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FLOOD 2022: AN INSIGHT INTO DAMAGES TO AGRICULTURE AND LIVESTOCK IN DISTRICT DERA ISMAIL KHAN, KP, PAKISTAN

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ABSTRACT

Dera Ismail Khan, a southern district of Khyber Pakhtunkhwa province was massively affected by the massive floods of July and August 2022. These unprecedented floods not only threatened human lives at a national scale but also caused unprecedented damage to livestock, agriculture, forests, and wildlife, while the destruction of infrastructure is incalculable. These floods resulted in total crop loss in most the cases and death of animal herds. The fluctuations in monsoon patterns due to erratic climate changes additionally alarm the future scenarios of peak pest infestations and heat stress. Some crops i.e., cotton (quantity and quality) were partially affected but sugar cane, rice, and other types of seeds have opted. Inaccessibility, lack of awareness, expertise, and baseline information of the natural resources-livelihood nexus. No organization has considered the damage caused to natural forests, wildlife, rangelands, and aquatic flora and fauna. The floods have directly devastated natural resources and the environment in several ways i.e., flushing out the forests, carnage of wildlife, and the destruction of native aquatic fauna. The post-flood scenarios are the spread of exotic flora and fauna, the spreading of epidemic diseases, and the destruction of habitats. Eventually, natural resources must bear the brunt of the damage caused by the flood in one form or another which ranges from extracting timber, firewood, and fodder to earning a livelihood from forest sales. The farming community of D.I. Khan has been gravely affected by the flood, not only deteriorating cropping patterns but negatively impacting the agriculture-based market economy.

Keywords: Agriculture, Flood, Livestock, Mortality, Economic losses, Pakistan.

INTRODUCTION

Just west of the Indus River is the town of Dera Ismail Khan in Pakistan's Khyber Pakhtunkhwa province. The town is named after Ismail Khan, the Baloch chief who founded it in the fifteenth century. In 1823, the Indus River washed away the former town, which was located 6 kilometers (4 miles) east. Durrani chiefs designed the new town, which became a municipality in 1867. A bridge over the Indus connects Darya Khan (12 miles [19 km] east) and Dera Ismail Khan, two significant transportation hubs. The main hand-made products include lacquered woodwork, glasswork, mat and ivorywork, and lungis (sarongs); the industry also includes textile, sugar, flour, oil, and rice mills, as well as soap manufacturers. The main crops grown nearby are sugarcane, wheat, rice,cotton, pulses, berseem, maize, sorghum, and millet. Among the livestock goat, buffalo and cattle are raised on large scale, while donkeys, sheep, and camels are also raised widely. Tribes from the Baloch and Pashtun regions reside in this area. A hospital, two parks, four large bazaars, two Universities, and several colleges affiliated withthe University of Peshawar are among the amenities in Dera Ismail Khan.

Overview

River floods can be caused by changing atmospheric processes such as monsoon rain, extratropical frontal systems, a high temperature that convert the ice into water, and landfalling hurricanes (Blöschl et al., 2017; Smith et al., 2018; Tarasova et al., 2019). The hydrological cycle has become more complex because of global warming and climate change, resulting in greater unpredictability in water reservoirs around the world (Westra et al., 2014; Wehner et al., 2021; Inam et al., 2022). Asia's burgeoning population growth has an immediate impact on water, food, and energy. Global warming, climate change, population growth, floods, and droughts all have an immediate impact on the water resources management system. The dam is an important water resource manage-ment structure that serves several functions, including irrigation system stability, power generation, and water distribution

for community development (Donnelly et al., 2017; Wang et al., 2019; Ishfaque et al., 2022).

Pakistan has been soaked by dangerous monsoon rains since mid-June 2022, consequential in the worst flooding in several areas of Pakistan but the rains that fell from June to August had a devastating effect on the Dera Ismail Khan, KPK, Pakistan. Pakistan's DI Khan District is situated about 390 kilometers south of Islamabad. There are 5 tehsils in the district of DI Khan, including DI Khan, which is believed to have a population of over 2 million (Wazir & Goujon, 2019). In Khyber Pakhtunkhwa, which is in the southwest and borders Afghanistan, monsoon rains began in July and August of 2022, causing flash floods that destroyed numerous villages in the D.I. Khan District. Roadways in and around the impacted areas have been completely devastated by floodwater, which limits overland transit during a flood.The main Indus highway connecting DIKhan with South Punjab & Sindh, Draban road connecting the area to Baluchistan, and Bannu road connecting the area to the Southern Districtof Khyber Pakhtunkhwa are among the severely damaged Indus highways. Chashma road connects DI Khan to North Punjab (including Islamabad).

