



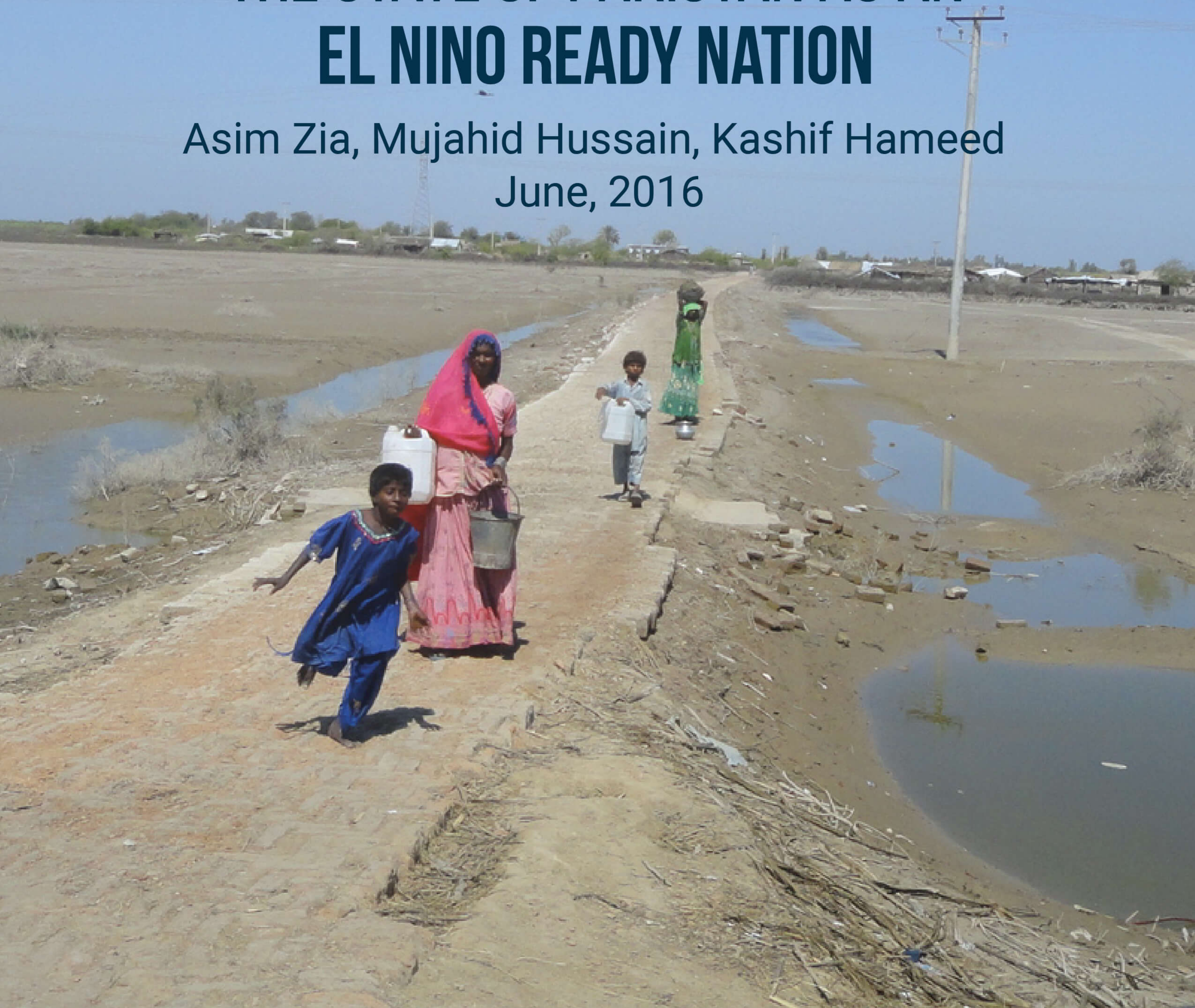
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Research Study Report

THE STATE OF PAKISTAN AS AN EL NINO READY NATION

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Consortium of Capacity Building (CCB) of University of Colorado in collaboration with its partners conducted country specific case studies research on El Nino (ENSO) Impacts, Current status of El Nino Readiness, lessons learned from past El Nino events, and what are current responses to the El Nino forecasts by concerned government institutions and humanitarian agencies/civil society. This research project is being implemented in 19 countries including Pakistan that are clearly affected by El Nino.

