goods and services is very important for better standard of living of the communities

• Government should provide financial incentives for the improvement in livelihood status of the affected communities.

• In the disaster affected areas there should be reconnection of power lines and transport infrastructures

Conclusion

Disasters destroy or affect people's livelihoods and cause serious damages to infrastructure and lives, the public feel unsafe from these dangers. This research examined the 2010 Attaabad disaster impacts on livelihood of upstream population of upper Hunza. During the analysis it was found that the disaster has worse impacts on livelihood of the area. Economic reactivation and growth imply in jobs and incomes until catching up with previous conditions and beyond post disaster investments and economic strategy should aim at maximizing inclusiveness, job creation and build up of sustainable livelihoods. Agriculture is one of the important activities of the people and main source of income was potato which was a cash crop. The findings of the study revealed that income level of the people badly affected compare with before the disaster. After the disaster annual income from potato badly affected which due to communication barriers between up and down stream. Internal displace persons are also badly affected due to complete loss of their land and homes, dislocation from their ancestor land and isolation from their previous settlements. This study has great significance in order to understand after impacts of such natural disasters, and it should be considered as a reminder that such kind of disaster can occur in any place of mountainous region of Gilgit-Baltistan. The 2010, Attaabad disaster teach an important lesson in order to understand mitigation, preparedness,

response, recovery and, most importantly, public communication about natural hazards.

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