Draft Report

Pakistan 2010 Floods:
Causes and Lessons Learnt

Islamabad, Pakistan

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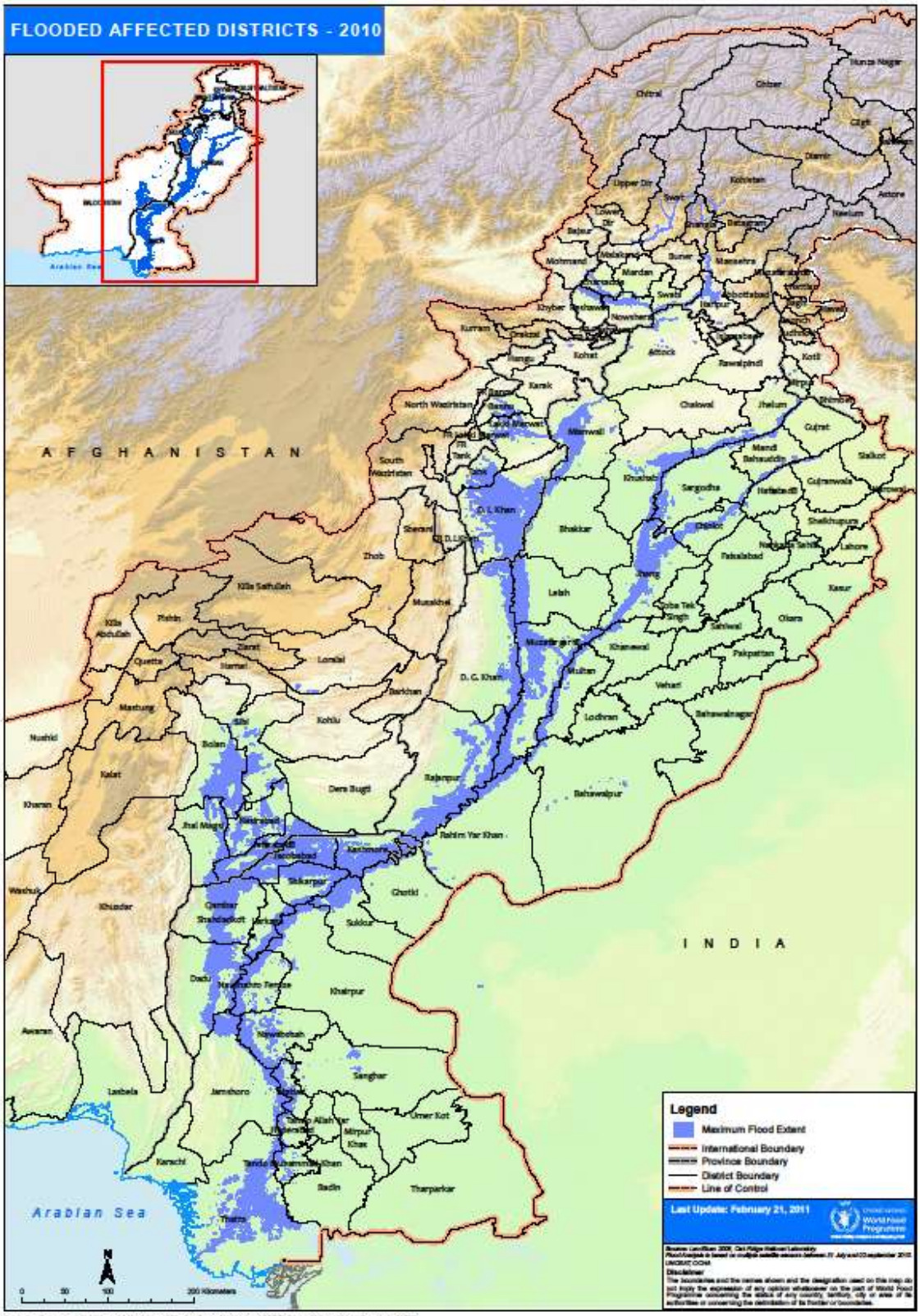
Map of 2010 Flood Affected Areas in Pakistan



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List of acronyms

DNA: Damage and Needs Assessment, 2010 floods by Asian Development Bank and the World Bank
NGO: Non-governmental Organization
KPK: Khyber Puktoonkhaw
WFP: World Food Organization
PMD: Pakistan Meteorological Department
IRS: Indus River System
IBIS: Indus Basin Irrigation System
PARC: Pakistan Agricultural Research council
NDMA: National Disaster Management Authority
NDMC: National Disaster Management Commission
PDMA: Provincial Disaster Management Authority
PDMC: Provincial Disaster Management Commission
DDMA: District Disaster Management Authority
DRM: Disaster Risk Management
FFC: Federal Flood Commission
WAPDA: Water and Power Development Authority
PIDA: Provincial Irrigation & Drainage Authority
FFC: Flood Forecasting Division
I/NGOs: International/Non-governmental Organization
EWS: Early Warning System
DRR: Disaster Risk Reduction
UN: United Nations
GDP: Gross Domestic Product
ADB: Asian Development Bank and
WB: World Bank
PKR: Pak Rupees
USD: United States Dollar
AJK: Azad Jammu and Kashmir
UNIFEM: The United Nations Development Fund for Women
IPCC: Inter-governmental Panel on Climate Change
CRED: Centre for Research on the Epidemiology of Disasters
ENSO: Elnino-Southern Oscillation
GCISC: Global Change Impact Studies Centre
NDRMF: National Disaster Risk Management Framework
HFA: Hyogo-Framework of Action
CBDRM: Community Based Disaster Risk Management
DEPECO:
DFID: UK Department for International Development
EU: European Union
USAID: United Status Agency for International Development
NORAD: Norwegian Aid for Development
PCIW: Pakistan Commission for Indus Waters

Executive Summary

Oxfam GB conducted this study to review causes and lessons learnt from the 2010 mega floods in Pakistan. The findings from this study may provide recommendations to the government of Pakistan and the international donor community to appropriately incorporate the flood risk management into disaster preparedness for a safer and more resilient Pakistan. Literature review, discussions with experts, partner NGOs perceptions and focused group discussions made the basis for the findings in this report.

The 2010 flood damages surpassed all the previous records associated to any disastrous catastrophe in Pakistan. It damaged more than 1300 villages, urban centers, and economic infrastructures and affected over 20 million people in seventy-eight districts. About 1.7 million homes were destroyed with 1,985 reported deaths and 2,946 injuries. Agriculture based rural livelihood was affected most by the floods. The DNA estimated direct damages of US$ 6.5 billion and indirect losses of US$ 3.6 billion. The estimated reconstruction costs range between US$ 6.8 billion to US$ 8.9 billion (DNA 2010).

The areas affected by the disaster included many which had already been suffering from the highest levels of poverty and food insecurity and the people most severely affected were mainly small farmers and agricultural laborers in all the four major provinces (KPK, Punjab, Balochistan and Sindh). Even the medium income group had been affected and their food security status changed to highly food insecure (WFP 2011). **Women vulnerabilities** increased as the devastating flood disaster made them more dependent on men. Their basic livelihood sources (poultry, goats and tools) perished.

Various interacting forces contributed to the 2010 floods. These included climate/weather related factors, inefficient water management and unsustainable land use management. Climate/weather variability associated with climate change could be the basic cause of 2010 floods. The unusual interaction of two weather systems – westerly wave and monsoonal wave over Northwest Pakistan caused heavy rainfall mainly over KPK constantly for 24 to 36 hrs. In the past, such interactions normally occurred over Northeast Pakistan during monsoon season and brought floods in the eastern rivers. Sixty year historical data of PMD are pointing towards a shift in the monsoon rainfall about 80-100 kilometers westward in Pakistan and if this becomes a new climate, the probability of occurrence of extreme monsoon rainfall in the future will be high over Northwest Pakistan. This will cause Flash Floods in the upstream areas of KPK and reverine floods in western rivers (Kabul and Indus River). Policy makers therefore must focus on flood risk management and strengthening of institutions for flood preparedness in light of the changing climatic/weather variability.

Bad land use and water management widened the flood impacts and exacerbated the losses. The capacity of the Indus Rive System (IRS) to absorb/attenuate flood peaks has been drastically reduced by various unsustainable land use and water management practices. These include the on-going overexploitation of mountain ecosystem, illegal encroachments in river beds, artificial changes in natural river flows and unplanned infrastructural development in the Indus main and its tributaries. Upstream, these unsustainable lands use practices enhanced surface run off and caused devastating flash floods in western mountain areas. Downstream these practices together with unregulated urban development and poorly designed physical infrastructure (roads, bridges, canals and culverts) blocked the smooth flow of water in the Indus River System (IRS) and prevented flood water to reach the sea via its natural pathway.

The 2010 flood water flows outpaced the existing capacity of the Indus Basin Irrigation System (IBIS). The country has not developed any additional water storage capacity on the Indus since 1976 (PARC 2010) and the existing capacity of reservoirs and canals has already been reduced due to heavy sedimentation. The NGOs reported that most river streams, linked canals and

irrigation channels were not cleaned by the irrigation department for many years. Hence the flood water over flowed and inundated extensive agricultural lands and settlements in IBIS.

The protection bunds and retaining walls built by the irrigation department in 1976 along the IRS were weak and inadequately maintained. As a result these bunds in most places may have breached naturally but in some places these buds were breached by the irrigation department and influential feudal lords to protect agricultural land for the rich. Major breaches occurred at Torhi, Superio, Manchar lake, Begari, MS Bund, Surjani Bunds and caused widespread losses.

Pakistan's lack of preparedness added to the toll of the floods. The current policies, institutions and flood management practices proved not to be adequate for dealing with high intensity floods. The newly established NDMA being the main coordinating agency for managing all disasters had limited capacity. The Provincial Disaster Management Authorities (PDMAs) in all the provinces and District Disaster Management Authorities (DDMAs) at district levels are still in naissance stage and no capacities to deal with large disasters. The DRM Plans prepared for a number of flood affected districts for some reasons were not effectively used during the 2010 floods. These district plans and the annual pre-monsoon contingency plans did not cater to needs of the widely affected communities.

The existing flood management system is complex In addition to NDMA/PDMAs, the Federal Flood Commission (FFC) is also mandated for flood control and in formulating flood protection strategy for the country. The Flood Forecasting Division (FFD) under the Pakistan Meteorological Department (PMD) is responsible for the forecasting of floods and the issuance of forecasts. WAPDA, PIDA and the Punjab Police Wireless Telecommunication Wing supports the FFD in measuring the water flows and levels in rivers, barrages and canals. The Pakistan Army, District Management and other district officials also have a role in flood control, management and response**.** Thus multiple institutions are involved with duplicating roles and weak coordination mechanisms because of different reporting lines.

The experiences of the recent floods revealed many deficiencies in flood forecasting, monitoring and management. Especially, the present flood forecasting system failed in capturing very accurately the extreme precipitation events like the recent mega flood of July/August, 2010. The current flood early warning system also was not widely disseminated down to communities. Where the early warning reached to communities, they were not well prepared, not willing to evacuate and lacked confidence in forecasts.

A number of gaps were also reported in emergency response to the affected population. These included (a) local stocks (food and non-food) were not readily available in the affected areas and the affected communities (including women and children) were without food, water, medicines and shelter for 2-3 days, (b) roads and communication networks got damaged due to floods and there were no sufficient means of transport for the communities, (c) there were no designated escape points and/or camp sites as such most communities had to stay under open sky with their women and children, (d) where camps were arranged, these lacked facilities including latrines for women. In most areas, local NGOs and civil society was found to be more proactive despite limited resources in their hands.