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EXECUTIVE SUMMARY

Under the influence of El Nino throughout Pakistan, precipitation tends to drop drastically resulting into scanty rainfall both in the summer and winter seasons, adversely affecting agricultural productivity. The 1997-98 El Nino induced shortfall of precipitation, triggered Pakistan history's worst drought in terms of length and intensity, which prevailed from fall of 1998 to spring 2003, well beyond the 1997-98 El Nino (Naheed et al. 2013). The changes in Indian Ocean dipole also play an important role in modulating the ENSO-related monsoon rainfall variability on multi-decadal timescales.

Pakistan faces multiple levels and types of challenges, some of which even threaten the future existence of the country in its current administrative boundaries. Major challenges include rising poverty, terrorism, regional insurgencies in El Nino induced drought prone areas, religious & ethnic extremism, poor governance, corruption, gender discrimination, fragile economy, deficient public institutions, ill planned development process, and political system vulnerable to repeated military interventions. The prolonged conflicts on the eastern and western borders, India and Afghanistan respectively, are another major challenge to the development and security of the country.

Natural disasters in Pakistan are primarily caused by hydro-meteorological phenomena, such as floods, storms, cyclones, landslides and droughts as well as geophysical hazards such as earthquakes. Climate change and variability, on top of existing socio-economic drivers of change such as population growth, rural to urban migration, globalization and haphazard economic development are major dynamic pressures that increase the vulnerabilities of Pakistani society to hydro-meteorological

hazards.

Climate has been experiencing a rapidly changing trend embedded with the increased frequency and intensity of extreme events in Pakistan due to global warming. Increased frequency of torrential rains (e.g. 2010 Indus floods), prolonged heat waves, frequent tropical cyclones, recurring flooding and persistent drought are the phenomenal changes experienced in this deltaic region. Rapid deforestation and melting of glaciers in most of the north is contributing to floods downstream in the plains and contributes to coastal flooding. The intrusion of saline sea-water in the lower Indus delta, with decreasing wetland and Mangrove land cover, has severely affected the fertile agricultural land.

Pakistan has three levels of governance: national, provincial/state and district levels. At the provincial/state level, the Provincial/State Disaster Management Authorities (PDMAs) are the focal points of the disaster management, regulated at the national level by National Disaster Management Authority (NDMA). The capacity of District Disasters Management Authorities (DDMAs), the front-lines to directly deal with disasters remained weak over the years and even their capacity building is less focused.

There is no mechanism as such in place to respond to the El Nino forecast or early warning. The forecast is mainly a statement on potential drought conditions or excessive rains. There is as such no El Niño readiness or preparedness activities so far in Pakistan.

Although in relation to the recent El Nino in 2015, there is improvement in warnings by Pakistan Meteorological Department (PMD) & NDMA and

communication of its general impacts. However, there were no effective responses, preparedness activities, or mitigation actions and activities were taken up at the national or provincial levels. Another main reason behind such a lack luster government response is the lack of technical, financial, and human resource capacities at the federal, provincial, and local levels.

The existing research work is limited in a sense in that it is mainly concentrated on El Nino Impacts on summer monsoon rains but unable to develop region-specific physical, social, and economic impacts of El Nino and its associated anomalous weather patterns.

A research interest to explore the socio-economic impacts of El Nino is growing in different parts of Pakistan. There is a lack of technical knowledge, skilled human resources, and high-tech computers for advanced model simulation, coordination, and financial resources restricting the government's El Nino preparedness activities.

Hurdles and Obstacles

Although in relation to the recent El Nino in 2015, there is improvement in issuing early warnings by PMD/NDMA by using NOAA and/or WMO data and communicating its general impacts. However, there were no effective response, preparedness, or mitigation actions and activities that were taken up at the national and provincial levels.

Another main reason behind such a lack luster response is the lack of technical, financial, and human resource capacities at federal, provincial, and local levels. Even if the political will were to exist in more favorable political conditions (e.g. the dissolution of insurgency), the ability to generate accurate spatially specific forecasts would be limited due to poor technical and financial capacity in the relevant agencies.

The current insurgency in Balochistan, epicenter of El Niño induced drought, may play a bigger role in governmental inaction than the availability of El Nino forecast.

