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Socio Economic Impacts Of Floods: A Case Study Of Khyber Pakhtoonkhwa From 2010 To 2022

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ABSTRACT

Climate Change appears to jolt the global political and socio economic dynamics at an unprecedented rate. The discourse initiating by the end of twentieth century with plausible climatic, hydrological and habitational transformations internationally, henceforth, dominate the academic, diplomatic, security and economic rhetoric with wide ranging hazards. Even though Pakistan was one of the ten most susceptible nations, the terrible floods of 2022 solidified its place as the victim of the world's indifference to the problem. One third of the nation was submerged in flood in 2022, and the terrible floods of 2010 destroyed a fifth of the country, costing around USD 10 billion, which worsened to USD 30 billion. Pakistan is water rich but simultaneously water scarce country, already facing water security and concomitant food security crises. The situation is compounded manifolds by the Climate Change in all provinces of the country at varied scales. However, Khyber Pakhtunkhwa, the north western province has sufficient hydrological resources but the inadequate water management has complicated the problems as in the rest of the country. The phenomenon of massive flooding has increased in intensity, scale and volume due to inadaptability to Climate Restoration. Urban flooding is another [3]and major impact of flood devastations implicating national socio economic patterns. During the floods of 2010 and 2022, the districts of Swat, Nowshehra and Dera Ismail Khan in this province suffered mass flooding. The devastation of agriculture, industries, urban and rural infrastructure and climate induced migrations cause a myriad of economic and social problems implicating national fabric. This study is aimed at understanding the hydrological dynamics of KPK province from the social and economic perspectives. The research focuses on developing Climate Restoration Adaptation Framework for KPK by analyzing the US and Chinese models of mitigating floods.

INTRODUCTION

Climate Change has manifested devastating implications with the advent of the 21st century which is augmenting with every passing decade. The 20th century has been a landmark in human history as it achieved unprecedented industrial and technological development at an unanticipated pace. The intellectual development and pursuit introduced the world to

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globalized interdependence. The effects of complex interdependence were articulated globally with the introduction of the neo-liberal economy in the latter part of the 20th century. The triumph of Western Capitalism over Communism created a powerful, rich, economically and technologically advanced "core", and the more dependent, developing, and the underdeveloped, financially and technologically "peripheries". As the pattern of resources and wealth flight from colonies to imperialist powers dominated from the sixteenth to the twentieth century the shift of wealth continues till date from the Global South to the Global North, according to an estimate the North earns USD 2.3 trillion annually from the underdeveloped and poor Global South. If initiatives for social improvement and economic progress do not incorporate environmental sustainability, development will remain an unattainable goal (Zafarullah & Huque, 2018).

In 2022, the world has hit another milestone, of 8 billion of population which was certainly not sought after. Yet it is another wake up call for already overburdened and exhausted planet. In 1917, the global population was 2 billion which swelled to 7 billion in 2021. The population growth has posed unprecedented challenges to the humanity. Due to a lack of infrastructure, resources, and coping strategies, the Global South's developing nations are the most severely impacted (Wu et al., 2021) (Zhao et al., 2021). According to the recent scientific reports, the frequency and intensity of natural disasters has increased exponentially in the last few decades. The case of Pakistan exemplifies the gravity of the situation as it has been one of the worst affected countries by the climate change induced disasters. Even while Pakistan contributes less than 1% of the world's greenhouse gas emissions, its location and dry climate make it very sensitive; It is listed among the top 10 most afflicted nations. The per capita consumption of resources is so low that with this standard of living it would take a population of 16 billion to exceed Earth's carrying capacity. Anatol Lieven, in his thesis "Pakistan: A Hard Country" establishes that the threat climate change poses to Pakistan is biggest than any other social, political, economic or ethnic conflict, as it complicates, augments, and intensifies existing challenges across these domains (Lieven, 2011).

Climate change's varying impact on the global south and global north is due in part to development and institutional gaps. Extreme weather events are one of the most severe consequences of climate change, which Pakistan is now experiencing. The floods of 2010 and 2022 in Pakistan manifests this reality. In the broader South Asian context, Ilhan Niaz considers Climate Change as biggest regional stability challenge. Both Pakistan and India are highly vulnerable to its impacts. However, GDPs are calculated without factoring real environmental cost (Niaz, 2022). This oversight underscores the limitations of traditional economic metrics in addressing environmental realities. In a nutshell it would not be an exaggeration to aver that the repercussions of Climate Change complicate, augment and enhance a myriad of social, economic, political and class conflicts. The concepts of security and national security revolved around the traditional defense further augmented by nuclear security. However, as the neo liberal economic development and globalization unleashed a myriad of security and conflict issues, environment, water, energy and food elevated to get attention and intellectual consideration under the umbrella of security. As Niaz notes, the world has reached a juncture where "Anthropocene Geopolitics" has emerged, reflecting the profound and far-reaching consequences of human activities on geopolitical and environmental landscapes (Niaz, 2022).

This study is aimed at getting insight into the socioeconomic impacts of the floods of 2010 and 2022 in the province of Khyber Pakhtunkhwa. The province was already hit by terrorism, counter terrorism operations, internally displaced persons (IDPs), which is compounded by floods devastation.