Several policy recommendations were provided in the report as summarized below (specific recommendations may be seen in the report):

- NDMA, UN agencies, I/NGOs should as much as possible help in raising DRM awareness at all levels with emphasis on holistic approach and a shift from reactive to protective approach in line with the principles laid out in NDRMF and the Hyogo Framework of Action.
- In line with the National Disaster Risk Management Framework (NDRMF 2007), NDMA and FFC should jointly lead the process of developing Flood Management Policy and Strategy, which should be approved by the national and provincial assemblies. The policy and strategy should include:

- Clearly defined roles and responsibilities of institutions including a strong mandatory coordination role of NDMA at federal level and PDMA in each province with links down to district levels.
- It should include strong regulatory/ enforcement mechanisms and measures for implementation to stop riverbed encroachments, unplanned settlements, and introduce building codes for necessary infrastructure.
- Map out the changing flood "pathways" and devise a management strategy to ensure that the design and location of developments takes account of its susceptibility to flooding, river systems and flood defence infrastructure, the likely routes and storage of floodwater and its influence on flood risk downstream.
- Streamline coherent post flood humanitarian operation as well as pre-flood response preparedness, especially to channel the relief response under one umbrella of NDMA and PDMAs.

- NDMA in support of PDMAs should develop a contingency plan for flood based on various scenarios including 2010 floods as worst case scenario: It should also determine roles and responsibilities for pre-flood EWS and post-flood response, including stock piling and inventories. The plan should also include options for where and when the river should be breached so that the flood losses could be minimal.
- FFC together with PMD should lead the process of developing a less complex well coordinated Early Warning System (EWS) including flood forecasting and dissemination systems reaching to grass root communities- men and women. EWS should also take into account the changing climatic situation, not only meeting the flood management requirements of the Indus flood plains in Punjab and Sindh but also to cover the flash floods in KPK, southern Punjab and Balochistan.
- The Ministry of Water and Power in close collaboration with provincial irrigation departments must improve the water management system in Pakistan in light of the changing climatic situation. This should include wise and efficient use of water including rain water harvesting and tapping of flood water through more reservoirs upstream and along the Indus basin.
- The Ministry of Environment in close collaboration with provincial Forestry departments should initiate ecologically-sound flood management practices in the mountain areas through improving and protecting forests and watersheds.
- International agencies and I/NGOs should also help in shielding the already poor population and to prepare them for timely adaptation to the changing atmospheric/ precipitation patterns and the associated extreme climatic events leading to disasters.
- NDMA/ PDMAs in support of WFP should strengthen the logistical capacities by establishing food and non-food warehouses at strategic places in the flood prone areas.
- Local governments in support of NGOs should strengthen local level capacities in DRM as they are the first line of defence both in flood protection and also in the relief operation.

The opportunity for integration of DRR in rehabilitation of the flood affected communities should not be missed out during the currently on-going reconstruction phase. Preparing the communities and reducing the risks of future disasters should be the main focus in the post-flood reconstruction phase. Furthermore, efforts should be made to reduce and not deepen inequalities by targeting the needs for all, not just the rich and powerful, and work with poor and marginalized communities that are most vulnerable such as women, landless labour, and tenants.

The above recommendations and more specific recommendations might not be implemented without sufficient financial support from the donor organizations and UN agencies. A resource mobilization strategy should be prepared and shared with donors and UN agencies. Simultaneously, the relevant Government organizations should ensure timely and efficient implementation of these recommendations, and set-up institutions and build their capacities on sustainable basis.

1. Introduction

Oxfam GB is devising a campaign strategy for Disaster Risk Management (DRM) with particular reference to the floods hazard. To support the DRM strategy of Oxfam GB, this report reviews causes of the 2010 mega flood including factors that exacerbated the devastations in flood affected areas. It also examines existing pre-flood policies and practices with special reference to disaster preparedness and flood risk management in the country and to assess if these policies and practices were supportive in minimizing the flood impacts and losses. These lessons will help to provide recommendations to the government of Pakistan and the international donor community to ensure that the flood risk management is appropriately incorporated as part of disaster preparedness for a safer and more resilient Pakistan.

Literature review (published and unpublished) was carried out and discussions were made with various experts and practitioners (including NDMA, PMD, UN agencies). Focused Group discussions were conducted with national and international NGOs in a workshop to further understand and validate the causes and impacts of the flood. In addition, a checklist of open ended questions was circulated to local NGOs that provided local level perception on the flood causes and impacts.

The report is divided into several sections. The next section briefly explains methodology. The third section summarizes damages and impacts caused by the 2010 mega floods in the country. The fourth and fifth sections examine causes of the flood including factors that exacerbated damages, existing DRM policies and flood management practices in the country. The last section review provides recommendations for risk management strategy, including both risk reduction and response preparedness measures. Specific recommendations that need to be incorporated into the recovery and rehabilitation phase are also provided in the section.

2. Flood damages and impacts

2.1. Background

The 2010 monsoon flood was worst in the recorded memory of Pakistan. The capacity of the Government, local institutions and the communities was not up to the level required to manage this unprecedented mega flood. The extraordinary continuous and intensive rainfall in July brought heavy damages to houses, land and other infrastructure in mountain areas of Khyber Puktoonkhwa, Gilgit-Balthistan and Kashmir areas. This was followed by rising water levels in Indus and Chinab Rivers that over flowed and breached through inundating extensive rural and urban settlements in parts of Punjab, Sindh and Balochistan provinces. These rivers run along Pakistan's entire length before discharging into the Arabian Sea, a journey of some 3,180 kilometers.

The flash floods in the mountainous north catchments were intense and highly destructive washing away land, infrastructure and settlements. In the flatter areas of Punjab, Northern Sindh and Balochistan, the reverine flooding caused heavy damages, although with slower onset, affecting densely populated settlements, cultivated areas and standing crops mostly along the river bed. Many of the main irrigation canals that

take water from the Indus River in Punjab and Sindh were also flooded, pouring water onto agricultural lands and rural/urban settlements that never received such floods in the past. In lower Sindh, the delta flooding has longer lasting effects as most farmers could not plant the winter crops due to soil water saturation and high ground water tables in these low lying areas.

2.2. Damages and costs

The National Disaster Management Authority (NDMA 2010a) has estimated that the floods affected over 20 million people (one-tenth of Pakistan's population) in seventy-eight districts covering over 100,000 square km (Table 1). About 1.7 million homes were destroyed with 1,985 total reported deaths (nearly 2,946 injured), and perished tens of thousands of animals. The floods also damaged more than 1300 villages, urban centers, and economic infrastructures such as roads, bridges, hydro-power and rural based industries. According to the UN estimates, about 12 million of the affected people were in need of support (UN OCHA, 2010).

The flood inflicted heavy losses to the economy in general and livelihoods of the majority of the poor population in particular. While the full economic losses of the flood may not be known for some time, the Damage and Needs Assessment (DNA 2010) by the Asian Development Bank (ADB) and the World Bank (WB) estimated direct damages of PKR 552 billion (US$ 6.5 billion) and indirect losses of PKR 303 billion (US$ 3.6 billion). The agriculture, livestock and fisheries sectors suffered the highest damages. The estimated reconstruction costs range between PKR 578 billion (US$ 6.8 billion) to PKR 758 billion (US$ 8.9 billion) under various options (DNA 2010).

Total emergency needs of the UN and other agencies on the ground amounted to USD 460 million (UN appeal). On the other hand the immediate rehabilitation costs as estimated by UN are USD 1.9 billion, that includes food support to poor and vulnerable, reconstruction of water channels, rehabilitation of access/farm to market roads, some land reclamation and restoration of agriculture and livelihoods.

Table 1: Summary of flood damages

Type of damage	Description
Districts affected	**78 districts (**KPK: 24; Punjab: 11, Sindh: 17, Balochistan: 12, AJK: 7, GB: 7)
Villages affected	1300
Population affected	20 million
Area affected	100,000 (+) Sq KM
Cultivated land affected	21%
Reported death	1,985
Reported Injured	2, 946
Houses damaged	1,744,471
Medical facilities dmaaged	471
Schools damaged	12,693
Loss to agriculture	USD 2.6 billion
Loss to National Roads	USD 153 million
Loss to water and power	USD 153 million
Loss to Railways	USD 62 million
Total direct damages	USD 6.5 billion
Total Indirect damages	USD 3.6 billion
Rehabilitation/reconstruction costs	USD 6.9 – 8.9 billion

Source: NDMA, 2010(a)/ DNA, 2010

The magnitude of the flood impact especially in terms of geographic area and population affected was more than twice than the total impacts of the Pakistan Earthquake 2005, Cyclone Katrina 2005, Indian Ocean Tsunami 2004, Cyclone Nargis 2008 and Haiti Earthquake 2010 (Oxley 2010). The 2010 flood damages were also higher than the total damages of natural disasters (including the 2005 devastating Earthquake) recorded since 1987 (Table 2). While the numbers of people affected by 2010 flood were about 50% of the cumulated figures of all major floods, these numbers were higher than any other major floods in the country. What is striking about these losses is that the number of deaths from this flood was low compared to other such floods, perhaps because of relatively better preparedness on the part of the local NGOs and rescue.

Table 2: Analysis of Natural Disasters in Pakistan (1987-2006)

No	Disaster Type	People Homeless	People Killed	People Injured	People affected	Total affected	Total Damage 000$	%	Ranking
1	Wind Storm	22,597	11,654	1,183	1,057,000	1,080,780	4,100	2	6
2	Earthquake	2,853,585	142,812	88,096	1,294,429	4,236,110	5,019,255	8	2
3	Flood	8,927,685	11,702	1,262	38,669,447	47,598,394	2,746,030	86	1
4	Land Slides	3,100	384	114	200	3,414	-	0	7
5	Famine	-	-	-	300,000	300,000	-	1	4
6	Epidemic	-	283	211	16,275	16,486	-	0	5
7	Extreme Temperature	-	1,406	324	250	574	-	0	7
8	Drought	-	223	-	2,269,300	2,269,300	2,47,000	4	3
9	Insect Infestation	-	-	-		-	-	-	8
	Total	11,806,967	168,464	91,190	43,606,901	55,505,058	8,016,385	100	
Flood 2010		1,744,471	1,984	2,946	20,184,550	20,184,550	10,000,000		

Source: NDMA 2010b, Mid-Term DRM Plan (2011-2015)

2.3. Flood coverage and impacts on livelihoods

About 1/5th of the total area of Pakistan was covered by this devastating flood (NDMA 2010a). Out of the 4.30 million hectares total area affected by the floods, Sindh was the most affected province area-wise (41% of total area) followed by Punjab (36%), KPK (12%), Balochistan (11%) and a small fraction in Kashmir (PARC 2010). Agriculture based rural livelihoods particularly irrigated agriculture was the major land use system affected by the floods covering over 2.5 million hectares and representing 59.3% of the total flood-affected area. Other land use systems affected by the floods were rainfed/ flash flood irrigated systems (4.2%), bare soil and uncultivated lands (15.5%), forests and rangelands (13.5%), water bodies (6.4%) and settlements (1.1%). Standing crops of rice, cotton, sugarcane, maize, fruits and vegetables were badly affected. These crops provide an important source of livelihoods for the poor population in the rural area including livelihoods for women in cotton picking, and rice/ sugarcane harvesting. Other economic loss associated with agriculture included land loss, damages to tube wells and watercourses, and loss of stored food, seeds and fodder.

The livestock losses were much less compared to crops as the owners were able to take most of their animals along with them in Punjab and Sindh. Very few were sold at lower prices. However, poultry birds (an important source of income for women) were completely lost. The incidence of animal diseases and thefts has added to the losses due to the floods according to NGOs. No detailed assessments to quantify animal losses has been carried out despite of the fact that livestock plays an important role in livelihoods of the poor population.