Lessons

1. Flood and drought forecast and mitigation capacity (as well as political will) are severely lacking in the current political and security environment.
2. Generating awareness is an ongoing process even though el Nino is an irregularly recurring phenomenon. Societies have to consider the need to generate awareness continually at all levels of education and after via media, workshop, etc. "Once is not enough."
3. PMD and concerned academic centers need capacity building to undertake scientific work on measuring the impacts of El Nino in various regions of the country.
4. El Nino is presently not included in the national risk matrix. It should be incorporated in the national risk matrix of Pakistan.
5. In view of the apparent increased frequencies of El Nino events in last decade and its tele connected impacts, it is imperative to fill the huge prevailing gaps and to devise and implement a broad-based national- level action plan on El Nino Preparedness and Readiness for Pakistan.
6. There is a need to organize exclusive training and sensitizing program(s) for print and electronic media in Pakistan on El Niño Impacts.
7. The probability of flooding increases in La Niña years, hence a full ENSO readiness approach needs to be taken in the case of Pakistan.
8. Utilization of El Nino forecast is not only a function of forecast availability, rather the political climate in the region, i.e. the presence or absence of insurgency, also plays very important role in proactive governmental action to mitigate the adverse

impacts of El Niño induced droughts.

9. There is need of further research to explore the socio-economic impacts of El Nino particularly in those conflict prone districts of Baluchistan.

10. There is clear gap in knowledge and understanding on El Nino and related issues at all government, NGOs, academic and community level and need awareness and education.

11. There is also gap in El Nino preparedness coordination among the concerned institutions at national and provincial level. This could be established through the existing coordination mechanism among the institutions; PMD, Ministry of Climate Change, NDMA, PDMA, Planning and Finance Ministry. There are also ample opportunities for integrating El-Niño preparedness in the national level Disaster Risk Reduction (DRR) program and promoting social safety nets for the vulnerable communities living in the El Niño impacted regions and districts.

Recommendations

1. The study findings recommend that more specific research work is required on impacts of El Nino & La Nina in Pakistan. Differentiate and clarify the linkage of El Nino & La Nina with climate change.

2. Forecast and early warning for hydro met hazards (Climate, Water and weather) communication as well as proposed preparedness actions should be communicated in such a way that it is easy for a layman to understand

3. El Nino preparedness planning should be ideally done by NDMA/PDMA, i.e. build the capacity of existing federal agencies. New DRM/DRR initiatives and their linkage with El Nino and La Nina events need to be clarified.

4. Future technical sessions should be organized by the NDMA, PHF or NHN on emergency preparedness and on NGOs, efforts in progress in order to

link relief, rehabilitation and development “Best case studies, Lessons learnt”

5. The study also recommends to develop mitigation strategies on hydro met natural disasters and response and preparedness in Pakistan

6. NDMA to coordinate with regional countries to develop regional level preparedness plan for El Nino as early as possible to get benefits of regional information and expertise. Build the capacities of Disaster Management Authorities (DMAs) on El-Nino and La Nina impacts at local level

7. There is a need of urban resilience initiatives; WASH, Livelihoods and health particularly require to prepare for climate induced catastrophe

8. Communities with access to water and road infrastructure and a diversified income respond more easily to the impacts of El Nino related disasters than do others with no access to such infrastructures. Settlement on flood-prone areas are to be discouraged rather than enforced.

9. Integrated watershed development to manage flooding is limited, though river, lake and dam development to harness water resources exist in Pakistan, which is categorized as a water-deficient country.

10. Combining science-based expertise with socio-economic and sociocultural analysis is needed in order to better understand all potential impacts and to foster cooperation between sectors and governance structures.

11. Without clear scientific understanding of El Niño-related risks in vulnerable societies, and without outreach from forecasters or policy-makers toward farmers and livestock owners, forecasts and advice as relevant decision-making tools might continue to be discounted or even disregarded. Outreach should specifically focus on El Nino, and not only on droughts, to ensure a clearer understanding among relevant stakeholders.



THE SETTING

Political Context:

From political history of Pakistan during the last 68 years, it can be deduced that governance system in Pakistan is still struggling to deepen its roots in a fragile democratic system. The Non-political elements in the form of military and civil establishment continue to exercise control on the state's decision-making structures and processes. The power struggle among political parties and establishment, particularly control on security and foreign policy, is one of the major vulnerability factors for continuation of a British parliamentary type of "democratic" system in Pakistan. The imbalance between civil-military relationship has adversely affected the growth of participatory democratic governance in the country, which has exacerbated the stream of societal and political challenges in the current state of Pakistan.