LITERATURE REVIEW:

CLIMATE CHANGE AND IMPACTS FOR PAKISTAN

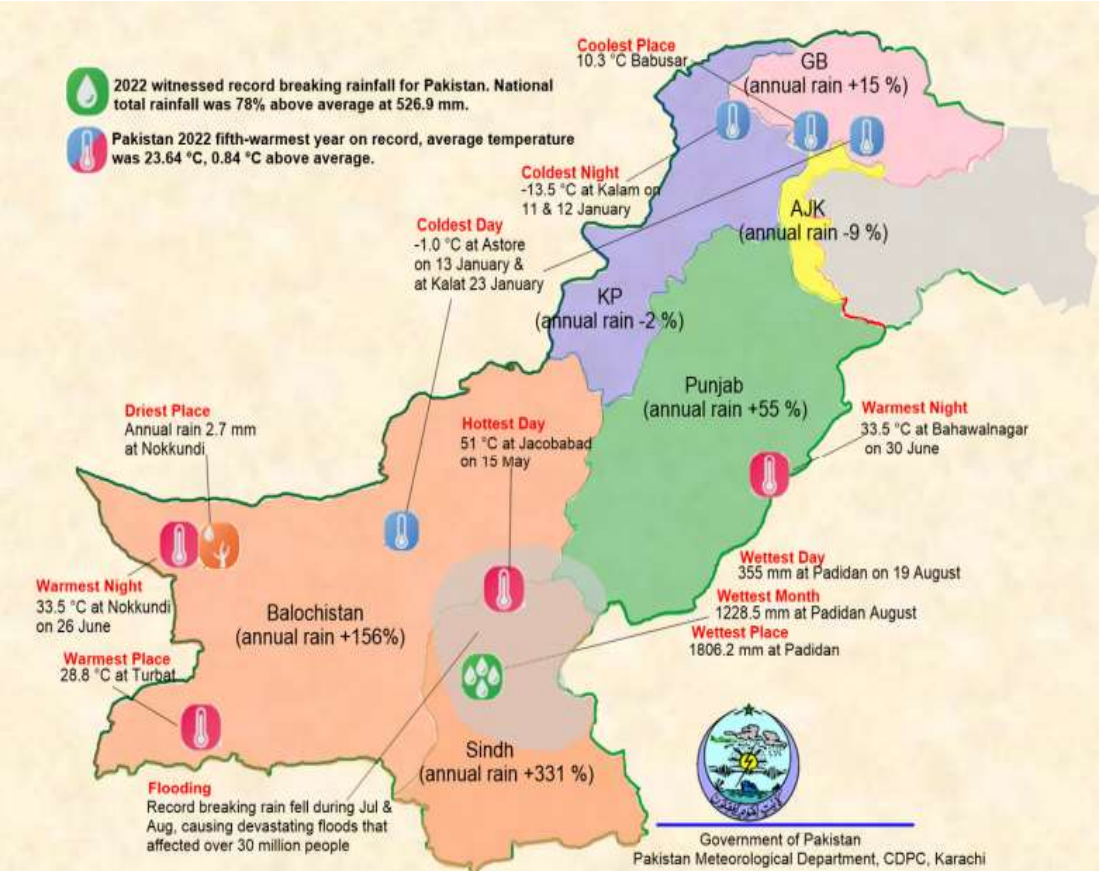

Figure 1: Important Climate Events in Pakistan, Source; (Government of State of Pakistan Climate in 2022, n.d.)

Pakistan faces severe challenges from climate change, including extreme weather events and devastating floods (Baron et al., 2022). Projections indicate that these impacts could reduce the country's GDP by 18-20% by 2050, highlighting the urgent need for effective mitigation strategies. Although Pakistan contributes less than 1% to global emissions, addressing climate change remains critical for tackling local crises such as air pollution and smog, which threaten both livelihoods and public health. (D. Barón & Asad, 2023). The repercussions of climate change are already being seen throughout Pakistan. A study found that temperatures in the country increased by 0.6°C between 1960 and 2018 (Janjua et al., 2021). This temperature unpredictability has serious consequences, with estimates indicating that Pakistan may face up to $19.5 billion in climate change costs from lower wheat and rice output by 2050 (Janjua et al., 2021). This has disastrous effects, as the agriculture industry employs more than 40% of the workforce and makes major contributions to the national economy.

Extreme weather events have also caused extensive damage in recent years. Over the previous decade, natural catastrophes have affected more than 80% of Pakistan's 124 districts and 33 million people, costing an estimated $17.1 billion in economic damages. The August 2022 floods, considered the worst in Pakistan's history, were primarily driven by extreme

precipitation events exacerbated by climate change. Proper identification of the prominent flood drivers and estimation of their future probability is crucial for building resilience (Nanditha et al., 2023). Pakistan's vulnerability to climate change is further compounded by its low adaptive capacity and limited resources to address the challenges. Despite contributing negligibly to global emissions, the country's placement among the most climate-affected nations in the global climate risk index rent inequities in the global response to this crisis