2.4. Post flood vulnerabilities

Impact on economy

Pakistan should be ready to face another poor year for the economy, in terms of the rate of the growth in the national product, pace of job creation and inter-personal and inter-regional income distribution. The government's prediction that GDP in 2010-11 would increase by 4.1% now seems extremely optimistic (CWI 2010). It appears that the national product will not increase by more than 2.5 to 2.8% this year against the target of 4%. This will increase vulnerabilities of the poor.

Livelihoods Vulnerabilities and incomes

It is an un-debated fact that households or communities with high risk and low coping capacity are deemed to be highly vulnerable, while those with low risk and high coping capacity are expected to have low vulnerability. Vulnerability is medium for the other two combinations: low risk/low coping capacity, and high risk/high coping capacity. The areas affected by the disaster include many which had already been suffering from the highest levels of poverty and food insecurity and the people most severely affected were mainly small farmers and agricultural laborers, although rural dwellers, especially in Sindh, have also been seriously affected. Preliminary findings of a recent assessment indicate that even the medium income group has been affected and their food security status has changed to highly food insecure (WFP 2011).

In addition to crops losses in the current season, majority of the small farmers have missed the next cropping season in flood affected areas, especially in Sindh lying in the Indus Delta where water did not recede well in time before the start of the winter cropping season. Furthermore, canal irrigation system has also been affected and water for irrigation might not be available to the farmers in many areas for the next cropping season(s) unless these are timely rehabilitated.

The floods also have impacted tenancy patterns in the affected areas. The flood affected areas in Punjab and Sindh are mainly lying in Kucha areas along the Indus Basin where the land rights are not clearly defined. Few powerful landlords occupy the land (e.g., 80% of the land is claimed to be with 20% of the farmers and the landless tenants live and work for these landlords on a $1/5^{th}$ share basis (Oxfam 2009). The flood has destroyed houses of these poor tenants and most have migrated to nearby towns and cities. During discussions with these tenants, they preferred to stay and work as urban wage labourer. According to NDMA, even till to date, about 157,000 people are still living in camps. This could unbalancing the labour market e.g., increased supply in urban labour and shortage of labour in rural market.

The government is offering soft loans and other facilities mainly to land owners, but these loans are not available to the poor landless tenants who have no documentary proofs for land ownership rights. The private money lenders and land lords are providing loans to tenants and small farmers at high interest rates, which will further increase their indebtedness.

The damage to livelihood systems caused by the floods is likely to have longer-term consequences in terms of (a) additional exposure to risk, and (b) a reduced coping capacity among affected households. Existing vulnerabilities have therefore been exacerbated and new vulnerabilities have emerged as some who were previously economically secure are now unable to meet their daily needs (WFP 2011).

Impact on women and their post-flood vulnerabilities

The partner NGOs reported that around 72 percent of persons displaced by the flood were women and children. Though women and children were supported by men first in safe evacuation, the men had to stay behind to safeguard their houses and animals. These women and children without men were exposed to a number of problems including sexual harassment, malnutrition, water born diseases and maternal and new born mortality. Most women and their children interviewed in camps were found to be emotionally disturbed.

The UN OCHA bulletins (UN OCHA 2010) during the flood particularly pointed towards a clear risk of malnutrition among children and pregnant/ lactating women and appealed that food relief should particularly be sensitive to specific needs of the infants and lactating women. Such food was not available for two to three days after the flood. A rising trend of diarrhea among the affected population and especially children was observed in the camps. Lesser sensitivities for women/children specific facilities e.g., separate toilets, privacy and health and hygiene were also noticed in the camps.

In the post-flood situation, women vulnerabilities have increased more compared to men because in a rural society like Pakistan where women have economic dependency on men, the devastating flood disaster made them more dependent on men. Their basic livelihood means such as poultry, small ruminants (goats) and tools (such as sewing machines and embroidery equipment) have been washed away.

The Preliminary Gender Needs Assessment report by UNIFEM reports that women may become unnoticed in the compensation process too as their economic contribution is usually invisible (UNIFEM 2010). Land rights which are challenging for poor men, are even more challenging for women who are usually denied inheritance and property rights. The devastation caused by the floods destroyed their limited assets, worsened their personal security situation, and changed their responsibilities as they are forced to respond to emergency conditions. Damage assessments often overlook the gender dimension of vulnerability. The forms being used by the Agriculture Cluster in Pakistan in the preliminary agricultural assessments (Agriculture Cluster, 2010), at least for the upper basin areas covered so far do not seem to allow for differential analysis of the impact on women and men (WB 2010).

Women workload has also increased in the post flood situation. While most men are busy in land clearing and working off-farm in towns and cities, workload for women has increased as they have to take care of children at home, repairing of houses, plastering of mud walls, cleaning of sand and silt accumulated in homesteads, fetching drinking

water and collecting fodder and taking care of animals. It is essential that the Government adopts a rights-based development approach to reconstruction (DNA 2010).

3. Causes of 2010 Floods

There is significant convincing evidence that heavy and prolonged rainfall of more than double of the normal annual rainfall (300 mm/annum) in the western mountains mostly in KPK and also in mountain parts of Punjab and Balochistan in the last week of July 2010 caused devastating flash floods. The unique part of this event is that the temperate region (western mountains) received the summer rainfall where such rainfall during July – September is usually insignificant in those areas. The excessive rainwater further accumulated mainly in the Indus River and its tributaries and contributed to the enhanced stream flow that caused floods in the plain areas of Punjab, Sindh and parts of Balochistan, affecting extensive area both along the river bed as well as settled areas away from the river where such floods were never experienced.

Various interacting forces caused excessive rains and exacerbated flooding. These can be categorized as climate/weather related factors, inefficient water management and unsustainable land use management factors. In addition, there is also an important role of policies, institutions and capacities of the government and civil society in flood risk management/ preparedness and response. Cause and effect relationship of these interacting forces is shown in Figure1.

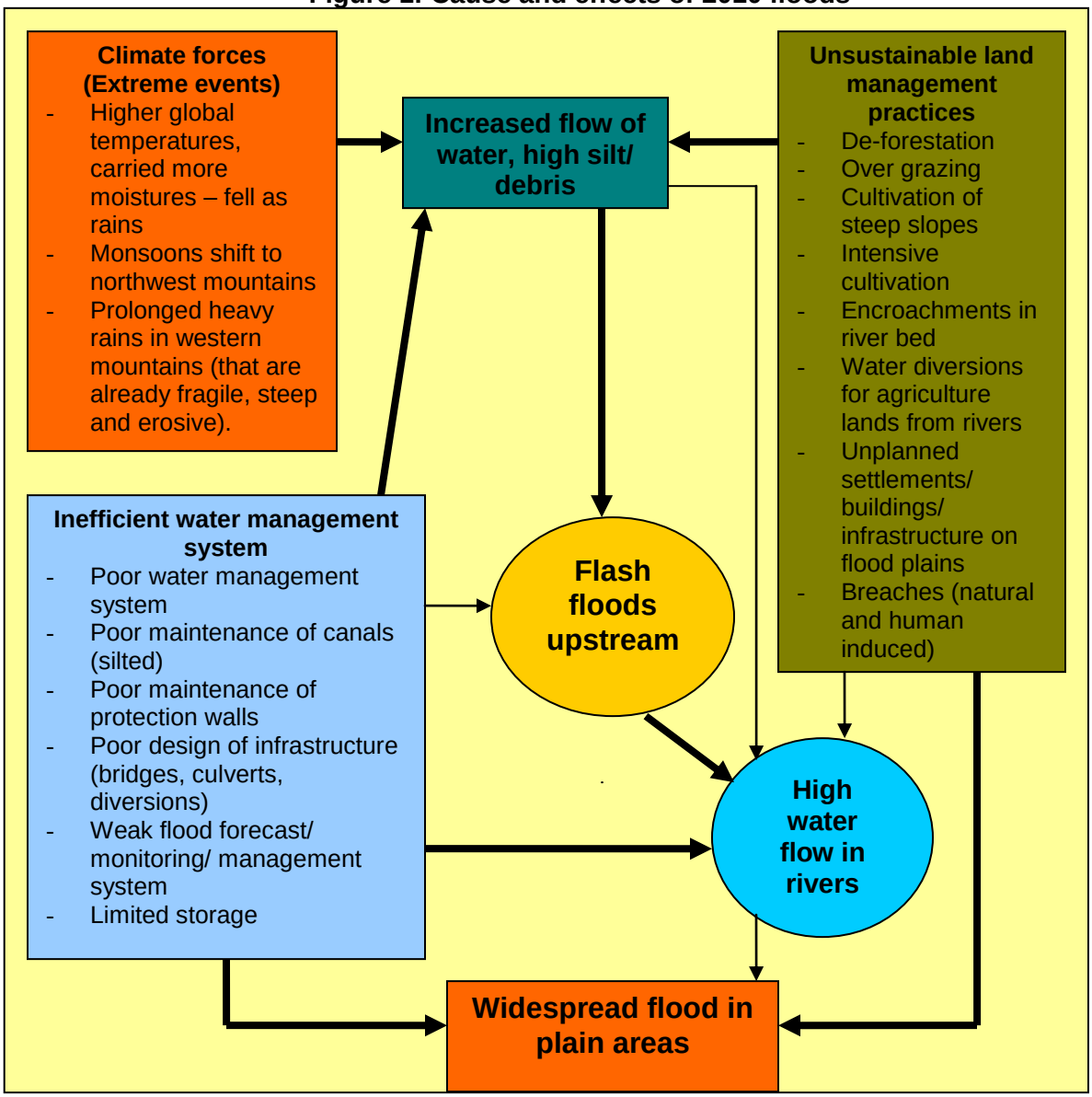
Heavy and prolonged rains that are considered to be associated with climate change variability caused flash floods in the north western mountainous region. These flash floods were further exacerbated by various inefficient water management systems and unsustainable land management practices that also affected the smooth flow of water at its natural path in the rivers. While the natural factors such as excessive quantity of rain water, erosive characters of soils, fragile and steep mountains with less water absorbing capacities, enhanced the water flow downstream, the inefficient water and land management practices played more harming roles in expanding the floods over larger areas covering most parts of Indus Basin and the Delta (see Figure 1). Similar causes were also reported by the partner NGOs (Annex 1).

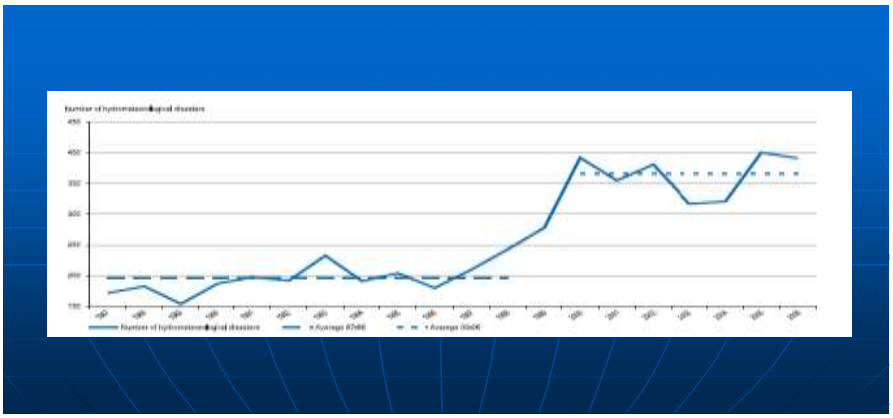
3.1. Unprecedented heavy rainfalls caused by climate variability

The most probable cause of the 2010 floods could be attributed to the climate change associated increased climatic/weather variability. Most climate change models predict that weather extreme events (floods and droughts) of greater intensity and frequency (IPCC 2001 and IPCC 2007). They also predict that these extreme events are likely to be more severe in arid and semi-arid environments in future. Historical data already indicates that the frequency of disasters have increased all over the world as well as in Pakistan since 1990s (Figures 2). Most of these disasters are hydro- meteorological and have close correlation to climate change because during the same period global temperatures also have increased at a rapid rate (IPCC 2001 and 2007). The changes in precipitation pattern could be equally important component of global climate change, but the phenomena of precipitation change are more complicated than those for temperature

by human activity. Nevertheless, scientists believe that latitudinal shifts in precipitation are occurring that have strong linkages to climate change (IPCC 2001 and 2007).

