Policy Brief No: 44

Planning for Floods: Now or Never

By:

Fahad Saeed, Abid Qaiyum Suleri,

Kashif Majeed Salik

A publication of the Sustainable Development Policy Institute (SDPI).

Sustainable Development Policy Institute is an independent, non-profit research institute on sustainable development.

First edition: December 2014

Mailing Address: PO Box 2342, Islamabad, Pakistan.

Telephone ++ (92-51) 2278134, 2278136, 2277146, 2270674-76

Fax ++(92-51) 2278135, URL: www.sdpi.org

Table of Contents

Introduction

The year 2014 is the fifth consecutive year when Pakistan is undergoing extreme weather conditions. In July 2010, Khyber Pakhtunkhwa (KP) and the Punjab provinces were affected by record rains causing heavy floods, 1700 deaths and disruptive impact on over 20 million people (Houze et al. 2011; Webster et al. 2011). In 2010, the magnitude of catastrophe was so high that the number of affected people exceeded the combined total of people hit by the 2004 tsunami in Indian Ocean, the 2005 earthquake in Pakistan, and the 2010 earthquake in Haiti. In September 2011, a massive flood severely hit Sindh province, caused over 400 deaths, affected 8 million people, and inundated 1.7 million acres of arable land (Habib 2011). In 2012, Pakistan received unprecedented rainfall resulting in over 450 deaths and affecting more than 5 million people along with thousands of acres of arable land in KP, Southern Punjab and Upper Sindh (CNN 2012). Intense rainfall caused flooding yet again in August 2013, but this time in different pockets throughout the country, including KP, Karachi city, and central Punjab, resulting in around 200 deaths, and affecting 1.5 million people. To this series of flooding, the year 2014 was no exception, when a heavy cloudburst occurred once again over Kashmir region resulting in huge devastation in Indian held Kashmir (IHK), Azad Kashmir as well as downstream areas of Pakistan. This time the death toll has risen to 500 people both in India and Pakistan besides the number of people affected by the floods was again in millions (Singh et al. 2014).

Can floods be attributed to changing climate?

The consecutive extreme rainfall during the last five years rings alarm bells among the scientists to find out the reasons behind it. It is a general perspective that climate change is responsible for extreme events (such as floods and droughts) due to increased Green House Gases (GHGs) in the atmosphere. GHGs (water vapour, carbon dioxide, methane, etc.) are the important part of the earth's atmosphere, as they trap the radiations emitted from the earth's surface and reflect a good part of it back to atmosphere. However, after the industrial revolution, there has been an out of all proportion increase to the GHGs in the atmosphere. This increase leads to enhanced trapping of earth's radiations and hence resulting in increase of the earth's temperature. In the recent assessment report of Intergovernmental Panel on Climate Change (IPCC), the earth's mean temperature is reported to have been increased by 0.85°C due to changing climate.

There are robust projections according to the latest research, which suggests that we are not just heading towards a simple and steady increase in global precipitation, rather shifting towards less frequent, but more intense rainfall events. This would lead to a threatening situation with an increase in floods and droughts in the wet and dry regions respectively. The question remains that how this increase in temperature will cause extreme events like floods and droughts?

Let us assume that there is a balloon in the air above a certain region, which bursts and causes rainfall when it is filled with 100 liters of water. The rise in atmospheric temperatures due to climate change will increase the capacity of the balloon to hold more water, so 150 liters of water would perhaps be needed to burst the balloon. This increase of 50 liters will affect the wet as well as dry regions. The drier regions, which are already devoid of water, will struggle to find extra 50 liters of water for rainfall to occur and hence would get drier. On

the other hand, the wetter regions, which used to get rains at the threshold of 100 liters previously, will not get rain unless the balloon is filled with 150 liters. However, when the threshold of 150 liters is acquired, it will result in heavy downpour.