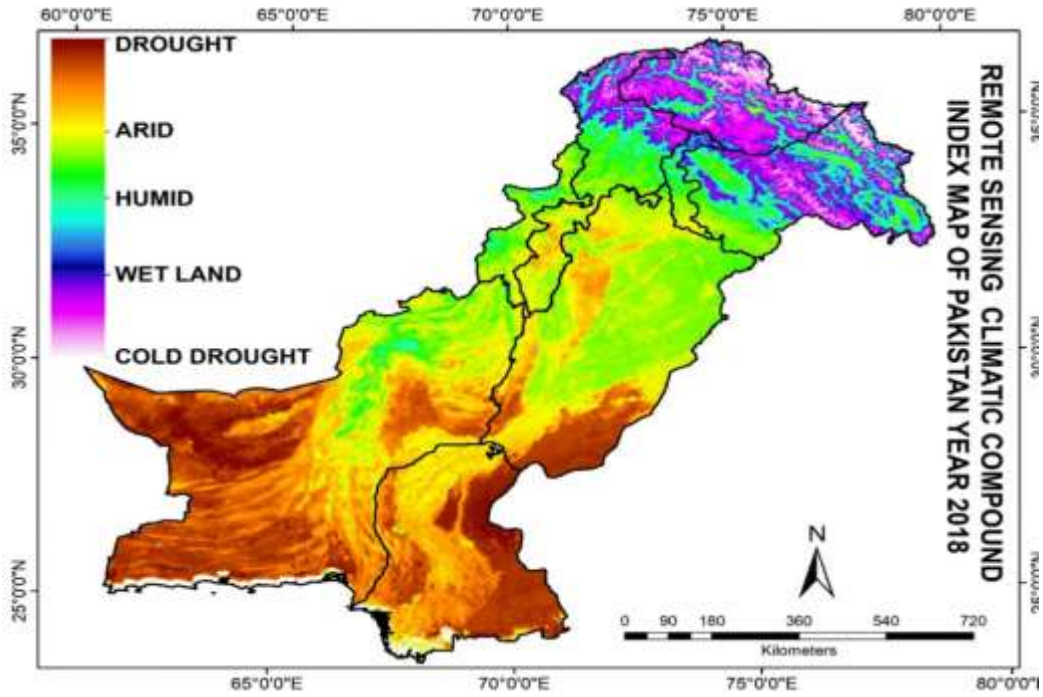

Figure 2: Climate Classification of Pakistan, Source: (Javid et al., 2019)

According to the Intergovernmental Panel on Climate Change's Fifth Assessment Report for Asian Region nations, the vulnerability to climate change threats to agriculture-dependent economies, such as Pakistan, stems from geography, demographics, a lack of adaptation, and insufficient infrastructure. The AR % particularly states the threats for South Asia are precipitation, global warming induced temperature mean and pattern of monsoon rainfall and glacial melts, all change resultantly (Chaudhry, 2017). Pakistan had been working on Climate Change since the start of 21st Century. Pakistan sent the United Nations a National Communication on Climate Change in 2003. It has since received assistance from the United Nations Development Program and the United Nations Environment Programme. Following the Conference of Parties (COP 14), Pakistan had been employing Nationally Appropriate Mitigation Action to guide emissions below "business as usual" by 2020. Since then, there is continuation of NAMA. Before Conference of Parties at Paris (COP 21) 2015, Pakistan submitted Intended Nationally Determined Contribution to global mitigation efforts, updated in 2016. INDCs describe the post-2020 Climate Actions that nations aim to take under the Paris Agreement to prevent global temperature rise to 1.5 to 2 degrees Celsius. Pakistan approved the Paris Agreement in 2016. Pakistan wants to lower 20% of its expected Greenhouse Gas Emissions by 2030, which are predicted to be 1,603 million tonnes of CO2 equivalent, subject to the availability of International Grants to fulfil the target of USD 40 billion (Chaudhry, 2017). According to Pakistan Meteorological Department from 1950 to 2000, Pakistan's annual mean surface temperature increased overall. In the hyper arid plains, arid coastal areas

and mountain ranges 0.6 to 1.0 degree Celsius increase was estimated while in central Pakistan 0.9 degree Celsius increase was noted (Farooqi et al., 2005). Pakistan's projected average of temperature increase was estimated to be higher than the world and expected increase in higher parts was more than the lower parts. Water availability has been projected to decrease at an alarming rate while the wheat and rice crops' yield projection also indicated decrease. The rainfall pattern was projected that it would increase in Upper Indus Plain while decrease in Lower Indus Plain (Ahmed & Suphachalasai, 2014). Since 2000, 14 out of 21 extreme climate related events have taken plae in Pakistan (Nanditha et al., 2023)

Figure 3: Pakistan Average Rainfall (2013-2022), Source: (World Bank Open Data, 2022)

Climate Change and Water Scarcity: Compounded Crisis

The causes of water crisis in Pakistan are mainly wastage of water, limited water supply, outdated irrigation systems, reducing storage capacity of reservoirs, Climate Change, population growth and drying rivers (Akbar et al., 2021). The amount of freshwater has been constant in last 100 years but the problem was of the unbalanced availability and access issues. About 80% of Pakistan's population is already facing grave water shortage during at least one month in a year. This is a grave situation as main sector relying on water is agriculture which is a contributor of 23% to GDP and producing 42% of jobs. In 1947, the per capita water availability was 5229 cubic meters which has reduced to 1187 cubic meters in 2017. In major cities, surface and drinking water is in dreadful condition as it is contaminated and 80% pf country's population is getting contaminated water (Ishaque et al., 2022). Pakistan accounts for 2.8% of the world's population and 0.5% of its renewable water resources. Pakistan is ranked 36th in the world in terms of renewable water resources, followed by India at eighth and Bangladesh at twelve. Pakistan ranks 160th in terms of water extraction to water resource ratio. The most stressed part is the groundwater resource of Indus River Basin as 60% of irrigation, 70% drinking requirements and 100% industrial usage depend on it. Pakistan only recycles 1% of wastewater. Between 1972 and 2020 population increased 2.6 times. Over 80% of country's water resources are utilized by four major crops. Pakistan saves only 9% of Indus water while rest of the world's average is 40%. From the Indus Water River 143 BCM only 55 BCM is used by farming sector but 61% or 87 BCM is wasted to canals, distributaries, minors and water courses (Maqbool, 2022).