Figure 1: Cause and effects of 2010 floods

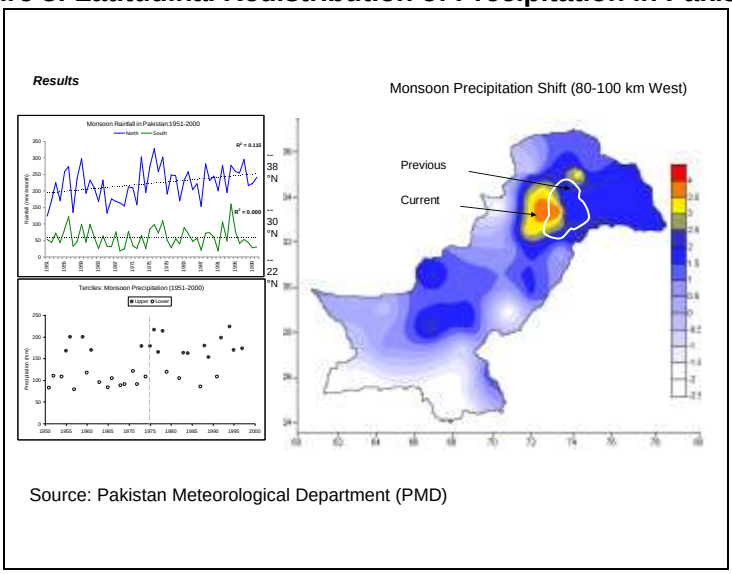




Source: CRED 2006

Similar latitudinal shift has also been observed in Pakistan. Sixty year rainfall data of Pakistan Meteorological Department (PMD) suggest that the present climatic variability has shifted the monsoon rainfall about 80-100 kilometers westward (Figure 3). In the past this monsoon rainfall was dominated in the eastern parts, Hazara Upper Punjab and Kashmir.

Figure 3: Latitudinal Redistribution of Precipitation in Pakistan



Source: Pakistan Meteorological Department (PMD)

Meteorologists believe that the interaction of two weather systems – westerly wave and monsoonal wave over Northwest Pakistan (mainly KPK) could be the major reason for 2010 mega flood which caused heavy rainfall in those areas constantly for 24 to 36 hrs. In the past, such interactions normally occurred over Northeast Pakistan during monsoon season and resulted into supper floods (e.g., 1929, 1959, 1992 and 2010).

Meteorologists are also of the opinion that the rapid development of a La Niña cycle in the Pacific Ocean, typically resulting in a heavier-than-normal monsoon season in South Asia, also played a role in helping to create a rarely-seen atmospheric setup that led to disastrous floods in Pakistan (PMD briefings, Oxley 2010, PARC 2010).

The above climatic changes and the associated latitudinal shift of precipitation has important implications for Pakistan and the region. Especially if the westward shift of

High Pressure Regimes becomes a New Climate, then the climate scenario of Central South-West Asia (Iran-Afghanistan-Pakistan) will change. The displacement of Highs towards west (during La-Nina phase) may cause excess rainfall over the North West parts of Pakistan during the monsoon season and deficient winter rainfall over Pakistan. The PMD modeling for future climate based on past trends are already pointing towards changes in the seasonal precipitation patterns, with wetter summers and drier winters (See Figure 4 to 6 for past, current and projected seasonal rainfall patterns respectively).

Figure 4: Past seasonal rainfall pattern in Pakistan: 1961-1990

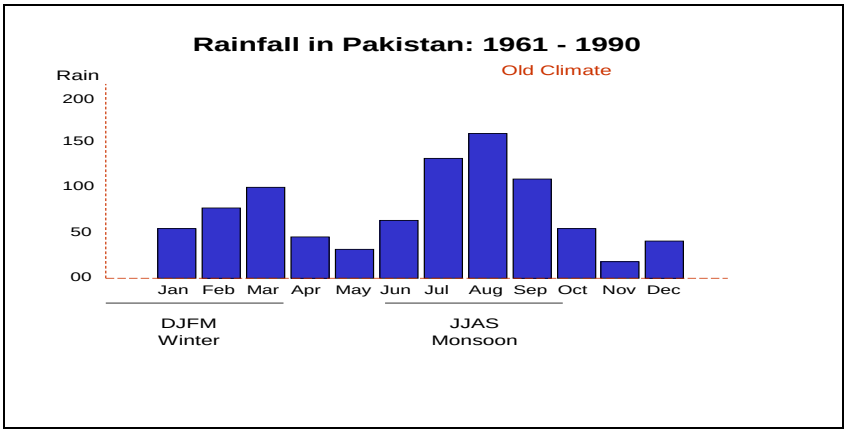


Figure 5: Current seasonal rainfall pattern in Pakistan: 1991-2010

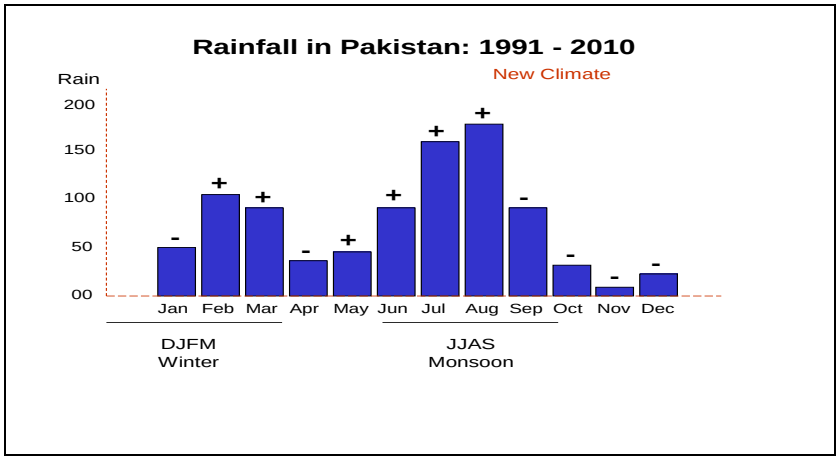
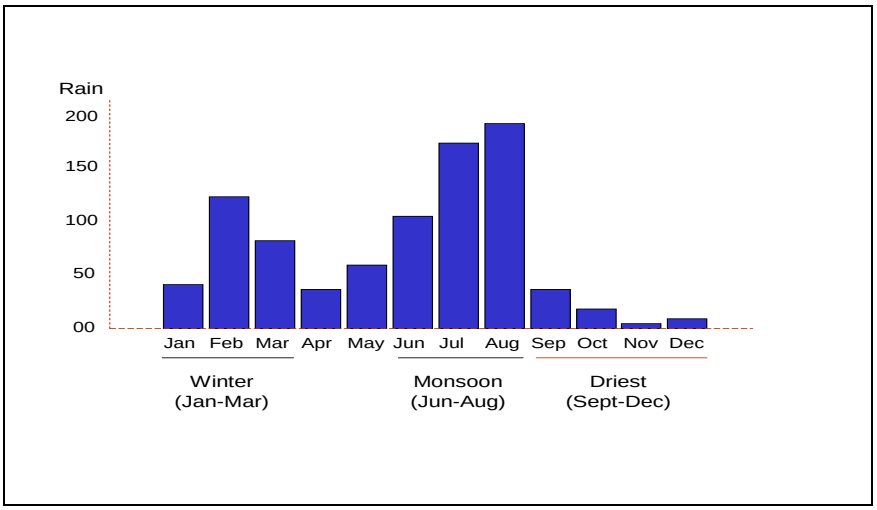


Figure 6: Projected seasonal rainfall pattern in Pakistan: 2011 – 2020



Source: Pakistan Meteorological Department

The monsoon rainfall over the catchments areas of eastern rivers has already decreased. In the new climate change scenario, the probability of occurrence of extreme monsoon rainfall will be high over Northwest Pakistan (covering KPK) in the future causing Flash Floods in the upstream areas and reverine floods in western rivers (Kabul and Indus River), especially during ENSO cycle.

These changing climatic events will have consequences in the shape of deadly floods in the Indus River System (IRS). Policy makers therefore must understand and adopt the changing climate to improve the water management in Pakistan (including tapping of flood water through more reservoirs upstream). The country also needs to prepare for and timely adapt to the changing atmospheric/ precipitation patterns and the associated extreme climatic events leading to disasters in the country.

3.2. High water flows enhanced the intensity of flooding

The flow of water in rivers depends upon various natural and human induced interacting factors. These include quantity and quality of water, soil absorptive/infiltration capacity, capacity in reservoirs and unsustainable human practices. Unfortunately, all the above factors were not conducive and enhanced the intensity of 2010 flooding in the country.

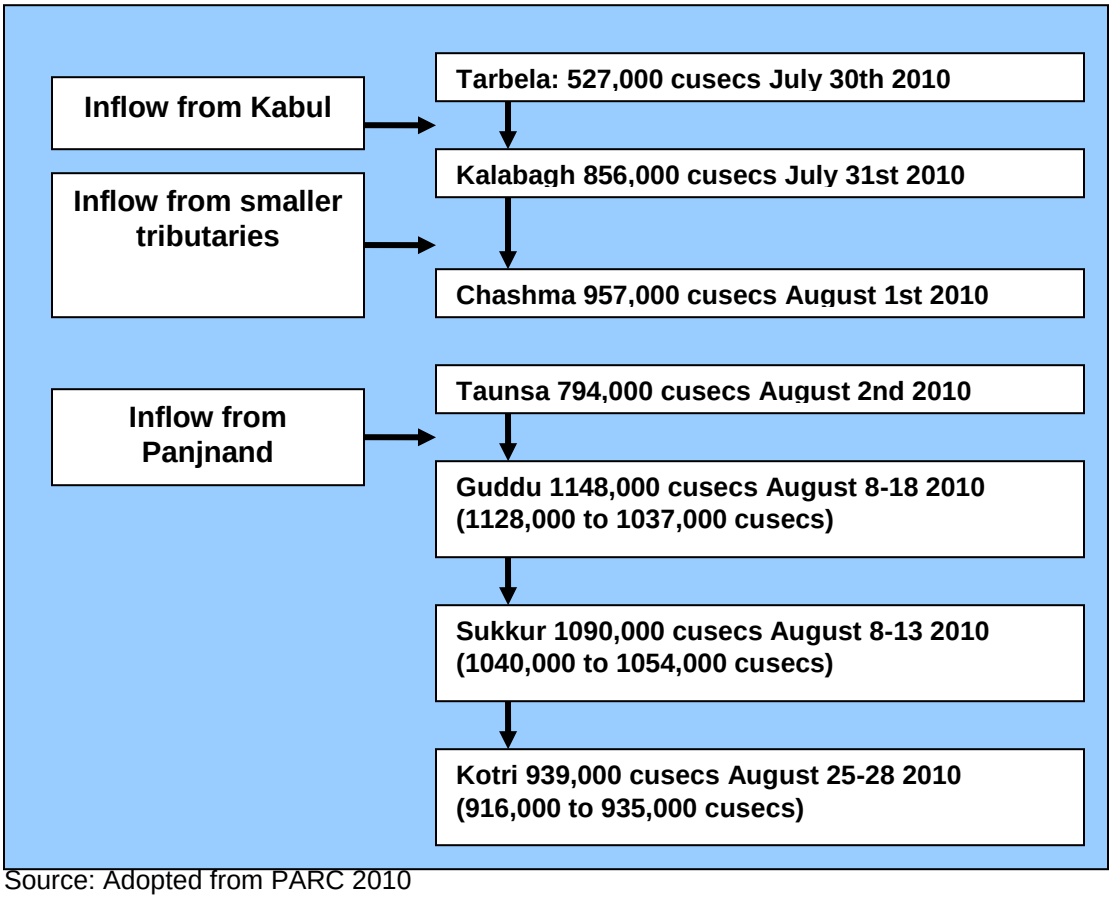
Heavy rains in KPK caused high water flows and peaks leading to flooding

The intensive and prolonged rainfall that occurred in the steep north western mountains of KPK generated heavy amount of water causing soil erosion of steep soils and land sliding that flushed into streams and rivers. The watersheds in these mountains are fragile, dry and highly erosive by nature. These areas had never received rainfalls of such intensity. These watersheds are heavily degraded too because of deforestation that caused rapid runoff and increase flood peaks. The duration of flood peaks persisted almost a day in the upstream areas to 11 days at Sukkur barrage and almost 29 days at Kotri barrage (PARC 2010). The peak started at Tarbela Rim Station on July 30 and it reached Kotri Barrage on August 27. Total flood flows were in the range of 527,000 to 1,148,000 cusecs. (Figure 7).