Rainfall is 2.87 times higher than the 30-year average across the country, with some provinces receiving more than five times as much as the 30-year average. This rain causes severe economic losses as affects humans, animals, crops, infrastructure, and property (Nandargi et al., 2010; Adhikari et al., 2015; Wilhelm et al., 2019; Zarekarizi et al., 2020; Ahmad & Afzal, 2022). According to the DI Khan division disaster management authority, 44,869 homes have been damaged, with 18,971 partially damaged and 25,898 destroyed. Several people have been injured and many have died due to the devastating effects of the flood and landslides which continue in D.I. Khan. The infrastructure of division KPK has been damaged due to high water flow and approximately 1,380 houses in Tank, 24,503houses in the Dera district, and 15 houses in South Waziristan have been damaged. It has beenreported that the district tank is highly affected, and more deaths have been reported. The list of DIKhan areas that were found highly affected byflood 2022 and a comparison scenario with the previous year's water influx is shown in figure 1 while table 1 shows the list of tehsils and villages of the Province, KPK, Pakistan. Population density, Area, and councils of DI Khan are given in table 2.

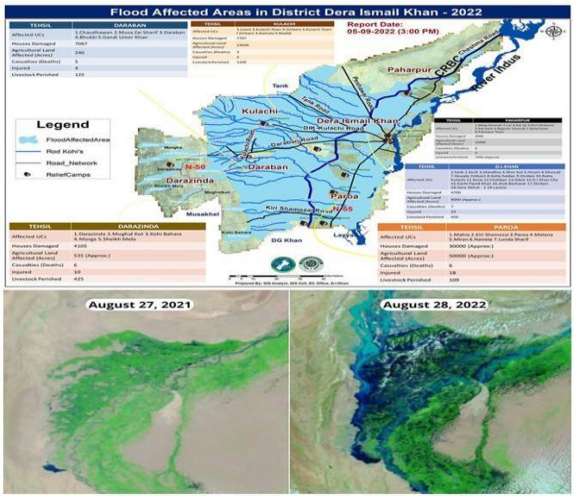

Figure 1: **Picture showing flood density in Dera Ismail Khan, Pakistan 2022.**

Table 1: **List of tehsils and villages visited**

Tehsils	Villages
Dera Ismail Khan	Shorkot, Ratta Kulachi, Ketch
Paharpur	Bandkorai, Dhap shumali, Lar
Parova	Parova, Sipra, Naiwela
Kulachi	Hathala, Gara Mohabat, Kotwali Dad
Daraban	Daraban, Garah Sheikh, Gandi Umer Kham

Table 2: **Population density, Area, and councils of D.I.Khan**

Tehsils	4
Population (Pakistan Census, 2017)	16,27,132 inhabitants
Population density	116.4/km2 (301.6/sq mi)
Area	7326 Km2 (2828.58 sq mi)
Language	Pashto, Saraiki
Village councils	150
Neighborhood councils	36

Flood Disaster in Pakistan and Responses from different societies

Situation overview: The Government of Pakistan has officially declared 66 districts as "calamityhit" 23 in Sindh, 31 in Baluchistan, 09 in Khyber Pakhtunkhwa (KPK), and 03 in Punjab. The situation is changing day by day due to the fluctuation of water flow in the rivers of the country. The cost of flood damage in Pakistan has been estimated at $30 billion, and the country's annual economic growth for this fiscal year has been reduced from 5% to 1.6%.

Pakistan Red Crescent Society (PRCS) Response: With the assistance of DREF, PRCS has been responding to the flood disaster in Balochistan and

Khyber Pakhtunkhwa (CHF 481, 058). Aside from the deployment of 6 mobile water treatment plants, NFI (hygiene kit, jerrycan, and mosquito net) and cash assistance (16,000 PKR-73.5 CHF) are being provided to 1,100 families in Balochistan, 400 in Sindh, 400 in Punjab, and 1,100 in KPK. In addition, the IFRC intends to launch an Emergency Appeal in the coming days.