The above-mentioned analogy applies to monsoon rainfall as well. The monsoon phenomenon is very complex and involves a lot of moisture and energy. In the active monsoon phase from July to September, the winds from warm equatorial oceans, carrying a lot of moisture from Indian Ocean, travels towards the land. The moisture in the monsoon season arrives in Indus basin through mechanisms like movement of cyclones from Bay of Bengal, advection from Arabian Sea, local recycling of irrigated water, etc. There is another very interesting interplay between the monsoon currents and mid-latitude jet-stream resulting in heavy rainfall events over upper reaches of Indus basin (Ding & Wang 2007; Lau & Kim 2012). As the name indicates, mid latitude jet-stream is the fast moving stream of westerly winds meandering north and south across the globe in the upper atmosphere (at the height of around 12 km) and is known to affect the northern hemisphere weather to a large extent. Climate change is responsible for the unprecedented rainfall associated with the jet-stream over northern Pakistan in 2010, 2011 and 2012 (Rasmussen et al. 2014). The jet-stream got stuck for several days with a trough over northern Pakistan resulting in heavy downpour. The jamming of jet-stream is very strongly attributed to climate change. The initial analysis of 2014 flooding seems to have similar pattern of mid-latitude jet-stream blocking with the development of upper atmosphere trough over Europe in August, which created situation feasible for monsoon depression to intrude deep into the land and cause intense rainfall.

Floods & role disaster management bodies

On September 02, 2014, Jammu and Kashmir region was hit by more than 200mm of rain in less than 24 hours, which was four times the average monthly rainfall. Over the next few days, rains continued on both sides of the valley. On September 05, Jhelum river in Srinagar and Tawi river in Jammu were flowing above the danger mark (Jhelum at 12 feet above the danger mark in Anantnag district). This is considered the worst floods in that area during the last 50 years. The river dykes were breached to save major cities by the Indian authorities. The water flowed from Jammu to Pakistan and flooded the downstream seasonal nullahs (drains) of Sialkot and Chenab river for which Tawi serves as a major left bank tributary. The nullahs in Pakistan, with their catchment areas in Jammu, became uncontrollable, and the Chenab river turned violent. This coupled with heavy rains in Pakistan ruining districts after districts in the Punjab, and affecting parts of Sindh as well (Suleri 2014).

Both the Indian and Pakistani authorities had to face a lot of criticism by the stakeholders, their inability to predict rains on the one hand, and on the other, showing negligence to cope with the urgency. In Pakistan, the mainstream media incited an argument between the government institutions on the flood situation. Pakistan Meteorological Department (PMD) was somewhat praised by different analysts/experts for the event's forecast well before time. However, other institutions like National Disaster Management Authority (NDMA), Provincial Disaster Management Authority (PDMA), and Federal Flood Commission (FFC) had different stances. Let us examine the situation by analyzing the numbers and figures.

Two days before the onset of the event on September 01, Pakistan Meteorological Department's National Weather Forecasting Commission (NWFC) issued a weather advisory that reads:

"A well-marked Low Pressure Area (LPA) is located over eastern India (Southeastern Madhya Pradesh) and is likely to move west-northwestward during next 2 days. Under the influence of this weather system, strong monsoon current will start to penetrate in Pakistan (Punjab, Sindh and Kashmir) on Tuesday/Wednesday. This LPA has a potential to produce at times very heavy rainfall over northeast Pakistan (upper Punjab & Kashmir) during Wednesday to Friday."

However, it took two days for PMD's Flood Forecasting Division (FFD) to translate the information issued by NWFC into a flood alert. On September 03, the FFD issued a warning that reads:

"According to latest meteorological conditions a Well-Marked Monsoon Low lies over Rajasthan (India), which is likely to affect upper catchments of all the major Rivers except Indus.

Under this scenario, Very High to Exceptionally High Flood Level is expected in Chenab rivers & its associated nullahs, whereas High Flood Level is expected in Ravi river along with its associated nullahs.

High to Very High Flood Level is also expected in Jhelum & Sutlej rivers."

PMD went on to claim their better prediction of the event referring to their advisory of September 01 by NWFC. However, NDMA, PDMA and FFC kept on criticizing that the PMD-FFD warning of flood came too late. The lack of coordination shown by various federal and provincial level departments is astounding considering that it was the fifth successive year in which an extreme rainfall occurred during the similar time of the year.

Moreover, during the event the Indus River System Authority (IRSA), responsible for regulating the river flows, opted to fill the Mangla reservoir despite the flood warnings from PMD. Once the reservoir got filled, 283,000 cusecs of water had to be released from Mangla on September 6. This release of water combined with the exceptionally high flood of over 480,000 cusecs at Marala and downstream at Khanki/Qadirabad (over 600,000 cusecs) further aggravated the situation. Had the water been incrementally released between September 4 & 5, a massive surge at Trimmu could have been avoided (Sharaf 2014). This once again shows the lack of coordination between various government departments working on the same issue.