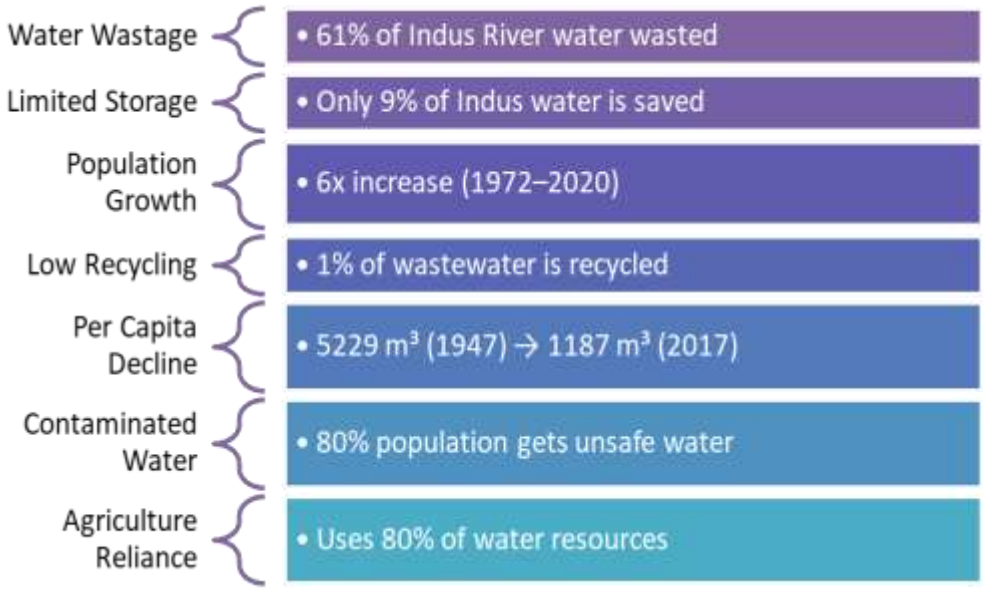

Figure 4: Water Crises in Pakistan: Causes and Statistics

Pakistan's water scarcity situation, with serious socioeconomic consequences. Floods have destroyed infrastructure, including water delivery systems and irrigation networks, limiting access to clean water and reducing agricultural production (Kakar et al., 2018). The floods had devastating effects on the local inhabitants. Displacement, loss of livelihoods, and the spread of waterborne diseases have aggravated an already terrible situation (Tariq et al., 2020). The floods have also had a substantial impact on the region's economy, causing damage to industry, enterprises, and agriculture. The floods have also disproportionately affected the most vulnerable communities, including the poor and marginalized. These communities frequently lack the means and resilience to deal with the consequences of natural calamities, and the floods have further exacerbated already existing inequities.

The combination of water scarcity and climate change-induced calamities, such as the recent floods in Khyber Pakhtoonkhwa, has exacerbated the region's socioeconomic well-being. To alleviate the severe impacts on Khyber Pakhtoonkhwa's population, immediate action is required to address the core causes of water scarcity, enhance water management practices, and build resilience to climate-related calamities.

FLOODS OF 2010 AND 2022 AND WATER MISMANAGEMENT:

Floods are a regular feature of river basins casing immediate losses but in the long run a vital source of maintain the hydrology of basins. In Pakistan, the flood protection, planning and works were under the purview of provinces until 1976. In 1973 and 1976 provinces could not manage their flood devastation so in 1977 Federal Flood Commission was established. It issued three flood protection plans: National Flood Protection Plan I (1978-1988), National Flood Protection Plan II (1988-1998), and National Flood Protection Plan III (1998-2008). From inception to 2010, Pakistan sustained a total loss of USD 30 billion, with 8,887 persons killed and 109,822 communities severely devastated by floods. The primary causes of floods in Pakistan are strong concentrated rainfall in river catchment areas, which is occasionally supplemented by snow melt, which occurs every year. The losses are primarily suffered when regions along river banks are inundated, causing damage to irrigation and communication systems across or close to rivers. Along the river banks hen soil is eroded it also leads to overflowing of water. In upper parts of Indus River banks water inundating areas flows back to rivers. In lower parts of Indus Plain it flows at higher elevations than adjoining areas and