Turkish Red Crescent Society (TRCS) Response Plan: TRCS, in collaboration with PRCS, has assisted 300 families in Jafferabad, Balochistan, with cash assistance (16,000 PKR - 73.5 CHF) and NFI (300 hygiene kits, 600 jerrycans, and 1,500 mosquito nets). Furthermore, 100 tents (16m^2) and 1,000 blankets have been sent by air cargo by Turkey's Ministry of Interior, Disaster and Emergency Management Presidency on 28 August 2022, to alleviate the suffering of flood victims. Additionally, free medical camps were being planned to assist in the diagnosis and treatment of approximately 6,000 people.

Social consequences of floods for local communties: Floods have a variety of immediate consequences, such as death, property damage, crop destruction, livestock loss, and deterioration of health. Some economic activities may halt, people may have to flee their homes as shown in figure 2, and normal life may be disrupted when communication links and infrastructure such as power plants, roads, bridges, and canals are damaged or destroyed as shown in figure 3.

Figure 2: **Destruction of homes & Infrastructure due to flood in D.I.Khan**

Figure 3: Structural damage of flood to roads, bridges, and canal breaches in Dera Ismail Khan

In the same way, disruptions in the industry can cause livelihoods to be lost. It is also important to note that infrastructure damage has long-term consequences, such as disruptions in water supply, wastewater treatment, electricity, transportation, communication, education, and health care. Floodplain communities can become economically vulnerable as livelihoods are lost, purchasing power is reduced, and land value is reduced. In addition to traumatizing victims and their families, floods can also cause long-term effects on them. It is especially difficult for children to cope with the loss of a loved one. People can experience stress even after they have been dis- placed from their homes, lost property, and had their business or social lives disrupted. Psycho- logical impacts can last a lifetime for some people.

Effects of flood on agricultural productivity: Floods are natural occurrences that result in a temporary water cover of land. Flooding has long been a problem for the people of Pakistan. Floods play an important role in many natural systems in maintaining key ecosystem functions and biodiversity. They connect the river to the land around it, recharge groundwater systems, fill wetlands, increased connectivity between aquatic habitats, and move sediment and nutrients across the landscape and into the marine environment (Leibowitz et al., 2018). Floods cause breeding, migration, and dispersal in many species. Except for the most severe floods, these natural systems are resilient to their effects. Flooding's environmental benefits can also benefit the economy by increasing fish production, replenishing groundwater resources, and preserving recreational areas (Bunn & Arthington, 2002; Douglas et al., 2005). Area affected due to flood in 2022 is given in table 3 while the list of crops affected due toflood is given in table 4 and figure 4.

Table 3: **Agriculture land or area affected due to flood. (Sources: Crop Reporting Services office, D.I. Khan)**

Parameters	Area in hectares	Area reported by the DC office	Area reported by communities	Average area affected
Cultivated Area	2,46,806	-	-	-
Uncultivated Area	4,83,774	-	80,000	-
Cropped area	147,605	36,000	75,000	55,000
Reported area / Agriculture Land	7,30,575	-	-	-

Table 4: **List of crops affected due to flood. (Source: District Director Agri Extension, D.I.Khan)**

Tehsil	Rice	Sugarcane	Mungbean	Cotton	Vegetables	Sesame
DI Khan	+	+	+	_	+	+
Kulachi	+	+	_	_	_	_
Parova	+	+	+	+	+	+
Daraban	_	_	+	+	_	_
Paharpur	+	+	+	+	+	+

Note: + = effected and - = not effected

Figure 4: **Destruction of maize crop in DI Khan.**

Floods, which are common extreme weather events around the world, are caused by the hete- rogeneity that characterizes the intensity, loca- tion, and rain period. Floods affect many econo- mic sectors, with agriculture being one of themost vulnerable because agricultural activities are directly dependent on climatic factors. This is significant for Europe because agricultural land accounts for nearly half of its total land area.Perpia et al. (2018) and Rana et al. (2022) repor- ted that agriculture faces a critical challenge: ada-ptation. Several vegetables and fruit orchards have suffered due to an overflow of water coming from higher areas to lower areas which ultimately caused serious economic losses. Due to high humidity and precipitation, higher fungal isolates occurred which attack the animals and crops such as rice, maize, wheat, sugarcane, etc. (Rana et al., 2022). It has been reported by Proskura & Tkach- enko (2013) that in the Irkutsk region in 2009, floods caused massive damage to potato crops which reduce 90% of yield (SÎLI et al., 2020). It causes famine in that area and becomes lethal for human and animal consumption as shown in figure 5.