It is important to mention that similar or even higher flood peaks/discharges (up to 1,166,000 cusecs at Sukkur barrage) were experienced during the super floods of 1973,

1976, 1978, 1986, 1988, and 1992 but the overall losses were less than the 2010 floods (Obtained data from Irrigation Department, Government of Sindh). This could be a clear indication that the capacity of the Indus River Systems (IRS) has drastically reduced to absorb/attenuate flood peaks because of other unwanted human induced factors (discussed in next section).

Figure 7: Flood peak flows on Indus Main at Rim Station and Barrages during Floods



Source: Adopted from PARC 2010

Limited storage capacities and poor management of irrigation infrastructure increased the flood peaks.

An important component of water flows in IRS and flood management is the Indus Basin Irrigation System (IBIS). It is comprised of the mighty Indus together with its tributaries

(Jehlum, Chenab, Ravi and Sutlaj) and a large contiguous network of dams, barrages and canals. The country has three large dams, eighty five small dams, nineteen barrages, twelve inter-river linked canals, and forty five command canals (data obtained from irrigation department data, government of Sindh). Furthermore the country has numerous wetlands/ lakes though most have dried up or encroached by humans. The 2010 flood flows outpaced the existing capacity of the IRS/IBIS. The IBIS is continuously degrading and the storage capacity of reservoirs is at a declining trend because of heavy sedimentation. Yet, the country has not been able to develop additional storage capacity on the Indus since 1976 (PARC 2010). It was also learnt during discussions with NGOs and communities that most river streams, linked canals and irrigation channels have been heavily silted and are never cleaned by irrigation department and hence the flood water from rivers and canals over flowed and inundated extensive agricultural lands and settlements in those areas (See Table in the Annex).

Poor management of the protection bunds caused overflows from rivers that further inundated wide areas and expanded the flood impacts.
Protection bunds/retaining walls/ embankments play an important role in flood management. These protections were built along the Indus and its tributaries in 1976 by irrigation department with mandated responsibility of regular repairing and strengthening. The partner NGOs informed that these protections and other infrastructures for managing the flood flows on its natural pathway are sub-standard in quality and inadequately maintained (see Table in the Annex). They also mentioned that the protection bunds/ retaining walls breached at many places affecting populated areas. Irrigation department officials claim that these bunds breached naturally because they remained dry for the last 15 – 20 years and because high flood flows/peaks forced them to breach. The NGOs and communities however blame the irrigation department for weak structures. The also stated that heavy losses occurred in those areas where the bunds were intentionally breached by the influential feudal lords (e.g., breaches were made at Torhi, Superio, Manchar lake, Begari, MS Bund, Surjani Bunds) to protect their own property (the dispute is still in the court). In some places, communities strengthened the retention walls on self help basis during the flood.

Overall, there was a complete mismanagement for flood protection with no clear flood management strategy and no pre-determined plan by the government for diverting/breaching the excessive flood water to safe places with minimum losses. Using the 2010 floods as the worst case scenario, and given that future such floods are inevitable because of climate change, there would be a need to urgently map-out safe breaching points and designate them with a legal status. Regular strengthening and monitoring for the flood protection walls should also be undertaken, especially with support from communities.

3.3. Unsustainable land use practices exacerbated flood impacts

A number of unsustainable land use practices are on-going in the catchments and Indus Basin. These include overexploitation of mountain ecosystem, illegal encroachments in river beds, artificial changes in natural river flows and unplanned infrastructural development in the Indus main and its tributaries. These unsustainable land use practices exacerbated and widened the flood impacts.

Upstream, the pressure on natural resources (including deforestation, overgrazing and use of steep lands for cultivation) has been causing watershed degradation and changes

in the mountain ecosystems. These unsustainable practices therefore have substantially decreased water retention/absorbing capacity, enhanced surface run off, erosion of top soils with the resulting high sedimentation loads in rivers and dams (GCISC 2003). Downstream, the Indus Basin and its tributaries have become home to densely populated communities obviously because of increased livelihood opportunities for the rural communities in those areas. The Indus Basin has one of the world's largest canal irrigation networks where intensive agriculture is practiced that has caused substantial land use changes (Oxley 2010). Extensive wetlands are being cleared and artificially drained along the Indus River and its delta to make space for expanding agricultural lands. Legal and illegal encroachments of fertile lands mostly by influential are on-going on both sides of the Indus and its tributaries. River beds have been narrowed down filled up by residential and industrial wastes, thus blocking natural flood control mechanisms and have become barriers for free passage of excessive flood water in the rivers (see Table in the Annex).

The unregulated urban development and poorly designed physical infrastructure such as roads, bridges, canals and culverts have also become barriers preventing rain water to reach the sea via its natural path. These structures are less sensitive to attenuate super floods. Discussions with communities and NGOs revealed that these new built infrastructure played role in obstructing the smooth flood flows in rivers and thus caused heavy damages. The NGOs mentioned that most properties that flooded had been built in the last 25 – 30 years. This reinforces a need for strong controls in the development of infrastructure in the floodplain and these should be sensitive to floods.

4. DRM Policies and Performance of Institutions in Flood Management

Pakistan's lack of preparedness has added to the toll of the floods. The current policies and flood protection schemes proved not to be adequate for dealing with high intensity floods. According to the DNA, (a) the exceptional intensity and prolonged period of the rains and consequent flooding clearly overwhelmed national, provincial and local disaster/flood management capacities, particularly at the district level; (b) the partial implementation of already prepared national response and contingency plans, limitations of existing early warning arrangements and emergency response mechanisms; and (c) the affected communities lacked disaster preparedness awareness, sensitization and education regarding localized hazard and flood risk reduction, emergency preparedness and response functions -particularly required for populations located within flood plains (DNA 2010).

4.1. National roles and capacities in DRM

The National Disaster Management Authority (NDMA), under the guidance of National Disaster Management Commission (NDMC) led by the Prime Minister, is the main coordinating agency for managing all disasters in Pakistan, including both pre-disaster preparedness/ risk mitigation. NDMA was established in 2007 in the aftermath of 2005 Earthquake through an Ordinance which was promulgated as an Act of Parliament in December 2010 (NDMA website). Similarly, Provincial Disaster Management Authorities (PDMAs) in all the provinces and District Disaster Management Authorities (DDMAs) at district level have been established under the supervision of Provincial Disaster

Management Commissions (PDMCs) led by Chief Ministers in each province. Gilgit-Balthistan, FATA and AJK have similar institutional arrangements.

It is encouraging to note that since the establishment of NDMAs/PDMAs the disaster management focus has shifted in the country from simply post disaster emergency relief and early response to a holistic approach covering the full spectrum of DRM cycle including response, preparedness and risk reduction. The National Disaster Risk Management Framework (NDRMF) is the major policy document that encompasses nine priority areas covering all the above DRM aspects. The NDRMF essentially revolves around the objectives of the Hyogo-Framework of Action (2005-2015) adopted in Hyogo Japan in 2005, which is the major global agreement which was signed by 168 countries including Pakistan (HFA 2005-15). The HFA underscores the need for a holistic concept of DRM covering the pre-disaster preparedness and risk mitigation, as well as introduction of approaches to integrate DRR in post-disaster relief and recovery (See Annex 2 for more details about the HFA).

For the implementation of NDRMF in the country, NDMA has to rely on PDMAs and DDMAs because DRM falls under the provincial responsibility. However, PDMAs and DDMAs are still in naissance stage and their capacities have to be substantially enhanced before they could independently take the charge for managing diverse and more frequent disasters. Furthermore, the PDMA and DDMA officials get frequent transfers which have implications for sustaining the DRM capacities in the province/district. This is a serious issue, hindering the sustainability of DRM activities. The government has to resolve this issue through establishing a permanent set-up at district level, including allocation of DRM funds.

For the past two years, NDMA initiated few activities but would require a lot more efforts before they could be effective. DRM Plans for a number of districts have been prepared including some flood affected districts but these would need implementation by DDMAs. These district DRM plans were never used by the district officials, especially during the 2010 floods. Pre-monsoon contingency plans are prepared by each district but these are mostly supply based that focus only on the inventory of machinery and facilities that exist with relevant departments in the district (e.g., departments of civil works, irrigation, agriculture etc.). These contingency plans are not based on needs of the potentially affected community. Thus while there are different plans for DRM but these are not need based and sometimes overlapping. This is an important area of intervention. In discussions with NDMA, it was emphasized that one district DRM/ Hazard Livelihood and Vulnerability plan for each district should be developed that include hazard mapping, vulnerabilities and risks, and quantitative information about the likely affected population, their livelihood needs and a contingency plan with clear coordination mechanisms, roles and responsibilities. This plan should be a live document and updated annually.

Similar contingency plans are also emphasized to be developed at provincial levels and jointly discussed using the NDMA pre-monsoon coordination meetings forum. Such meetings are organized by NDMA since the last three years, involving federal and provincial relevant departments. Even before the 2010 floods, a pre-monsoon coordination meeting was organized in Jun in which contingency preparedness for monsoon was discussed and gaps identified including some remedial measures. The Pakistan Meteorological Department (PMD) also presented forecast results for the monsoon to be normal in 2010 as such no serious preparatory measures were made by the respective departments. This point towards deficiencies in seasonal weather

forecasting and early warning system, and which would need serious efforts to improve the system including its dissemination up to communities.

A joint DRM programme of NDMA and One UN is ongoing since 2009 to implement the NDRMF that covers four outcomes (a) strengthening of policies and institutions at national and provincial levels, (b) Information management/ hazard and vulnerability assessments/ early warning systems for major disasters, (c) DRM education, and (d) Strengthening local DRM mechanisms at district level, including district response capacities and community based DRM (CBDRM). Some progress has been made in initiating activities under the above mentioned joined programme of NDMA/ One UN. This joint programme is however highly resource constrained, mainly because DRM has remained a low priority for donors in Pakistan. Major bilateral donors that may have interest in DRM area for example DEPECO, DFID, EU, USAID, NORAD etc. No discussions were made with these major donors but after the 2010 floods in Pakistan there interest must have increased in disaster preparedness with particular reference to more frequent disasters like floods and droughts.

While the NDMA, PDMAs and DDMAs with the support of Army, UN humanitarian agencies and NGOs were instrumental in mobilizing rescue and relief response immediately after the flood, a number of gaps existed that delayed timely support to the affected population. These included (a) Local stocks (food and non-food) were not readily available in the affected areas. These were stockpiled and arranged from provincial headquarters and transported from long distances and as such the affected communities (including women and children) were without food, water, medicines and shelter for two to three days, (b) Many areas were inaccessible because the roads and communication networks were damaged and there were no sufficient means of transport for the communities. Army had deployed helicopters for air drops and rescue boats that could not meet the needs of the widely affected population, (c) There were no designated escape points and/or camp sites and as such the affected communities did not know as to where they should reach. Most communities had no option and stayed with their women and children under open sky along roads or on bunds without any water and sanitation facility and fodder for their animals, (d) Where some camps could be arranged, these also lacked facilities, especially latrines for women. In most areas, local NGOs and civil society was found to be more proactive despite limited resources in their hands.