water does not flow back to river. Embankments are when broken along causes heavy water losses. The current discharge capacity of certain significant infrastructure, including as barrages and rail and road bridges, on the Chenab, Indus, and Ravi rivers is insufficient, which is a major cause of floods. This creates significant structural issues as well. The unplanned settlements of villages encroaching upon riverine areas cause huge losses of life, agriculture and settlements. This happens when there is no proper regulatory framework regarding riverine areas. Another phenomenon is of encroachments on river banks beyond safe limits of riverine areas for cattle farming. In the recent years the managerial crises has also led to excessive urban flooding (Government of Pakistan Ministry of Water and Power Resources, Federal Flood Commission, 2010, p. 5-10). Due to Global Warming, frequent and intense floods and storms are becoming rampant increasing forced displacements an extremely likely consequence. Climate Change stands to be major contributing factor as the Inter Panel on Climate Change in 2007 had warned rampant flooding in Pakistan. However, flood management is a multifunctional process (Government of Pakistan Ministry of Water and Power Resources, Federal Flood Commission, 2010, p. 18).Pakistan's flood forecasting method is also primitive. The problem of flood forecasting is also unique because greater part of flood generating upper catchments of River Sutlej, Ravi, Jhelum and Chenab lie across border in Kashmir. Due to a number of new projects there the flow of downstream water is disturbed. In 1989, an agreement was signed between Indus Water Commissions of Pakistan and India including provision to share river discharges data and rain data as considered important for forecasting in Pakistan. Indus Water Commission transfers the data to Chief Meteorologist, Lahore. In case of severe flooding the transfer of data reception is increased to six hourly even every hour. Indus Water Commission, Federal Flood Commission, National Disaster Management Authority, Flood Commission Cell, Flood Communication Cell are the main organs involved and arrange pre flood meetings. Police is used to communicate flood warning. This system is needed to be replaced with automatic data communication system. In order to make this more effective there must be a mechanism to ensure pre flood familiarization training. Two things are the basic requirement of flood management; flood data and flood forecasts (Government of Pakistan Ministry of Water and Power Resources, Federal Flood Commission, 2010, p. 15-25).

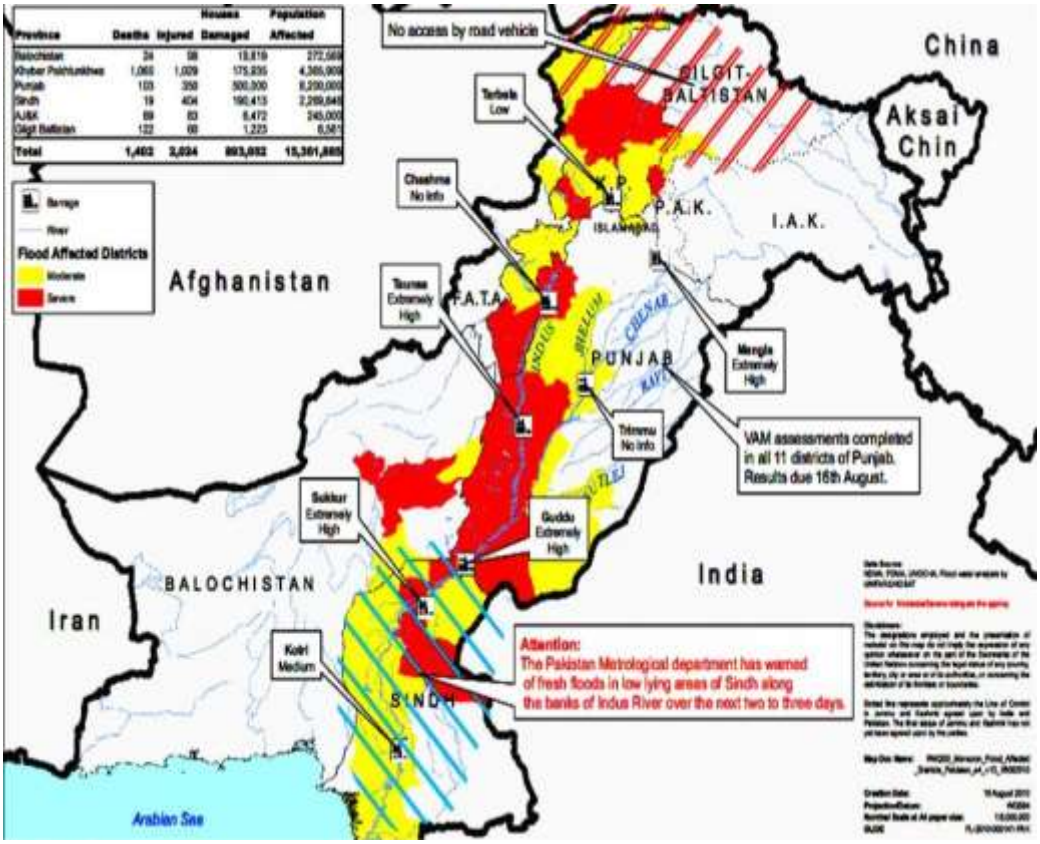

Figure 4: Flood affected areas of Pakistan, monsoon flood 2010

Source:
https://www.researchgate.net/publication/303524154_ENVIRONMENTAL_EFFECTS_OF_HAZARDOUS_FLOOD_OF_2010_IN_THE_PROVINCE_OF_KHYBER_PAKHTUNKAWA_KPK_PAKISTAN_ITS_CAUSES_AND_MANAGEMENT

The major reasons of flooding are extensive deforestation as Pakistan's tree cover had reduced 80% since 1947. This situation is worsened by poor governance and planning and lack of political will. Though Climate Change is the magnanimous reason now yet the operational and administrative menace multiplies this immensely. In worst Climate Change scenario it will be realized that average annual economic losses will be more than 9% of GDP. Yale University's ranking put Pakistan on 176th number out of 180 in Climate Change impacts' severity, (Pakistan's 2022 Floods and Implications for U.S. Interests, 2022). In 2010, it was the worst flooding of 18 years. Heavy rainfalls of about 200 millimeters caused intense outflow in Kabul and Swat rivers from July 27-30. It was the worst percentage. In Balochistan on July 22, few hours of heavy rainfall led to heavy flooding and breaching of Lehri Flood Protection Bund and flood water outburst 43 KM upstream of Sibbi (Government of Pakistan Ministry of Water and Power Resources, Federal Flood Commission, 2010, p. 27). In 2010Pakistan Meteorological Department had forecasted normal monsoon season during July to September. But on June 21st PMD cautioned urban flash flooding from July to September (Government of Pakistan Ministry of Water and Power Resources, Federal Flood Commission, 2010, p. 30).