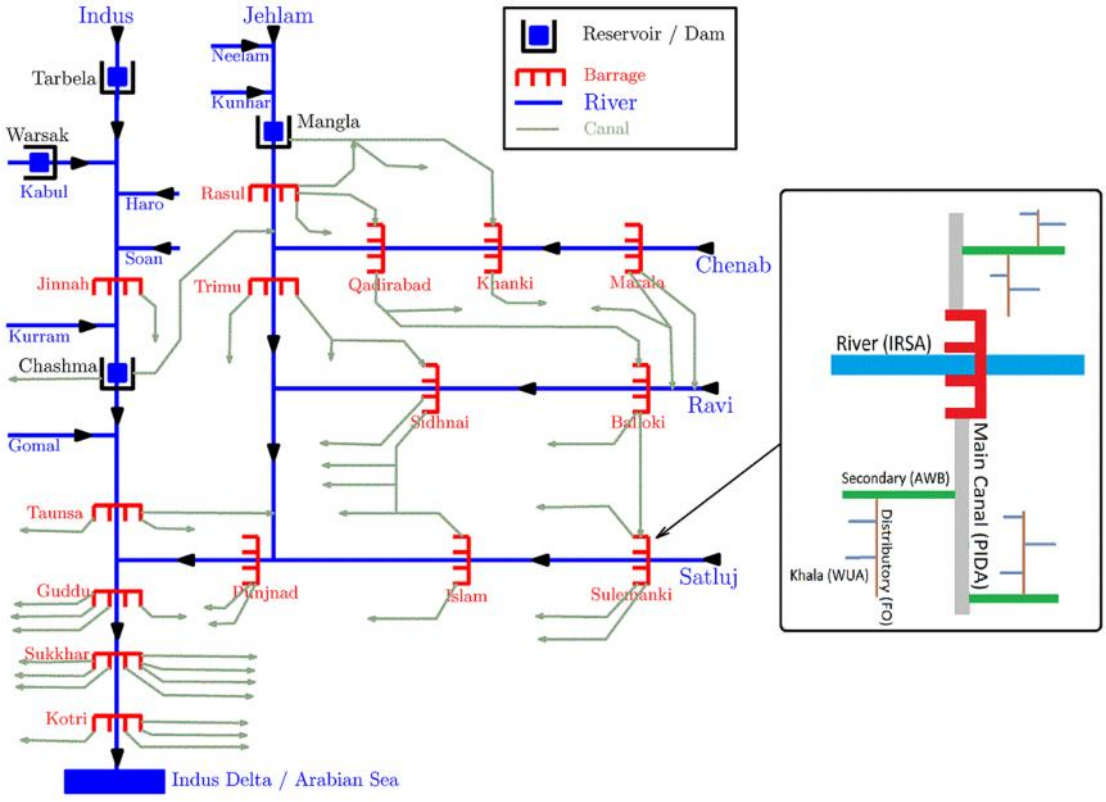
Meanwhile, the accusations of "water aggression" from India were highlighted in a section of local and international Press. The premise behind this criticism was the dual peak in Chenab at Marala inflows on September 5 & 7, as can be seen in Table 1. Especially, the second peak on September 7 is attributed by media to the manipulation of flows from Indian water management authorities. However, Pakistan's Indus water commissioner denied those allegations and said that India was continuously sharing the data with Pakistan at sub-daily time scale. Commenting on the issue, the Harvard University's Prof. Dr John Briscoe also said that India could not have exacerbated the current floods in the Chenab and Jhelum basins in Pakistan. India does not have any large storage reservoirs on either the Jhelum or Chenab, in part due to the restrictions of terrain, and in part due to the restrictions of the Indus Waters Treaty (Briscoe 2014).

