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Exploring the Impacts of Climate Change on Agriculture: The Case of Devastating Floods of 2022 in Balochistan, Pakistan

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ABSTRACT
Climate change induced devastating floods are becoming more regular, especially in Pakistan. Especially the 2022 floods are an excellent example. Objective: The objective of this research is to determine how the 2022 flood have affected agriculture in the Qila Saifullah District of Balochistan, Pakistan. For this case study research, a quantitative approach was used. Through a household survey, primary data were collected from farmers. Result: The findings showed that floods 2022 has negatively affected the livestock and agricultural farms in the study area, eventually affected their livelihood. The maximum number of crops were five. Out of the total, 96.7% of the crops were fully damaged due to the flood. The farms having less than 20 trees were highly 73.9% damaged. Similarly, the farms with less than 30 trees were highly (88.5%) damaged due to floods. The data showed that small farmers had great losses. Conclusion: The finding demonstrates that flooding is often viewed as a major natural hazard due to its potential to cause disease, property damage, fatalities, infrastructure damage, and disruption of public services. Devastating floods of 2022 have caused severe losses to livestock and agricultural farms in Balochistan. The findings of this study suggest that preparedness and mitigation measures to climate change induced disasters such as floods can reduce the extent of losses in future.

Keywords: Flood, agriculture, livestock, monsoon, climate change impacts

INTRODUCTION
Globally, people are becoming more concerned about the effects of and vulnerabilities caused by climate change (Lee et al., 2015). One of the world's areas most susceptible to flooding is Pakistan. Heavy rains during the monsoon season frequently cause flooding in the area, which can seriously harm people, property, crops, and infrastructure (Mirza, 2011). Particularly in Pakistan, Bangladesh, and India, catastrophic floods are occurring more frequently (Kale, 2014). Additionally, the problem has got worse in recent years as a result of climate change (Gössling et al., 2020). Extreme rainfall in Pakistan has had a negative impact on the country's agriculture sector and people's ability to support their families since the start of the 2022 rainy season (Manzoor et al., 2022). In comparison to prior floods, which were mostly caused by excessive precipitation, the floods in Pakistan in 2022 were even more unprecedented in terms of scale and impact. 1324 people were murdered as a result of the exceptional events, which also left over 33 million people homeless and flooded around a third of Pakistan's land area (Stephen & Duncan, 2022).

Floods affect agriculture and food security, especially in areas where flood occurrences may be getting more frequent. Balochistan’s frequent flooding has an impact on the way of life for some rural residents. Balochistan’s livestock system is evolving as a result of the rise in demand (Baloch et al., 2021). Little has been studied on the effects and causes of climate change induced floods in 2022. Particularly, the effects of the flood in 2022 on livestock and agriculture in the Balochistan district of Qila Saifullah, have not yet been a focus of any research. Thus, this research explores the effects of flood of 2022 on agriculture and livestock in Balochistan's Qila Saifullah District.

MATERIALS AND METHODS
Study Area
The Qila Saifullah district is located in the northwest of the province of Balochistan, between 31.0140° north and 68.3339° east. Qila Saifullah, Loiband, and Muslim Bagh are the three tehsils that make up the district. The region is highly known for its farming, vegetables, and cattle, as well as its almond and apricot products, which are well known throughout the country (Figure 1).

Samples Collection

For this case study research design, quantitative approach has been used. The primary data was obtained through field survey with farmers in Qila Saifullah district. The study variables included farms and livestock losses due to flooding such has injuries and deaths of livestock and partial and complete damages to crops. The sample from the households was chosen randomly, and the sample size was calculated using Yamane's methodology. A sample size of 396 households was chosen from 10 union councils within three tehsils in Qila Saifullah District.

Statistical Analysis

Statistical Package for Social Sciences (SPSS) Version 22 and Microsoft Excel were used to analyze the data through descriptive statistics.