During 2022, Pakistan experienced the worst flooding of its history affecting almost 33 million people, injuring 13,000 and killing more than 1,600. More than one third of the country was

inundated which was far more than 2010, with a loss of about USD 30 billion. During the summers of 2022, the southern provinces of Pakistan received 350% more than usual rainfall (Nanditha et al., 2023, p.1). Pakistan cut its annual economic growth for its fiscal year, June 2023. The largest affected population was of Sindh i-e, 44%, then Balochistan 28%, Punjab 15% and KPK 13%. More than 50% of livestock in Balochistan and 32% in Sindh were affected. Total damaged homes were 2 million out of which 88% were in Sindh. In Sindh, 64% of roads were destroyed and 27% in KPK. United Nations estimated that 7.6 million people were displaced on which it issued Flash Humanitarian Appeal on August 30th of USD 60 million (Pakistan's 2022 Floods and Implications for U.S. Interests, 2022, p.1-3). Due to intense heatwaves, there were seven summer glacial lake outbursts in upper Indus Plain (Nanditha et al., 2023, p.3). The current account deficit for the FY 2022 reached 4.4% and the fiscal deficit (excluding grants) reached 7.9% (Pakistan Floods 2022: Post-Disaster Needs Assessment (PDNA) | United Nations Development Programme, 2022, p.38)

Year	Key Event	Impact
2010	Worst flooding in 18 years	200 mm rainfall caused flooding in Kabul and Swat rivers
		Breach of Lehri Flood Bund in Balochistan
		PMD cautioned urban flash flooding (June 21)
2022	Worst flooding in history	33M affected, 13K injured, 1,600+ deaths
		One-third of the country submerged; $30B in losses
		2M homes damaged (88% in Sindh); 7.6M displaced
		Southern provinces: 350% more rainfall; 7 glacial outbursts

Figure 5: Comparative Analysis of Flood in Pakistan (2010 vs 2022)

Floods in Khyber Pakhtunkhwa province between 2010 and 2022 had a devastating socioeconomic impact. Floods in the province in 2010 and 2022 severely damaged livelihoods, crops, and infrastructure (Nanditha et al., 2023). According to estimates, the 2010 floods affected over 3 million people in KP, with over 1,700 killed and more than 300,000 homes destroyed. The 2022 floods were even more severe, affecting over 1.7 million people in the province, with over 300 killed and more than 70,000 homes damaged or destroyed (Ishaque et al., 2022).

Large tracts of farmland have been drowned, and crops have been damaged, resulting in a substantial impact on agriculture. Crop loss increased from over 700,000 acres in 2010 to over 380,000 acres in 2022. The livelihoods of farmers and rural communities, many of whom depend on agriculture as their main source of income, have been severely impacted by this. (Janjua et al., 2021) (Nanditha et al., 2023) (Asgary et al., 2012). Roads, bridges, and other vital infrastructure have been washed away or rendered useless, resulting in significant infrastructure damage. Road damage increased from nearly 3,000 km in 2010 to over 1,700 km

in 2022. This has disrupted economic activity and access to vital services, hindered relief and recovery operations, and more.

HYDROLOGY OF KPK

Khyber Pakhtunkhwa is the north western province of Pakistan bordering Afghanistan. It has a population of 35.5 million with 83.5% rural chunk. The population growth rate in KPK is 2.65 and is expected to be 51 million by 2030 and 89 million by 2050 if the current rate is not checked. KPK has a high density of multi sectoral poverty. As Pakistan is intrinsically an agrarian economy so lack of sufficient water leads to further economic degradation. The province has a unique terrain including mountains, agricultural plains and dry lands. The mountainous areas of the province have abundant water resources playing vital part in the regional hydrology and are prone to climatic variations. Despite the fact the province has enough water resources the unserved population is 21% of rural and 2% of urban. The diverse landscape and small and mountainous water resources offer ample opportunities yet is prone to climatic diversities and naturally small agricultural areas considerably limit the loss bearing capacity. Overall there is low agriculture and water productivity with 50% losses (Government of Khyber Pakhtunkhwa Planning and Development Department INTEGRATED WATER RESOURCE MANAGEMENT STRATEGY Government of Khyber Pakhtunkhwa, n.d, p.4-6)

The average precipitation of this province is also better than other parts of the country i-e, 738 mm till 2020, 753 mm till 2030 and 744 mm till 2040. The annual potential of rainfall in the province is about 4 MAF. The province has 31 small dams harvesting about 0.28 MAF of water which is expected to increase with 33 more small dams and Mohmand Dam, Gomal Zam Dam and Kurram Thangi Dam. The exact groundwater potential of the province is not known as no fresh study was conducted in last three decades. However, the extraction of groundwater for drinking and agriculture annually is about 3.97 MAF(Government of Khyber Pakhtunkhwa Planning and Development Department INTEGRATED WATER RESOURCE MANAGEMENT STRATEGY Government of Khyber Pakhtunkhwa, n.d, p.8)