Thus, despite of the fact that legal frameworks and institutions are in place, overall national and local capacities in disaster response and preparedness was significantly deficient and fragmented. Furthermore, coordinated efforts to implement effective DRM programmes (including efforts in pre-disaster preparedness and risk reduction measures) that reach the communities and local actors, remain weak or non-existing.

4.2. National Flood Forecasting and Management System in Pakistan

There are multiple institutions involved in flood management in Pakistan. The Federal Flood Commission (FFC) is the main agency responsible for flood control in the country. FFC was established in 1977 to ensure coordination and management of floods and flood protection works in an integrated manner. FFC is also responsible for formulating a National Flood Protection Plan including structural and non-structural elements, and ensuring its implementation through the provinces. WAPDA and PMD also have important roles to play in flood forecasting and early warning.

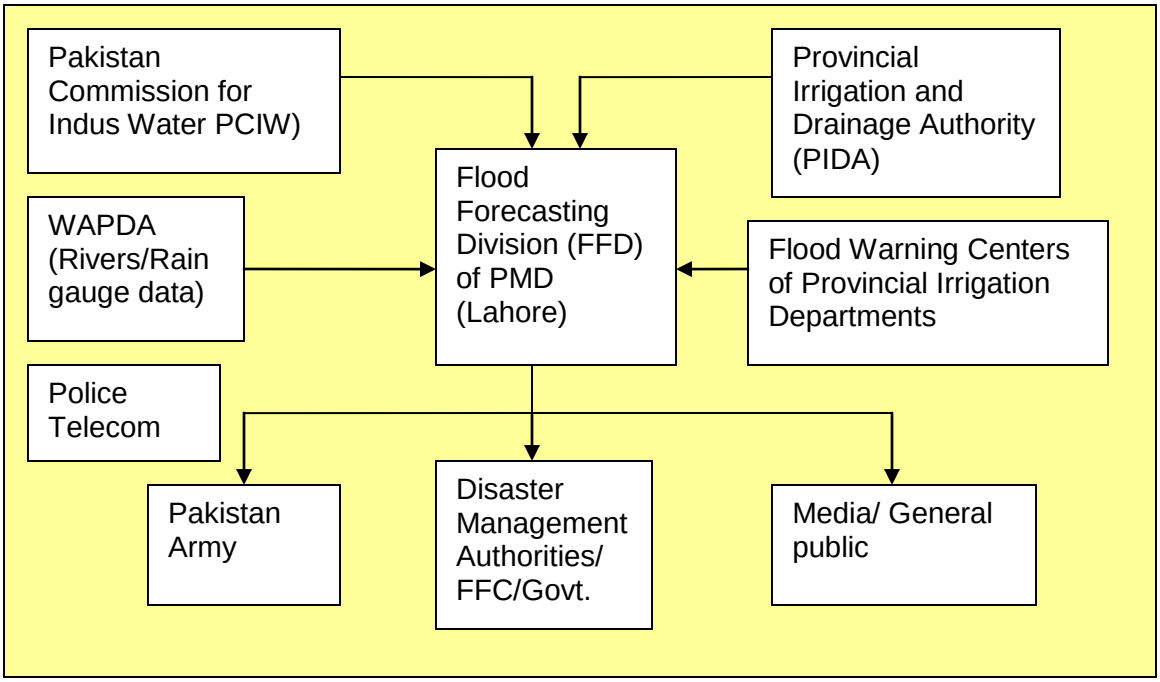
In view of the recurrent floods in the country, Pakistan has established flood forecasting and warning system coordinated by the Flood Forecasting Division (FFD) of PMD based in Lahore.

The process of flood forecasting and monitoring system undergoes three stages:

- The PMD, in the first sage, monitors the monsoonal weather system that generates either in the Arabian Sea from the west or the Bay of Bengal in the east. Their movements are tracked for the upper catchments lying in Pakistan or across the border and forecasts are made one to two days in advance for likely rains and the intensity of these rains. In case of rains, the amount of rainfall is gauged and assessed for their potential run off relationship above the rim stations.
- Next is the flood formation stage which starts with the generation of runoff from the rim stations and moving down in the Indus River and its tributaries. Forecasting of the predicted rainfall and the flow data and the actual flows upstream constitutes the hydro-meteorological component of the flood forecasting system.
- Finally, monitoring and managing the routing of the flood wave below the rim station of the rivers at the downstream sites is the hydrological component of the forecasting system. This is managed monitored by WAPDA and managed by irrigation departments in respective provinces.

The flood forecasting, monitoring and dissemination of warnings is therefore a complex system that involves a number of different organizations as shown in Figure 8. Flood Forecasting Division (FFD) of Pakistan Meteorological Department (PMD) is responsible for the forecasting of floods and the issuance of forecasts both qualitative and quantitative on daily basis during the flood season. PMD has a network of Radar/ Satellite system that covers whole of Pakistan, and parts of Afghanistan, Iran and the Arabian Sea. PMD also have observatory stations spread all over Pakistan.

Figure 8: Flood forecasting and warning system in Pakistan



For the flood monitoring and management, WAPDA has an active involvement and provides the river flow data from through telemetry sensors located within the catchments of the rivers. This telemetric network is directly linked to FFD where WAPDA established as office, which has permanently been established within the premises of FFD. These telemetry sensors are however located below Tarbela and flows generating in the upper catchments are not captured from where major flows generate. Thus the information on the flow of water is always late. WAPDA also provides the data on water levels and discharge from its hydraulic structures such as Mangla and Tarbela Dams and the Chashma Barrage.

The Punjab Police Wireless Telecommunication Wing also establishes a camp office in FFD Lahore and deploys teams at about 27 head works and several link canals on the Indus river and its tributaries to collect discharge data during the flood season. This data is communicated to the Camp office at FFD at three hourly intervals and in critical conditions on hourly and half hourly basis. This information helps in the issuance of daily flood forecasts for monitoring the flood situation in the main rivers. FFD also coordinates and obtains quantitative data from the Provincial Irrigation & Drainage Authority (PIDA) which plays a significant role in the process of flood monitoring and management. Major flood related functions falling within PIDA domain are; flow measurement at the specific sites at rivers, canals and nullahs; designing, construction and maintenance of flood protection works; maintenance of data communication network on Indus river and its tributaries to provide the river flow data to FFD; and diversion of excessive water to/from canals to manage the flows. It can be noticed that some of these functions duplicates with WAPDA and police telecom.

Since a greater part of upper catchments especially in the eastern parts of Himalayas that generate floods lie across the border in India/Indian-held Kashmir, the river flow data from India is obtained by the Pakistan Commission for Indus Waters (PCIW) under 1960 Indus Water Treaty. This information is shared with FFD as well. It would also

important for PMD to strengthen linkages with the Indian Meteorological Department for monsoon early warnings. Similar linkages of PMD with other regional and global forecasting systems would need strengthening.

The Pakistan Army Engineers Corps have a significant role in flood related functions. An Army engineer is placed during flood season in the FFD for timely communication of flood warning to D.G. Engineers so that the Army support in relief and rescue could be mobilized.

The flood warning information is disseminated by FFD to NDMA/PDMAs, FFC, respective departments. The information is also disseminated by FFD to the general public through print and electronic media. District Coordination Officer (DCO) mobilizes its staff and police department for warnings to rural population and to help them in evacuation.

Thus while a comprehensive flood management system is in place there have been multiple institutions involved in flood management some times with duplicating roles. These institutions also have different reporting lines both at federal and provincial levels. These coordination mechanisms need to be streamlined, strengthened and duplications removed.

The experiences of the recent floods revealed many deficiencies in flood forecasting, monitoring and management. Especially, the present flood forecasting system failed in capturing very accurately the extreme precipitation events like the recent mega flood of July/August, 2010. Similar deficiencies were also observed when heavy precipitation hit Islamabad/Rawalpindi on 21 July, 2001. Unfortunately, despite the fact that flood depend on the magnitude of rainfall in the upper catchments, there are insufficient met stations in those areas and none in the higher mountains. Furthermore, while the PMD has full capability to generate accurate weather forecast for likely rains before 24-48 hrs and some capacity in medium term forecasts (1 – 2 weeks), long range seasonal and annual forecasting capability is not well developed as this science is still in the developing stage all over the world. These limitations hamper the flood forecasting and early warning capacity of the PMD. Yet the European Weather Forecasting Center, London had predicted this extreme event a week ahead with 80% probability but it was not widely disseminated (Washington Post, Feb 2011).

The current flood early warning system also has deficiencies in wider dissemination of flood forecasts down to communities. Fore example, while the flash flood due to heavy rains in the upper catchments (e.g. Swat and Dir) was abrupt and therefore early warning could not be timely disseminated, sufficient time was available for early warning and to evacuate the population in the lower parts of KPK (e.g., Chasada and Nowshera). Early warning was not issued to these communities with the result that heavy losses of life, livestock and property were inflicted. These communities were not informed in time. In the plain areas (Punjab and Sindh) the communities were informed and evacuated ahead of time but they faced other difficulties. The NGOs informed that among others, communities were not well prepared and willing to evacuate because they received mixed messages on flood peaks/ flows and therefore lacked confidence in forecasts.
Concerted efforts are needed to improve the flood Early Warning System (EWS), especially because its value has grown with the strengthening of links between DRR and Climate Variability (HFA 2005-15). Early Warning is the provision of timely and effective information system through identified institutions that allows individuals exposed to a

hazard to take timely actions, avoid or reduce their risks and prepare them for effective response. A complete and effective Early Warning System thus comprises four elements (a) risk knowledge (b) regular forecast information services, (c) community centered dissemination/ communication system in local language, and (d) set of institutional/ organizational capacities (see Figure 9)

Figure 9: Elements of Early Warning System

Risk knowledge Systematically collect data and undertake hazard and vulnerabilities assessments	**Forecast information/ Monitoring/ w services** Develop monitoring and early warning services
Dissemination/ Communication System Reaching to targeted stakeholders Information is relevant and timely Messages are easily understood	**Institutions and capacities** Government institutions Local NGOs Community Organizations

Source: LP-IC 2010

5. Recommendations and way forward

5.1. Proposed Flood Risk Management Strategy for Pakistan

Floods are recurring phenomenon in Pakistan generated by heavy monsoon rains. Normally the floods of low intensity (Category I & II in meteorological terms) that mostly generate from the Bay of Bengal are welcomed by the communities in the Indus basin and the delta. However, Category III super floods are considered as one of the most devastating hazards in Pakistan as it happened in 2010. These occur when heavy rains are generated in the upper catchments caused by interaction of two weather systems that is low depression generated from the Bay of Bengal and strong westerly wave present over Afghanistan/Northwest Pakistan (see Sheikh 2010, and Rehman & Kamal 2005, for detail classification of floods in Pakistan).

The country has to move from simply flood control mechanisms more towards flood management including policy and planning. Following major actions are proposed.

Raising DRM awareness for changing the mindset: It would be necessary in the first place, to change mindsets at all levels from reactive to preventive mode for all types of natural disasters with more emphasis on response preparedness and risk reduction measures in line with the principles laid out in NDRMF and the Hyogo Framework of Action. Partly some achievements have been made with the establishment of NDMA and PDMAs. However, policy makers/ politicians are still not aware of the holistic concept of DRM. Lack of information and capacities in DRM could also be observed among the line departments, district level officials and communities. *Responsibility: NDMA/ UN agencies (lead), PDMAs, Line departments, I/NGOs, Media.*

Developing Flood Management Policy and Strategy: A flood management policy and a comprehensive flood management strategy should be prepared by the government and approved by the national and provincial assemblies with clear roles and responsibilities of institutions including a strong mandatory coordination role of NDMA at federal level and PDMA in each province with links down to district levels. These institutional arrangements and roles are already envisaged in the National Disaster Risk Management Framework (NDRMF 2007) but require more strengthening and implementation.