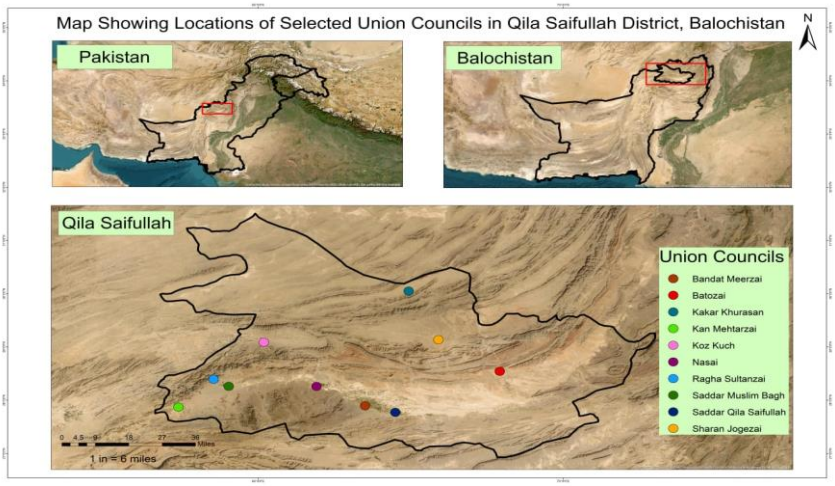

Figure 1. Study Area Map

RESULTS

Losses to Livestock in the Floods of 2022

Flooding is regarded as a serious natural hazard since it can cause damages to property and infrastructure, loss to livestock, and agriculture. Regarding losses to livestock, the majority of farmers reported losses to their livestock, with a loss of 1–20 animals per household, an un-usual amount of loss (Table 1). More than four-fifths (89.2%) of the respondents were small livestock farmers having less than 5 goats. However, a substantial portion of livestock farmers (98.5%) reported that there were fewer than 3 sheep and goat injuries. Majority of small livestock farmers (94.7%) with less than 3 goats reported deaths of their goats. Similarly, 92% of small livestock farmers with less than five (5) hens (poultry) reported poultry deaths. However, there were no losses of donkeys, cows, buffaloes, horses, and camels during the floods of 2022.

Table 1. Losses to Livestock in the Floods of 2022

Losses to Livestock	**Frequency**	**Percent**
Current Goats Population (numbers)		
< 5	356	89.2
5 – 14	35	8.8
15 – 24	4	1.0
25+	4	1.0
Goats Injuries (numbers)		
< 2	393	98.5
2 – 3	2	0.5
4+	4	1.0

Table 2. Continue		
Losses to Livestock	**Losses to Livestock**	**Losses to**
Goats Deaths (numbers)		
< 3	378	94.7
3 – 4	15	3.8
5 – 6	5	1.3
7+	1	0.3
Current Sheep's Population (numbers)		
< 5	391	98.0
5 – 9	6	1.5
15+	2	0.5
Sheep's Injuries (numbers)		
0	393	98.5
1	1	0.3
2	2	0.5
3	2	0.5
4	1	0.3
Sheep's Deaths (numbers)		
0	392	98.2
1	3	0.8
3	2	0.5
4	2	0.5
Current Cows Population (numbers)		
0	398	99.7
7	1	.3
Cows Injuries (numbers)		
0	398	99.7
5	1	0.3
Current Oxen Population (numbers)		
0	399	100.0
Current Hens Population (numbers)		
< 5	367	92.0
5 – 14	22	5.5
15 – 24	6	1.5
25+	4	1.0
Hens Deaths (Poultry) (numbers)		
< 5	369	92.5
5 – 9	21	5.3
10 – 14	7	1.8
15+	2	0.5
Source: Field Survey, 2022		

Losses to Agricultural Farms in Floods of 2022

The findings in this study showed that whole Qila Saifullah district was flooded, and the flash floods were caused by heavy rains that destroyed thousands of hectares of farmland. Dams were ruptured after severe floods. The maximum number of crops were five (5), 96.7% of the crops were fully damaged due to the flood. The farms having less than 20 trees were highly (73.9%) damaged. Similarly, the farms with less than 30 trees were highly (88.5%) damaged due to floods. The data showed that small farmers had great losses.

Table 3 Farm Losses in Floods of 2022

Numbers of Crops	Frequency	Percent
No crops	363	91.0
One crop	8	2.0
Two crops	11	2.8
Three crops	12	3.0
Four crops	4	1.0
Five crops	1	0.3
Damage to Crops		
0	394	98.7
One crop	2	0.5
Two crops	1	0.3
Three crops	2	0.5
Loss of Crops		
< 3	386	96.7
3 – 4	9	2.3
5 – 6	3	0.8
7+	1	0.3
Numbers of Trees Owned		
< 50	284	71.2
50 – 249	56	14.0
250 – 449	42	10.5
450+	17	4.3
Partial Damage to Trees		
< 30	353	88.5
30 – 79	13	3.3
80 – 129	24	6.0
130+	9	2.3
Complete Loss of Trees		
< 20	295	73.9
20 – 69	58	14.5
70 – 119	24	6.0
120+	22	5.5
Source: Field Survey, 2022		

DISCUSSION

The Balochistan floods of 2022 have harmed a million people across the province. In Qila Saifullah, five union councils were still flooded at the time of this study. Infrastructure was severely damaged, which led to a loss of dwellings and utilities including water, power, and sanitization (Shumilova *et al*., 2023). The findings showed that 96.7% of the crops were completely destroyed. Our analysis found significant infrastructure, economic, and residential damages, 92% of respondents said that backyard poultry was lost during the floods of 2022. An unprecedented disaster in Qila Saifullah occurred between June and August 2022 as a result of torrential downpours, flash flooding, and riverine, urban, and urban flooding. Numerous homes and important

infrastructure were destroyed, entire communities were submerged, and livelihoods were destroyed as a result of rain-induced floods, and consequent landslides (Ishaque *et al*., 2022).