Table1: River Flows data with all the figures in 1000 x Cusecs. Source WAPDA

	Jhelum at Mangla Inflow	Jhelum at Mangla Outflow	Chenab at Marala Inflow
Sept 02	24.6	45.0	33.0
Sept 03	22.7	45.0	42.4
Sept 04	95.0	30.0	136.7
Sept 05	310.2	15.0	484.8
Sept 06	413.2	282.2	323.3
Sept 07	146.8	128.4	562.8
Sept 08	107.5	95.2	127.5

On September 8, Pakistan's Federal Minister for Water and Power told the joint session of parliament that PMD had predicted below-average monsoon rains in Pakistan in 2014 and measures must be taken to improve their forecast (The News 2014). However, South Asian Summer Monsoon (SASM) is known to have a "notoriously difficult to predict nature" (Saeed et al. 2011) even in terms of average rainfall in a season, therefore, prediction of the extreme rainfall such as September 2014 is a far cry. Many scientists across the world were expecting dry summer in the subcontinent this year due to the presence of El Niño, which *The New York Times* lists as one of the biggest challenges for the new Modi government (Singh 2014b). Although PMD should be equipped to predict such an event a few days in advance, forecast of such an event should not be expected before the start of the season.

Figure 1: Indus Basin Irrigation System



Source: http://cyphynets.lums.edu.pk/index.php/HydrosystemsAT

Conclusion and Recommendations

It is said that one cannot avoid natural calamities but the implementation of a right set of policies and safety measures can help stop the natural calamities from turning into a deadly disaster. Owing to climate change, as discussed earlier, extreme events resulting in flooding are bound to happen. However, with proper management and appropriate actions, these events can be averted by making a potent strategy on the following lines.

a. Natural calamities know no boundaries and so are their consequences in the absence of a coordinated disaster management strategy. India and Pakistan, despite their political differences, would have to collaborate on issues of seasonal extremes — manifestation of climate change. We already have a flood control cooperation model (Sapta Kosi High Multipurpose Project) between India and Nepal on Kosi river. Through this project, the Kosi, once known as the sorrow of Bihar, is envisaged to be managed through Sapta Kosi High Multipurpose Project for the development of hydropower, irrigation, flood control and management, and navigation in both the countries. (Suleri 2014). Therefore, a platform or programme should be established for sharing objective information between India and Pakistan on the effects of actions during the times of floods and droughts. This could be achieved easily and transparently, for example, by involving a pair of competent Pakistani and Indian institutions.
b. This coordination should not remain confined to trans-boundary knowledge sharing, but coordination between the government institutions within Pakistan is also a must, as such coordination will result in improving the regulation of existing reservoirs for flood control. The series of damages caused by heavy rains and floods in the last five years should be a good enough caution for the Pakistani authorities to prepare for such a situation. There should have been a better coordination among IRSA, NDMA, PDMA, FFC and PMD to ensure better vigilance, water regulation and early warning. With the better information of water rushing downstream, IRSA could have released water between September 4 & 5 in order to avoid a major surge at Trimmu.
c. Another very important caveat among the government departments responsible to act under such catastrophes is political pressures. After the 2010 flooding episode, a flood inquiry commission headed by a retired judge of Sindh High Court held some officials responsible for their negligence for the breaches of a couple of Bunds (dykes) in Sindh province. Instead of some action taken against them, those officials were promoted at a later stage after the report was made public (Tunio 2014). Also, the report severely criticized the Federal Flood Commission (FFC) and National Disaster Management Authority (NDMA), the two main bodies that function at federal level, to tackle floods. In the case of recent flooding, these two bodies have already come under severe criticism from various sections of the civil society for their centralized nature and lack of autonomy in terms of decision-making and financial resources disbursement. Therefore, the government bodies (FFC, NDMA, IRSA, Irrigation Department, etc.) should not be under political influence and work as autonomous bodies to make best decision under the given circumstances.
d. In the absence of an “effective” local government system, the decision from where to breach the dyke would always be non-consultative and top-down. Such plans are to be prepared and vetted by the local government authorities, but in the absence of local governments, the provincial government should do the flood zoning and

discourage any construction in extremely flood prone areas (Suleri 2014). Therefore, strengthening of local governments, which can play an imperative role not only during flood management but also during the relief efforts, is essential.

e. In highly flood-prone areas, flood control should be given overriding consideration in reservoir regulation policy even at the cost of sacrificing some irrigation or power benefits.
f. PMD-FFD issued a warning on September 03, however it could have been given much earlier. A study published in a scientific journal indicates the potential prediction of such an event 8 to 10 days prior to its occurrence (Webster et al. 2011). The research unit of PMD should include such findings into their prediction methodology. More research funds should be allocated to forecast such events at the reasonable time lag.
g. Unplanned development at the riverbanks and dry river bed exacerbate the scale of disaster, which should be avoided at any cost. Dry river bed in dry season offers false sense of security. People need to be sensitized about potential loss to their lives, infrastructure and investment due to floods and must be discouraged from populating the river beds. This would also require a strategy to provide alternative settlements to landless settlers. According to the federal minister for water and power, there were less than 20 waterways from the Himalayas to the Indian Ocean in the south compared to 200 earlier because of encroachments, and this has exacerbated the losses due to flooding.