The flood management policy and plan should enforce strong regulatory mechanisms to stop the illegal riverbed encroachments, unplanned settlements, and introduce building codes for necessary infrastructure. It would also be necessary to map out the changing flood “pathways” and devise a strategy as to how these should be managed to ensure that the design and location of developments takes account of its susceptibility to flooding, river systems and flood defence infrastructure, the likely routes and storage of floodwater and its influence on flood risk downstream. Lastly the flood risk management strategy should focus on streamlining post flood humanitarian operation as well as pre-flood response preparedness. The working of the humanitarian agencies (both government and non-government) should be made coherent to channel the relief response under one umbrella of NDMA and PDMAs. *Responsibility: National Disaster Management Commission (NDMC) and NDMA (lead, Donor agencies/WB/ADB/UN to assist, Approval by National and Provincial Assembly.*

Contingency plan based on various scenarios including 2010 floods as worst case scenario: It would be right time for NDMA to map out the 2010 flood as worst case scenario and develop a contingency plan. The plan should include where the river should be breached so that the losses could with minimum. It should also determine roles and responsibilities for pre-flood EWS and post-flood response, including stock piling and inventories. *Responsibility: NDMA (lead), UN to support, Approval by NDMC.*

Less complex Early Warning System (EWS): A well coordinated but less complex flood early warning system (including flood forecasting, monitoring and dissemination reaching to grass root communities- men and women) is necessary. PMD needs to ensure its presence and establish more met stations in upstream areas. WAPDA should also install telemetry sensors in those areas for timely information on flood water flows. Irrigation department to manage the canals and drainage system.

The floods EWS should be updated too in light of the changing climatic situation. The flood management system only meets the flood management requirements of the Indus flood plains in Punjab and Sindh. Research work based on long-term climate change data points towards a scenario of future occurrence of heavy rainfall events during monsoon seasons over north-west Pakistan instead of north-east parts. As a result, areas along the western rivers of the country (Indus and Kabul) will be more vulnerable to flood episodes similar to the one experienced during the current season. No flood management system exists in KPK and Balochistan, especially for forecasting and monitoring of flash floods that have become more frequent in these provinces and in Southern Punjab. This could be an important intervention to be included as part of the flood risk management strategy for the country. These upstream areas are highly fragile and degraded which would require urgent attention for rehabilitation. Responsibility: Federal Flood Commission (FFC)/ NDMA (Lead), PMD, WAPDA, Ministry of Water and Power, I/NGOs, UN agencies to support.

Improving irrigation and drainage systems: Policy makers must also improve the water management system in Pakistan In light of the changing climatic situation. This should include wise and efficient use of water including tapping of flood water through more reservoirs upstream and along the Indus basin. *Responsibility: Ministry of Water and Power/ Irrigation departments (lead*), Donors/Un agencies to support.

Ecologically sound flood management practices: There would be a need to initiate ecologically-sound flood management practices in the mountain areas through improving and protecting forests and watersheds so that to increase the water absorptive capacity of the degraded water lands and reduce water run off.

The country also needs to shield the already poor population from extreme weather events. Especially, the country needs to prepare for and timely adapt to the changing atmospheric/ precipitation patterns and the associated extreme climatic events leading to disasters. The super floods caused by heavy rains this time may next such flood or a prolonged drought. Pakistan is already feeling the effects of climate change, and one of the effects climate change brings is unexpected precipitation events. Floods could therefore worsen because of climate change unless ecological sound flood prevention techniques are adopted. These consist of forest conservation, watershed management and river/delta conservation. *Responsibility: Ministry of Environment, Forest departments, Donors projects, I/NGOs.*

Strengthening Logistical capacities: There is a need to establish food and non-food warehouses at strategic places in the flood prone areas. *Responsibility: NDMA/PDMA/ WFP.*

Strengthening local capacities: The local-level capacity will have to be strengthened being the first line of defence in providing flood protection and then relief. The distant central government cannot do it. Responsibility: Local government/ /NGOs.

5.2. Specific recommendations

Table 3 lists specific recommendations for flood risk management on the basis of discussions and findings from the previous sections. Using the principles as highlighted in the Hyogo Framework of Action (HFA 2005-15), these specific recommendations are grouped under those needed for reducing the underlying risk factors and those necessary for effective response through strengthening disaster preparedness capacities at all levels (national, provincial and local levels).

Table 3: Specific Recommendations for flood risk management in Pakistan

Cause	Effect	Recommendations	
		Reducing underlying risk factors	**Disaster preparedness for effective response**
Monsoons are shifting towards western mountains (KPK) due to climate variability/ extreme events	- More flash floods - Increased erosion - High sedimentation in streams and reservoirs	- Introduce climate change adaptation practices by MOE. - Focus also on western mountains for flash flood management (FFC/PMD) - Integrated watershed management programmes (MOE) - Forest plantations involving communities - Check dams - New reservoirs (upstream) - Legal measures to stop encroachments of forest lands and river/stream beds for settlements/agriculture - Community awareness/ training for sustainable land-use practices	- More meteorological stations in upstream areas by PMD - Improving PDM forecasts (including seasonal forecasts) - More telemetry points by WPDA - EWS for flash floods with dissemination down to communities (including women) - Community awareness/training programme for safe/timely evacuation (including involving women) by UN agencies/INGOs
Unsustainable human	- Negative impact on	- Legal measures to	- Training the

Cause	Effect	Recommendations	
		Reducing underlying risk factors	**Disaster preparedness for effective response**
practices (encroachment of river beds, river water diversions though illegal structures, deforestation etc) (KPK, Punjab and Sindh) Poor management of protection walls/bunds (Punjab and Sindh)	hydrology/ river flows, natural pathways - Reduced wetlands - Reduced capacity of existing reservoirs due to sedimentation.	stop encroachments - A forestation along the rivers and streams - Irrigation department should strengthen the protection walls and regularly maintain them	communities in managing the protection walls to avoid breaching during floods. - Mapping of flood pathway including plan for breaching of protection bunds with minimum losses.
Poor irrigation water management system - Canals and distributaries are not properly maintained - New canals are built with low sensitivity to floods - Inefficient irrigation systems - No additional reservoirs since 1980s.	- Limited storage capacity for diversion of excess water - Canals capacity has reduced due to silts that cause overflows in case of excess flood water - Water logging and salinity	- Construction of new water reservoirs to mange the over flow (could be used for irrigation when needed) - Introduction of improved irrigation practices	- Introduce mechanisms for de-silting of canals by communities on self help basis. - Training the communities to stop overflows
Poor flood monitoring and forecasting system - Met forecasts only before 3-7 days - Insufficient met stations by PMD and no telemetry points by WA{DA upstream - Coordination is complex/ weak (multiple institutions) - No community involvement	- No timely warning down to community - Communities have less faith on forecasting	-	- Need to improve the flood monitoring and forecasting system involving communities. This should also include monitoring and forecasting of flash floods. - Improved coordination system. - Dissemination system down to communities
Poor flood management system - No flood management policy/plan - Limited/ no stock piles/storages (food and non-food) - Multiple humanitarian institutions with poor coordination mechanisms	- Rescue/ relief response delays	- Need for a flood risk management policy and plan - Need to integrate DRR in all development planning - Need to prepare codes for infrastructure, roads, bridges etc. to be flood prone/friendly that do obstruct the flood flows and change the natural flood path ways.	- Need based contingency plan - Warehouses (food/non-food) at strategic places (with at least minimum required stock piles) - Humanitarian agencies to work under one umbrella (NDMA/PDMAs)

5.3. Way forward for integration of DRR in the on-going Reconstruction Phase

A real question facing Pakistani society at this juncture is, whether the floods are likely to exacerbate current inequalities and social tensions, or whether the reconstruction efforts will provide an opportunity to reduce them, and to put in place systems reducing the effects of future disasters. Preparing the communities and reducing the risks of future disasters should be the main focus in the post-flood reconstruction phase (DNA 2010). Furthermore, efforts should be made to reduce and not deepen inequalities by targeting the needs for all, not just the rich and powerful, and work with poor and marginalized communities that are most vulnerable.

Specific recommendations have also been provided for integration of DRR in rehabilitation of the flood affected communities as this opportunity should not be missed out during the currently on-going reconstruction phase. The HFA global agreement also underscores a need for systematic incorporation of risk reduction approaches into the design and implementation of response and recovery programmes (HFA 2005-15).

The recommendations for integrating DRR in the reconstruction phase may significantly reduce the future flood risks, prepare the communities in coping with these disasters and improve the resilience of these communities. It is important to refer to the DNA 2010 recommendation that the targeting of the affected population to reach to most vulnerable communities and categories of population should be used as basic principle in the reconstruction phase. It should be ensured that the rehabilitation and reconstruction efforts are socially equitable with support targeted mainly to those in greatest need. Special measures should be put in place to ensure that vulnerable groups living in the flood affected areas, such as women, landless labour, tenants, and those in reverine areas where property rights are poorly defined, fully benefit from the support measures to be provided through targeted outreach and monitoring.

Following are few examples and there could be many more in practice which need to be adapted:

- Design of flood risk prone irrigation structures (design of culverts, contouring, linear tree plantations along cannels etc.)
- Introduction of improved irrigation methods like raised seed bed, improved drainage, land leveling, avoiding extremely raised bunds etc.
- Watershed management, block tree plantations on sloppy lands, reforestation, check dams and construction of micro-dams/ponds in suitable catchments areas.
- Soil and water conservation measures (terracing, check dams, contour ploughing, grassed water ways, contour bunds, improved tillage and cropping practices.
- Land use planning, including settlements in less risky areas
- Awareness raising material on flood risk reduction e.g. raised food storages, raised platforms for housing, safer places for housing, safer schools and hospitals.
- Some flood disaster preparedness activities can be identified and introduced at the time of rehabilitation. For example, community early warning system, access to weather forecasting, identification of safer place for evacuation, evacuation drills.

- Activities for adaptation to climate change may also be introduced e.g., while supporting the communities for seed (next season) efforts should be made to distribute heat/ moisture resistant varieties/crops.
- Community awareness material should be distributed on how to avoid the flood risks and minimize their losses.

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Annexure

Checklist Oxfam Working Paper (Flood Risk management-post floods situation in Pakistan)

Purpose and objectives:

- Reflect on factors that exacerbated the devastation caused by the 2010 floods
- Ensure that lessons are learned, and
- Recommend appropriate actions so that next time Pakistan is well prepared.

The paper will provide feed-back to the government of Pakistan, NGOs and International donors to incorporate appropriate actions for flood risk management in the recovery and development phase so that to create a safer, more resilient Pakistan.

Checklist of questions:

This checklist has been developed for partner NGOs to obtain their perceptions including the affected local communities. The NGOs may ask questions as listed below in an informal way from (i) key informants (ii) group of affected communities in their areas and (iii) local government officials.

Flood Impacts, vulnerabilities and risks

- What were the impacts of the 2010 mega flood? No need to exactly quantify.
- Why the impacts were more or less? List reasons
- Were these impacts high or low compared to the 1992 flood? Why?
- Who were most affected in the area (e.g., farmers or other livelihood groups)? Why were they most affected? List reasons.
- What were the kinds of impacts on women? What made them most vulnerable? How did they cope with the situation?
- Where were the affected communities most located (e.g., those close to the river bed were most affected)? Who owns the land (e.g., mostly own land or mostly tenants or government waste land)? Is this a new land recently encroached? Since how many years the land was under use?
- Were there any unsustainable practices along the riverbed that have increased the flood damage? List them.
- Are there any unplanned encroachments/ new settlements along the river bed? Who are responsible for such new encroachments/ settlements (e.g., land lords, any other groups)?
- Were there any infrastructural barriers that caused more damages (e.g., the recently built close by bridge or road, irrigation canal or any other infrastructure)?
- Any other risks/vulnerabilities/actions that enhanced the devastations?