Figure 5: **Animals without shelter and food due to heavy flood in DI Khan.**

Flooding in key agricultural production areas can cause widespread crop and fencing damage, as well as livestock losses (Table 5, 6). Crop losses due to rain damage, waterlogged soils, and harv- esting delays are exacerbated by transportation issues caused by flooded roads and damaged inf- rastructure. Tehsils-wise agriculture production losses due to flood 2022 are given in table 6 and crop-wise losses are shown in figure 6**.** As food prices rise due to supply shortages, the spillover effects of reduced agricultural production can often be felt far beyond the production area. Flood events, on the other hand, can benefit agri- cultural production in the long run by replenish- ing water resource storage, particularly in drier inland areas, and by rejuvenating soil fertility through silt deposition (Abua et al., 2009; Memon et al., 2015; Shamsudduha et al., 2022).

Table 5: **Direct and indirect losses caused due to flood 2022. (Source: Field observation & District Administration)**

Direct losses	**Indirect losses**
Buildings and contents	Disruption to living
Vehicles, infrastructure	Loss of community
Livestock, Agriculture	Shortage of fodder, shelter, and disease. Water shortage in safe areas due to damage to canals
Lives and injuries	Shortage of food and winter clothes
Loss of memorabilia	Ecosystem resource loss
Damage to cultural or heritage sites	Stress and anxiety
Ecological damage	Loss of cultural and environmental sites,

Table 6: Tehsils-wise agriculture production losses due to flood 2022 (Source: District Director Agri Extension, D.I.Khan)

Tehsil	**Crop**	**Total Area under cultivation**	**Damage (%age)**	**Damage area**	**Average Yield/Acres (Mounds)**	**Production Loss (Tones)**	**Market Rate/ Mound**	**Loss in Million**
D.I.Khan	Rice	11,500	10	1150	40	46	1400	64.40
	Seasame	27	15	4.08	10	0.04	6,000	0.240
	Mungbean	355	20	71	6	0.43	4,000	1.70

	Sugarcane	45,546	20	9109	800	7287	220	1603.2
Parova	Rice	15,037	30	4511	40	180.44	1400	252.6
	Seasame	750	50	375	10	3.75	6000	22.5
	Sugarcane	79,088	30	23726	800	18981	220	4175.7
	Mungbean	1482	80	1185	6	7.11	4000	28.45
	Cotton	1250	50	625	22	1375	6000	82.5
Paharpur	Rice	5090	30	1527	40	61.08	1400	85.51
	Seasame	400	20	80	10	0.80	6000	4.80
	Cotton	650	15	97.5	22	2.15	6000	12.87
	Sugarcane	22640	15	3396	800	2716.8	220	597.7
	Mungbean	1642	30	492.6	6	2.96	4000	11.82
Daraban	Mungbean	30	50	15	6	0.09	4000	0.36
Kulachi	Sugarcane	2500	15	375	800	300	220	66.00
	Rice	377	10	37.70	40	1.51	1400	2.11

*Area is given in hectares (ha).