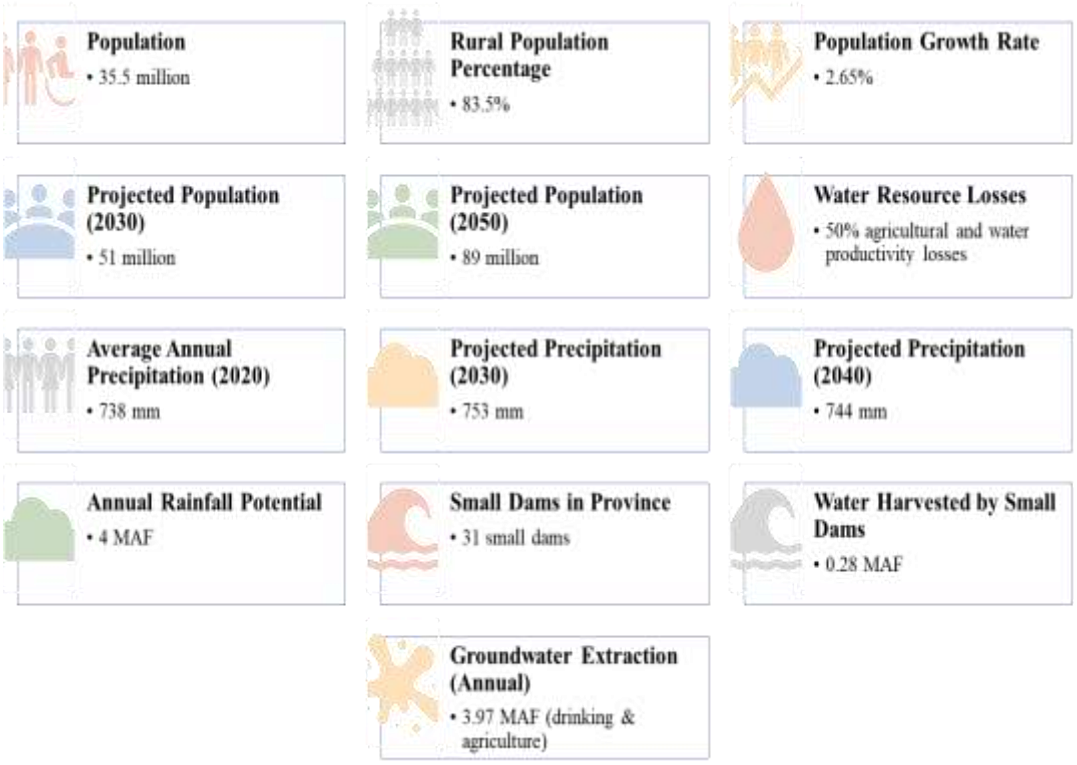

Figure 5: Population Dynamic and Water Resources in KPK

According to precipitation levels, the province can be divided into three zones; one part with quite high (above 1,000 mm), one with medium (less than 1,000 mm) and one large part with less rainfall (less than 600 mm). For agriculture the province mainly relies on surface water i-e, 30% groundwater, 34% canal water and rest on rains. A very few shifts in the rainfall patters are estimated from 2010 to 2040. The estimates show that 82% of the districts exhibit usual pattern until 2040 while 18% are experiencing diminishing rainfalls. In winter rainfall 14-18% decrease in expected in 85% districts while 87% districts are expected to receive more Spring precipitation by 2040. The summer rainfalls are expected to increase 7-22% by 2040(Government of Khyber Pakhtunkhwa Planning and Development Department INTEGRATED WATER RESOURCE MANAGEMENT STRATEGY Government of Khyber Pakhtunkhwa, n.d, p.8-9). The floods of 2022 in Pakistan hit this province intensely. The infrastructural damage was of USD 935 million, losses were of USD 658 million while urgent requirement for rehabilitation was of USD 780 million (Pakistan Floods 2022: Post-Disaster Needs Assessment (PDNA) | United Nations Development Programme, 2022,p.14)

SOCIO ECONOMIC IMPLICATIONS:

The impact of floods in KP gets worst as the initiating point remains the north of Pakistan. The coincidence of various events such as heavy rainfall, glacial melt preceding heatwaves, low pressure continuing for weeks. These huge impact of the devastating floods get compounded by the institutional incapacity and lack of preemptive strategies. According to table 1, the outflows at rivers in north i-e, Swat river were very high experiencing the direct impact of glacial melt.

Table 1: Outflows of various rivers of KPK flood during August.

River	Location	Discharge (Cusecs)	Flow Status
Swat River	Khawaza khela	14325	High
Swat River	Amandara	18997	Normal
Swat River	Munda Head Works	25249	Low
Swat River at Khlaiy	Charsada Road	25301	Medium
Panjkora River	Dir Talash	14631	Medium
Kabul River	Warsak	41650	Low
Kabul River	Nowsehra	75700	Medium
Adaizai River	Adezai Bridge	24694	High
Jandi River	Charsada	2188	Low
Dallus Nallah	Warsak Road	136	Normal
Kalpani Nallah	Mardan City	1466	Low
Gambila River	Gambila Bridge	811	Normal
Kurram River	Thall	17679	Low
Kaitu River	Spinwam	-	-
Indus River	Tarbela Outflow	279100	Low
Indus River	Kalabagh Outflow	372975	Low
Indus River	Chashma Outflow	505007	High
Indus River	Attock Khairabad	343800	Low
Peer Bala Khwar	Warsak Road	179	Normal
Budni Nallah	Charsadda	1454	Normal

2010 (PDMC, 2010)

One of the major impacts of the floods was that the rural population was badly affected and specially with the damage livestock. Another damaging impact was that as a result the number of displaced persons was quite high. These districts of KPK were already under the impact of terrorism.