Pakistan faces multiple levels and types of challenges, some of which even threaten the future existence of the country in its current administrative boundaries. It should be noted that East Pakistan was converted to Bangladesh in 1971, so the original boundaries of Pakistan that were left behind by British colonials in 1947 are not the same to this day. Such major challenges include terrorism, national insecurity, Baloch separatist movement, religious extremism, ethnic divide, poor governance, corruption, rising poverty, gender discrimination, fragile economy, deficient public institutions, haphazard and ill planned development process, and political system vulnerable to repeated military interventions. The prolonged conflict on the eastern and western borders is another major challenge to the development and security of the country. The

Afghan war over the last four decades and war against terrorism in FATA led towards influx of millions of Afghan refugees and hundreds of thousands of Internally Displaced Persons (IDPs) all across the country.

Overview on Mechanisms to deal with Disasters and Climate Change Impacts:

Historically, the West Pakistan National Calamities Act of 1958 provided for the maintenance and restoration of order in areas affected by calamities and relief against such calamities and focuses on emergency response. Based on the Act, an Emergency Relief Cell was created within the Cabinet Division in 1971 which was responsible for disaster relief at the national level. It provided assistance in cash and kind to supplement the resources of the provincial government and administered the Prime Minister's Flood Relief Fund.

The 2005 Earthquake brought death to more than 75,000 people in the northern areas of Pakistan that led Pakistan to initiate national efforts in developing a structure for disaster management focusing on prevention, mitigation and integration of responses by conducting a review of traditional disaster management systems and policies on emergency response. The National Disaster Management Ordinance (NDMO) was promulgated in 2006, later approved by Parliament, and became the National Disaster Management Act in 2010. This act provides a key framework for disaster management and risk governance in Pakistan.

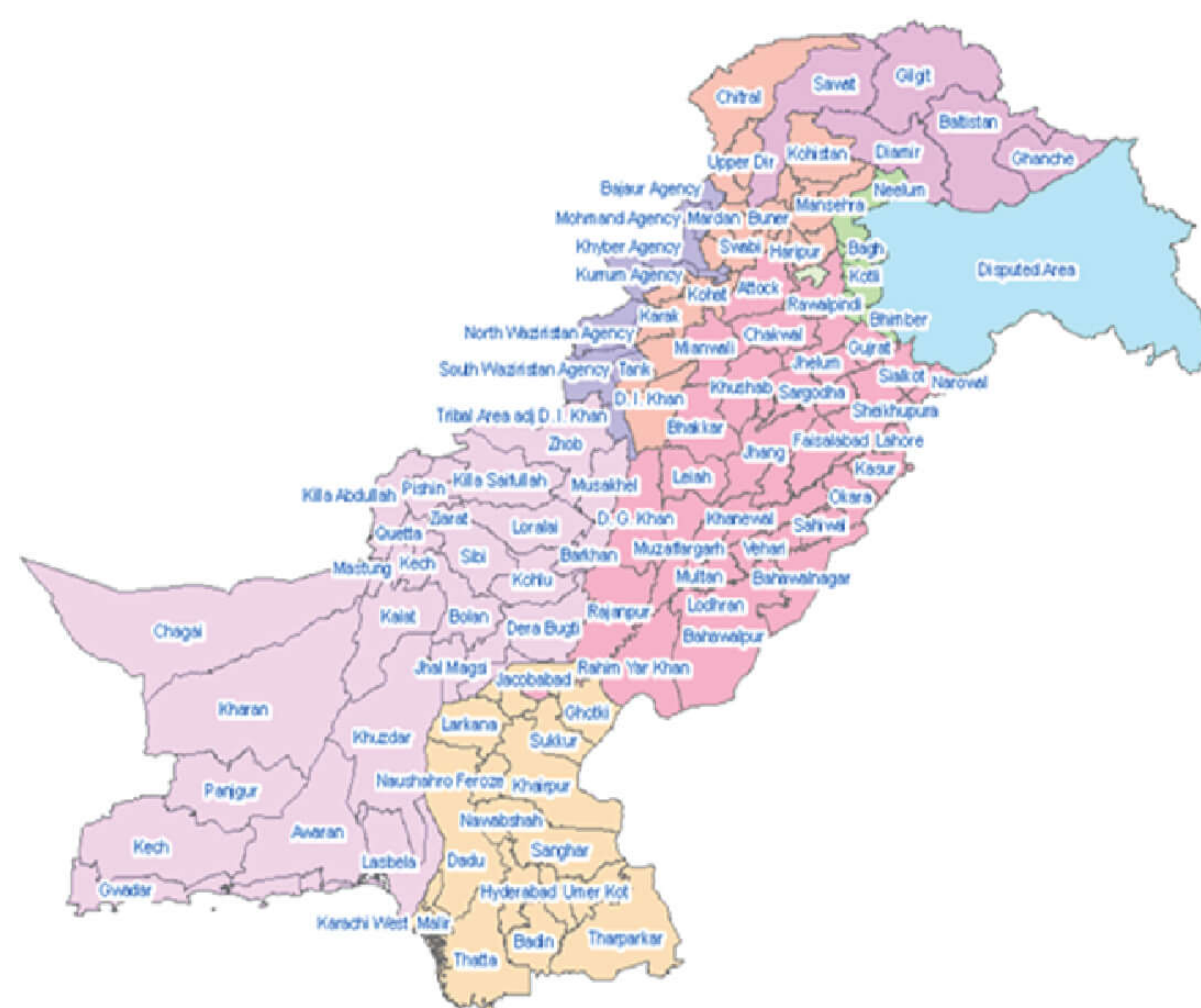
The National Disaster Management Commission (NDMC) headed by the Prime Minister was established to expedite the formulation of overall policies