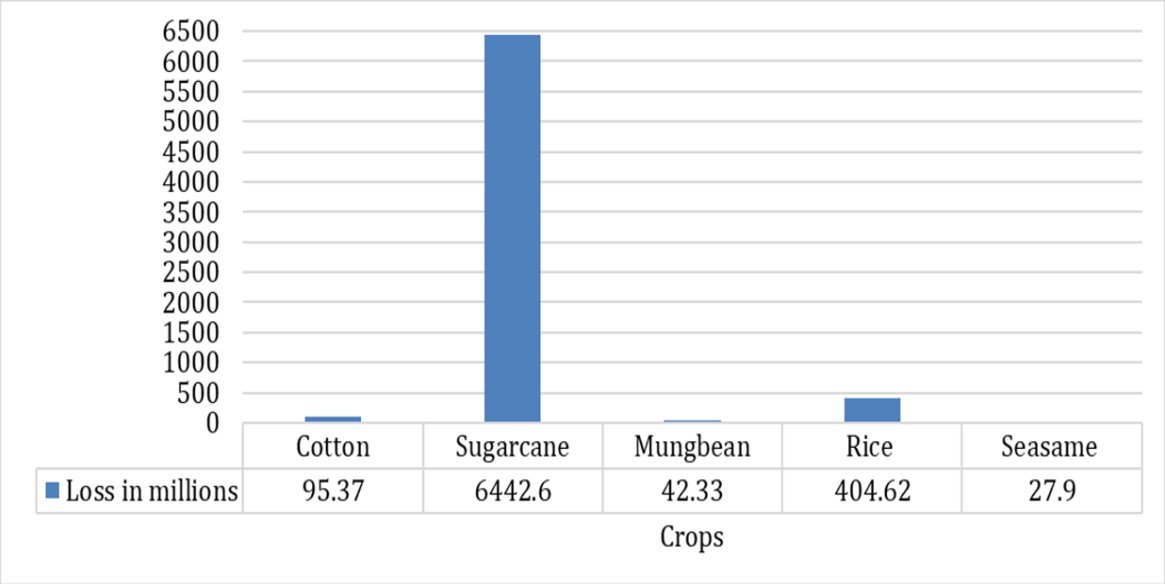

Figure 6: The estimated crop-wise economic loss in millions.

Flood effect on Livestock: D.I. Khan, District Livestock and Dairy Development Officer reported that 14,587 domesticated animals died from floods while the remaining animals are suffering from a lack of feed and fodder. Additionally, a significant quantity of feed and fodder have been lost because of the flood, which is a major issue for animals' health as well as the production of milk, butter, and yogurt from these animals. Additionally, animals have been infected with different viral diseases after the flood as shown in figure 7. The assessment of livestock losses has given in table 7.

Figure 7. Large and small ruminants dead due to floods.

Table 7: Assessment of livestock losses in DI Khan (Source: District Director Livestock, D.I.Khan).

S. No.	Type	Number Lost	Local Market Value (Rs.)	Total (Rs. In Million)
1	Cows / Cattle	877	100,000	87.70
2	Buffaloe	450	200,000	90.00
3	Sheep	3500	25,000	87.50
4	Goat	2700	30,000	81.00
5	Poultry Birds	4000	800	3.20
	Total	**11,527/-**	**-**	**349.40**

Heavy loss of domesticated animals occurred due to the heavy flow of water in flood form and dead animals flowing in water is shown in figure 8. Dead camels are also found in mountains due to the heavy flow of water as shown in figure 9 to protect their lives, people migrate with their animals from infected areas to others as shown in figure 10.

Figure 8. A indicates the heavy loss of domesticated animals while B indicates the dead animals flowing in heavy flood flow in DI Khan.

Figure 9. Dead camel found in mountain due during migration in floods in DI Khan.

Figure 10. Migration of people with animals to protect their lives and animals

Conclusion

Due to high vulnerability and exposure, floods have become more frequent in South Asia. The flood in Pakistan in August 2022 provides apeek at the size and destruction that could incre-ase because of global warming. Inhabitants of districts Dera Ismail Khan mainly rely on live-stock rearing and agriculture for their liveli-hoods. Over the past few years, Pakistan has experienced flooding and flash floods. As a result, crops, households, seeds, livestock, food grains, and infrastructure have been damaged. Local humanitarian workers and public health specialists have expressed concern about an inc-rease in numerous waterborne, mosquito-borne diseases, and skin infections because of the flooding that has submerged a third of Pakistan and affected more than 33 million people. We investigated the reasons behind the severe loss of life and property caused by flooding in Pakistan's downstream areas of the Indus basin. Between August 16 and 24, Pakistan's KPK,

Baluchistan, and Sindh provinces saw an exceptional precipitation event that caused the flood-affected area to experience these conditions. The 2022 flood in Pakistan was mostly caused by unusually heavy rains.

Authors' Contribution

All authors have equally contributed in this manuscript.

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