Flooding is frequently considered a serious natural threat. One to twenty animals per family were lost, according to the majority of responders, and the research region saw a loss of the typical number of livestock per household (Abbas *et al*., 2022). Flash floods in 2022 brought on by prolonged rains have inundated the whole Qila Saifullah area and wiped off thousands of hectares of agriculture. Following significant flooding, dam ruptures were common, and more than four in five (96.7%) crops were completely destroyed. Although Pakistan contributes less than 1% of the world's greenhouse gas emissions, the 2022 floods have revealed the country's highest vulnerability to climate change (Dai *et al*., 2022). The poorest households in the poorest places have been disproportionately affected by the floods. The severely damaged regions were those whose human development outcomes were already the lowest before the floods. Pakistan is among the top ten countries in the world most affected by climate change. The country has observed changing weather patterns, such as variations in temperature and precipitation, an increase in tropical storm frequency and intensity, an increase in coastal rains, melting glaciers, flooding from glacial lakes, sea level rise, a decline in biodiversity, desertification, and droughts. The nation's rainy August since 1961 occurred in the summer of 2022 (Allan et al., 2020). The rainfall in the provinces of Sindh and Balochistan was extraordinary, exceeding usual monthly totals by six and seven times, respectively. The extent of the flooding was unprecedented, despite the fact that other factors other than climate change were the fundamental causes of the disaster impacts. According to attribution studies, the five-day highest rainfall, a gauge of extreme rainfall, in such two provinces was almost 75% more severe than it would have been if the climate hadn't warmed by 1.2°C (Ahmad *et al*., 2022).

CONCLUSION

Pakistan, like many other countries around the world, is concerned about the negative effects of climate change. This study revealed the devastating impacts of climate change induced flooding. Pakistan experiences regular floods as a result of the country's intense monsoon rains. An unprecedented flooding in 2022 in Qila Saifullah district of Balochistan province caused huge losses to agriculture and livestock sectors and consequently devastated the livelihoods of millions of people. Small farmers were highly affected by the floods. Recovery of the populace to pre-flood conditions has been extremely important, however, with little progress. The flood of 2022 has shown areas where the nation's catastrophe risk reduction system needs additional investment in programs for emergency planning, response, and recovery.

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REFERENCES

Abbas, Q., Han, J., Bakhsh, K., Ullah, R., Kousar, R., Adeel, A., et al. (2022). Adaptation to climate change risks among dairy farmers in Punjab, Pakistan. *J Land use policy, 119*, 106184.

Ahmad, I., Wang, L., Ali, F., & Zhang, F. J. S. (2022). Spatiotemporal Patterns of Extreme Precipitation Events over Jhelum River Basin. *14*(23), 15558.

Allan, R. P., Barlow, M., Byrne, M. P., Cherchi, A., Douville, H., Fowler, H. J., et al. (2020). Advances in understanding large-scale responses of the water cycle to climate change. *1472*(1), 49-75.

Baloch, Z. A., Tan, Q., Kamran, H. W., Nawaz, M. A., Albashar, G., & Hameed, J. (2021). A multi-perspective assessment approach of renewable energy production: policy perspective analysis. *J Environment, Development Sustainability*, 1-29.

Dai, H., Mamkhezri, J., Arshed, N., Javaid, A., Salem, S., & Khan, Y. A. J. S. (2022). Role of energy mix in determining climate change vulnerability in G7 countries. *14*(4), 2161.

Gössling, S., Scott, D., & Hall, C. M. (2020). Pandemics, tourism and global change: a rapid assessment of COVID-19. *J Journal of sustainable tourism, 29*(1), 1-20.

Ishaque, W., Tanvir, R., Mukhtar, M. J. J. o. E., & Health, P. (2022). Climate Change and Water Crises in Pakistan: Implications on Water Quality and Health Risks. *2022*.

Kale, V. S. (2014). Is flooding in S outh A sia getting worse and more frequent? *J Singapore Journal of Tropical Geography, 35*(2), 161-178.

Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C.-Y., & Leiserowitz, A. A. (2015). Predictors of public climate change awareness and risk perception around the world. *J Nature climate change, 5*(11), 1014-1020.

Manzoor, Z., Ehsan, M., Khan, M. B., Manzoor, A., Akhter, M. M., Sohail, M. T., et al. (2022). Floods and flood management and its socio-economic impact on Pakistan: A review of the empirical literature. *J Frontiers in Environmental Science, 10*, 2480.

Mirza, M. M. Q. (2011). Climate change, flooding in South Asia and implications. *J Regional environmental change, 11*(Suppl 1), 95-107.