References:

Briscoe, J 2014, 'Indian dams on Chenab and Jhelum cannot cause floods in Paksitan', The News (Aman ki Asha), 17 September, viewed 2nd October, <http://www.thenews.com.pk/Todays-News-14-273137-Indian-dams-on-Chenab-and-Jhelum-cannot-cause-floods-in-Pakistan-%E2%80%93-John-Briscoe >.

Ding, Q, Wang, B 2007, 'Intraseasonal tele-connection between the summer Eurasian wave train and the Indian Monsoon', Journal of Climate, vol. 20, no. 15, p. 3751–3767.

Habib, N 2011, 'Hundreds dead, 660,000 displaced by Pakistan flooding', CNN, 1st October, viewed 2nd October 2014, <http://edition.cnn.com/2011/09/30/world/asia/pakistan-flooding>.

Houze, RA Jr, Rasmussen, KL, Medina, S, Brodzik, SR, & Romatschke, U 2011, 'Anomalous atmospheric events leading to the summer 2010 floods in Pakistan, Bulletin of the American Meteorological Society, vol. 92, no. 3, : p. 291–298.

'Hundreds killed in Pakistan flooding' 2012, CNN, 29 September, viewed 2nd October,<http://edition.cnn.com/2012/09/29/world/asia/pakistan-floods/>.

Lau, WKM & Kim, KM 2012, 'The 2010 Pakistan flood and Russian heat wave: Tele-connection of hydrometeorological extremes', Journal of Hydrometeorol, vol. 13, no 1, p. 392–403.

Rasmussen, KL, Hill, AJ, Toma, AE, Zuluaga, MD, Webster, PJ & Houze, RA Jr 2014. 'Multiscale analysis of three consecutive years of anomalous flooding in Pakistan, Quarterly Journal of the Royal Meteorological Society, doi:10.1002/qj.2433.

Singh, RK & Nam, R 2014, 'Five key challenges a Modi government would face,' Reuters, 8 April, viewed 2nd October , <http://in.reuters.com/article/2014/04/07/india-election-bjp-givernment-modi-chall-idINDEEA360JI20140407>.

Sharaf, SS 2014, 'Flood analysis 2014', The Nation, 17 September, viewed 2nd October 2014, < http://nation.com.pk/columns/17-Sep-2014/flood-analysis-2014>.Singh, HS, Ahmed, M, Smith-Spark, L 2014, 'Death toll climbs in flood-hit India and Pakistan' CNN, 14 September, viewed 2nd October 2014, < http://edition.cnn.com/2014/09/13/world/asia/india-pakistan-monsoon-flooding/>.

Suleri, AQ 2014, 'Five lessons from the floods 2014' The News, 5 October, viewed 08 October 2014, < http://tns.thenews.com.pk/five-lessons-from-floods-2014/#.VE9zm_mSySo>.

Saeed, F, Hagemann, S, Jacob, D 2012, 'A framework for the evaluation of the South Asian summer monsoon in a regional climate model applied to REMO'. International Journal of Climatology, vol. 32, no. 3, p. 430–440.

Tunio, H 2014, '2010 flood inquiry: Officials accused of negligence promoted', The Express Tribune, 14 September, viewed 2nd October , <http://tribune.com.pk/story/762047/2010-flood-inquiry-officials-accused-of-negligence-promoted/>.

Webster, PJ, Toma, VE, & Kim, H-M 2011, 'Were the 2010 Pakistan floods predictable?' Geophysical Research Letters, vol.38, no. 3, doi: 10.1029/2010GL046346.

'128 killed from rains, flash floods: Khawaja Asif'2014, The News, 9 September , viewed 2 October , <http://www.thenews.com.pk/article-159233-128-killed-from-rains,-flash-floods:-Khawaja-Asif>.