Table 2: Effects on human life and livestock in various districts of KPK during flood 2010 (PDMC, 2010)

District	Total Population (Million)	Dead	Injured	Total Population Displaced	Population inaccessible	Cattle	Crops (Acres)	Trans Former	Pole	Grid Station
Tank	0.343	11	20	35000						
DI Khan	1.247	31	61	20468			180252			
Lakki Marwat	0.708	12	26			35				2
Bannu	0.938	12	27	4310		135	89232			
Mansehra	1.526	36	37	28644				10	29	
Abbottabad	1.09	17	5	3304			1500			
Haripur	0.895	37	21	20629		141				
Battagram	0.607	33	18	1246		361		9		
Kohistan	0.478	85	10	32122	150000	14908		1	18	
Peshawar	3.054	46	68	37373		120	92797			
Charsada	1.431	66	115	145810		33559	40725			
Nowshera	1.226	167	10	350336						
Mardan	2.074	8	40	11403		8	700			1
Swabi	1.45	7	4	742			100			
Karak	0.63	23	63			6				
Kohat	0.821	35	36	50		302	3750			
Hangu	0.459	12	13	581		26				
Swat	1.863	95	207	101220	350000		34470			

Table 4: Damages to the Number of villages and infrastructure during flood of 2010 in KPK (PDMC, 2010) Source: World Bank

District	Affected Villages	HH	Infrastructure						
		Affected Approx	Houses		Shops	Roads	Bridges & culverts	Education Facilities	Health & Govt Buildings
			PD	CD					
Tank	16	21,270			1	7	4	3	
DI Khan	26	56,373	846	2924		35	2	311	
Lakki Marwat	26	4,013	107	57	5	2	1	8	1
Bannu	60	8,046	8633	431		1	6	35	12
Mansehra	12	3,267		4092		33	6	9	33
Abbottabad			994	472			1		106
Haripur	42	8,092	1859	2947		1	4	39	161
Battagram	9	1,488	865	178	72		35	25	11
Kohistan	38	66,333	488	1902	3			107	11
Peshawar	16	33,867	15202	5339					
Charsada	34	71,819	13,827	20,830		34	3	32	
Nowshera	27	71,403	17,892	50,048			4	137	11
Mardan	43	2,856	6016	1629			8		
Swabi	11	2,198	3					30	
Karak	21	7,276	7	83	1		1		
Kohat	32	5,531	10601	311		1			
Hangu	19	6,549	100	83	1	2	1		
Swat	42	90,665	3	14460	161	2	24	69	13
Dir Lower	7	25,812	200	60		56	16	1	13
Malakand	6	6,441	738	348	224	20	7	16	48
Shangla	7	11,950	1874	1777		4	30	36	5
Buner	24	802	1343	473	15	15	9	8	3
Dir Upper	14	30,071	600	55		57	100	19	19
Chitral	12	9,881	353	165	17	13	39		
Total	544	546003	82551	108664	500	283	301	885	347

The cumulative impact of the floods of 2022 was higher because of the already precarious situation and the poverty rate increased to 2.2% from the previous year.

CONCLUSION:

The disasters have various stages of losses as they encompass immediate damage, a slightly later stage of damage and then it compounds and augments when rehabilitation costs are included. The floods of 2010 and 2020 had huge impact on the social and economic sectors of KPK province which has diverse topography, varied hydro-logical pattern and intensely intertwined social and economic sectors. The damaged schools, tourism sector, health infrastructure had huge impact on the population even in the decade following the floods of 2010. The other pressing challenge is myriad of political, social and economic challenges. The

province which was badly affected by terrorism for last two decades got worst impact of the floods. The intangible impacts of the damage to learning, the gap in learning due to damage of infrastructural pattern, the issue of health due to the prolonged health gap due to damaged infrastructure and facilities, the loss of cattle paralyzing economic life. These issues add to the political and social faultiness which create cumulative national socio economic crisis.

RECOMMENDATIONS:

1. Invest in flood-resistant construction and rehabilitation of damaged infrastructure, including roads, bridges, and buildings.
2. Implement effective water management practices, including watershed management, to reduce flood risks.
3. Provide support to farmers, including seeds, fertilizers, and livestock, to help them recover from crop and livestock losses.
4. Restore healthcare and education services, including rehabilitation of damaged schools and healthcare facilities.
5. Integrate climate resilience into development planning, including urban planning, infrastructure development, and agriculture.
6. Implement and improve disaster risk reduction strategies, including early warning systems, flood forecasting, and emergency preparedness plans.
7. Promote water conservation practices, including efficient irrigation systems and water harvesting, to reduce water scarcity.
8. Restore and protect natural ecosystems, including forests, wetlands, and rivers, to maintain ecosystem services and reduce flood risks.
9. Strengthen institutions, including NDMA, the Provincial Disaster Management Authority, to enhance disaster preparedness, response, and recovery.
10. Engage local communities in flood risk reduction and management efforts, including awareness-raising, capacity building, and participatory planning.
11. Support research and development on flood risk reduction, climate resilience, and water management to inform policy and practice.

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