Pre-flood preparedness of communities/ local government

- Were the communities timely informed before the flood? How many hours/days before the flood? What was the source(s) of information? Did the communities timely evacuate? Who helped them?
- Were there any protection walls/ bunds to control floods? Did it help in reducing the impacts? Was the bund in good condition? If not why?
- Are the bunds well protected/ regularly managed? Who is responsible?
- Are there plantations along the river bed/ Bunds? Who manages?

- Did the flood water over flowed the bund? What should have been its minimum height? What should be done to make the bund stronger or more protective?
- Did the bund breach? How (e.g., the flood water broke the bund or it was manually broken)? Who broke the bund (e.g., communities themselves or government)? If by the government/army, was it the right place for breaching the bund?
- Were the irrigation canals/ channels regularly de-silted? Who does this?
- Were there any Communality Based DRM activities carried out before the flood? Who did CBDRM in the area? Did it help in reducing the impacts of 2010 floods? Explain how?
- Any other actions/practices that enhanced/reduced the devastations?

Post flood situation livelihoods

- How the communities are coping with the post flood situation? Are they back and houses built/renovated?
- Are communities back to normal livelihoods? Have they sown the Rabi crops? If no what are the hindrances (e.g., flood water is still standing; land needs leveling/ de-silting, irrigation channels/canals not in working condition etc.)?
- Are the rehabilitation activities initiated? Who are helping the communities for getting back to normal?
- Are the same tenants who were previously working with the land lords back? Or new tenants are being hired? Why?
- Has the flood changed the livelihoods patterns (e.g., more emphasis on non-farm work)?
- Are there any mass-migrations? Where?
- Has the credit indebtedness increased post floods? What is the source of credit?
- Are the local markets functioning and back to normal? Why not?

Recommendations for post-floods risk management

- What risk reduction actions at community levels are needed?
- What kind of disaster preparedness activities should be introduced (e.g., early warnings etc.)?
- What structural measures are needed to minimize losses? What other non-structural measures (including bio-engineering) are needed?
- How the encroachments along the river bed can be reduced?
- What policy measures are needed to reduce the risks of future flood damages?
- Any other recommendations?

Table: Partner NGOs Response to key questions on Flood Causes and Impacts (checklist was used to collect information from partner NGOs).

1. What were the causes of floods?
- Heavy monsoon rains and unplanned infrastructure in the river bed/katcha areas - In the case of Sindh, there used to be very rich forest cover that has almost vanished as the Government burnt these forests in most of the districts with the purpose of destroying the safe points of dacoits. - Unsustainable cutting of trees from the embankments also led to huge losses as the embankments got destabilized because of mass level tree cutting. Also non-maintenance of the embankments - After 1992, katcha land/river bed land was provided to people by the government - Illegal occupancy of river land by influential people - Establishment of human settlements and infrastructure increased the impacts of the floods - The past dykes and bunds could no longer contain the swollen rivers - Lack of evacuation management (unorganized evacuation) which increased the impact of the flood - Political and powerful people's involvement in breaches of bunds/embankments of their interest - Unplanned human settlement and infrastructure in the reverine areas and river bed caused hindrances in natural flow of flooding water. - As a result of new human settlements in the reverine areas/river bed, new link roads, main roads were constructed that hindered the water flow and caused more damages. - Over exploitation of natural resources (e.g., over cutting of forest trees) - It was negligence of the government departments, particularly irrigation department that was found totally incapable of managing the flood. - There were number of unsustainable practices along with river bed, which increased the flood damages, this include: deforestation, encroachments and human settlements in river bed, illegal bunds by powerful individuals, illegal cropping into riverbed removing of earth from bunds, pumping of water from river through tubewels to irrigate the land along side of riverbed., drainages like Right Bank Out Fall drainage (RBOD) in Sindh which chanalized the water and provided it exit to main land .
2. What were the impacts of floods
- Fast and furious flash floods in KPK destroyed all type of houses built of mud, stones and bricks and ruined all individual and their assets and belongings including cash, jewelry, ID Cards, legal documents of land donkey carts, ploughing equipment. - The reverine floods in Punjab and Sindh affected mostly mud houses. - Approximately one-fifth of Pakistan's total land area came under water directly affected about 20 million people, with a death toll of around 2,000. - Food sources and cash crops were damaged; lost cotton, sugarcane, rice, vegetables, fodder, agriculture tools, fodder/ straws. Some crops were close to harvesting. - Damaged irrigation systems, e.g., damage to water channels/courses, culverts, tube wells, peter engines. - Damaged all the sources of drinking water including hand pumps. - Other losses included losses of fodder pots, fodder cutting machines, chaff, poultry, sheds, small boats and damage to nets, damaged tractors, and storage structures etc. - Food grains became wet or drawn under flood water. Food stock, seed and fertilizer was washed away food storage of district government destroyed, stored manure demolished. - Fishing and livestock were affected. Livestock losses included thefts of livestock particularly small animals, livestock drowning and livestock diseases. livestock dispensaries were destroyed. - Micro and macro infrastructure including metal roads, tracks (kacha/packa), BHUs, schools, public buildings bridges, railways tracks, and electricity/power stations collapsed. - Small trades and business were also affected as the flood swept away their tools, equipment and machines.
3. Who were most affected?
- Poor were the first victims because of living in marginal areas in mud houses. Among them small farmers and tenants were most affected. - Daily waged labor and agri-labor living in settled areas. - Local rural markets based people.
4. What were specific impacts on women
- Around 72 percent of persons displaced by the flood were women and children - Women and children were exposed to a number of problems including sexual harassment, malnutrition, water born diseases and maternal and now born mortality. - Women and children in the camps/transitional settlements and in the villages in waters, they were most vulnerable to these problems. - This flood brought lot of worries and woes for women. They were emotionally disturbed, their livelihood tools such as sewing machines were washed away; their livelihood sources like livestock was ruined. - It is established fact the economic dependency of women on man makes her more vulnerable, therefore she has become more vulnerable and victim due to losing her livelihood sources and means of her earning.

- Many of women were pregnant during flood that's why they had to suffer immensely owing to non-availability of facilities at camps. They had to suffer emotionally owing to not have proper facilities and privacy of toilets, Pregnant and lactating mothers were most vulnerable to further health issues and life threat.
- Referring to OCHA reports from August 16, "the large numbers of children and pregnant and lactating women without access to food and the rising trend of diarrhea point towards a clear risk of malnutrition among the affected population."
- Health and Hygiene issues due to unavailability of resources, busy in constructing and pasting houses with mud liquid, lack of water. Collecting fodder for livestock.
- Being in flood crises the attitude of male is aggressive with family.

5. What was Government Preparedness? Was it effective?

- Government, local institutions and the communities had little capacity to manage this mega flood. Impact was unprecedented mainly because of absence of flood management capacity both at the government and community level
- Pre-flood planning and management was almost absent
- Lack of coordination among flood response agencies
- No civil defense system made compatible
- Since the scale of devastation was too large hence evacuation could not be managed. Millions of people evacuated from their native places toward the relief camps, informal settlements and relatives which created insecurity.
- Unorganized evacuation due to lack of evacuation management which increased the impact of the flood.
- Communities evacuated, but faced a lot of problems in getting makeshift settlement at the camps/safer places.
- Non availability of technical experts who can accurately gauge the flow of water especially from breeches resulted in misinformation and rumors which created panic and unnecessary migration of people and mental trauma.
- There was lack of disaster experts in overall response. Government was short of human resources to respond. Non availability of technical experts who can accurately gauge the flow of water especially from breeches resulted in misinformation and rumors which created panic and unnecessary migration of people
- There was information gap about the flooding. Frequent changing of the information by the government about flooding and its effect further enhanced the devastations.

6. Did the responsible government departments helped in pre and post flood management?

- Irrigation department is responsible for the maintenance of bunds but these are not regularly monitored and maintained. Stone pitching over the bunds should be made and maintained regularly.
- The existing protection bunds/embankments controlled the devastating flow of the flooding, but since the flow of water was more than 1.2 cusecs that breached bunds. In Sindh, people are of the opinion that intentional breaches were made by the local authorities, influential people to the bunds in order to keep their agri lands and other property safe in their areas.
- Breaches were made in Torhi, Superio, Manchar lake, Begari, MS Bund, Surjani Bunds that increased the extent of the devastation. Local communities at few places strengthened the protection bunds themselves.
- Irrigation department is responsible for plantation along the river bed/bund but no sufficient plantations along the river bunds were done.
- Irrigation department is responsible for regularly de-siltation of the main canals, distributaries/channels, but were not carried out on regular basis.
- Some breaches were made by the government in order to reduce pressure of the water at a certain point with the purpose to save big urban cities.
- Some breaches were made to the bunds by the local influential people, authorities to save their individual properties near the river bed or in Katcha area. For example, breaches were made by influential people and/or local authorities in Torhi Bund, Begari Bund, MS and Surjani Bund, and Manchar Lake bund.

7. What are the post flood vulnerabilities/conditions of the affected population?

- Almost 95% affected people have returned to their villages and leading miserable life in a situation of total devastation of the livelihoods and massive destruction of the housing, communication and irrigation infrastructure, schools, electricity infrastructure and the household assets.
- Almost 50 percent flood affected people were not able to sow Rabi crops mainly because of the poor land conditions, siltation brought by flood water and no in hand money to manage the crops. Affects of the winter further add to the sufferings of the people.
- At many parts water is still standing and land needs de-watering (Particularly in Dadu and Jamshoro districts). The affected people would not be able to sow even Khareef crops as still government has not started working on rehabilitating irrigation channels, minors, distributaries or the canals.
- In rural areas/villages small business other than agriculture like small hotels/shops, labor, carpeting works, mason works, and black smith shops have not been resumed. In semi urban areas the businesses are resumed.

- In Punjab, communities have sown wheat and other winter crops with the exception of some communities due to inability to clear lands from heavy silt and sand deposition.
- Rehabilitation activities are at nascent stage carried out by the NGOs. Only a very nominal percentage of the affected population is facilitated in rehabilitation.
- Only some agriculture support (see and fertilizers) has been provided to farming communities for rehabilitation or early recovery.
- It requires to have a comprehensive 'Flood Rehabilitation Plan' in place to undertake all the aspects of rehabilitation including rehabilitation of the irrigation infrastructure government buildings, schools, link and main roads, electricity, local markets and agents, village level small enterprises.
- Government's role is quite absent to rehabilitate the affected population, land, market and economies, bunds, channels, canals, minors, housing and other physical infrastructure affected during flood of 2010.
- Almost all the tenants/farmers previously working with land lords are back.
- Some indebted tenants are not willing to go back towards same landlord. So landlords have arranged new tenants.
- Credit indebtedness increased mainly for food security and livelihood security. Local credit providers is the main source.
- Local markets in the rural flood affected areas have not been back to normal situation mainly because of the damages to shop buildings/shelters, artisan tools, roads leading to main market, no mobility of the rural to main markets, no investment power to re-build the small enterprises etc. Local markets in semi urban localities have back to normal.
- Flood has definitely changed the pattern. People instead of farming, which became impossible due to standing of water has begun to do work on daily wages into small cities
- The relationship between the built environment, social and economic systems is disturbed by the 2010 floods.
- A change in human settlements, local markets, livelihoods has been witnessed.
- A significant number of people migrated to semi urban towns, cities to earn livelihood as in villages the agro based income sources are totally devastated and have become jobless.

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