at the national level. The National Disaster Management Authority (NDMA)⁴ is the focal point in charge of disaster management at the federal level. NDMA provides technical guidelines to national and provincial level Organizations on formulation of plans, strategies and programs for disaster risk management. NDMC formulate the policies, decisions and advice of NDMA and the Chairman of NDMA act as secretary of the NDMC. On October 26, 2011 the Government of Pakistan placed NDMA under the newly established Ministry of National Disaster Management which was later renamed as Ministry of Climate Change on April 18, 2012. NDMA is now placed under the Ministry of Climate Change. Pakistan has three levels of governance: national, provincial/state and district levels. At the provincial/state level, the Provincial/State Disaster Management Authorities are the focal points of the disaster management. Similar to the national level, the Provincial Disaster Management Commission (PDMC) is headed by the Chief Minister (or Prime Minister in AJ&K) of the respective province who acts as Chairman of the Commission. At the district level, the District Disaster Management Authorities (DDMAs) are established in selected hazard prone areas. Pakistan Humanitarian Forum (PHF)-alliance of international NGOs- in coordination with numerous national and grass root NGOs is also working on emergency response/DRR/climate change all across the country.⁵

The national organizations of Pakistan, which have historically actively worked on climate change, impact assessment and adaptation, are Pakistan Meteorological Department (PMD), Pakistan Agriculture Research Council (PARC), Pakistan Council of Research in Water Resources (PCRWR), and Pakistan Forest Institute (PFI), etc. But, in view of

increased climate change risks and its associated high frequencies of natural disasters many new organizations have recently been set up to address such issues with a dedicated focus. These new organizations include Global Change Impact Study Centre (GCISC) that was established in 2002, meanwhile Water and Power Development Authority (WAPDA), Pakistan Institute of Nuclear Science and Technology (PINSTECH), and Pakistan Institute of Engineering and Applied Sciences (PIEAS) have also set up limited capacity for addressing issues of hazard mitigation, climate change and global warming in their own respective realms (Rasul 2010).

Figure 1: District Boundaries of Pakistan



Source: citypulse.com.pk

⁴ <http://www.ndma.gov.pk/site/>

⁵ National Disaster Management Plan 2012

Socio-Economic Indicators of Pakistan:

Table 1: Provides an overview of recent socio-economic indicators of Pakistan.

Region		Southern Asia
Surface area (sq km)		796,095
Population (est., 000)		185,133
Pop. density (per sq km)		232.6
Capital city pop. (000)		1,297
GDP: Gross domestic product (million current US\$)	2013	225,419
GDP: Growth rate	2015-16	4.7
Unemployment (% of labour force)	2013	5.1
Population growth rate (average annual %)	2010-2015	1.7
Urban population growth rate (average annual %)	2010-2015	2.8
Rural population growth rate (average annual %)	2010-2015	1.0
Urban population (%)	2014	38.3
Population aged 0-14 years (%)	2014	33.3
Population aged 60+ years (females and males, % of total)	2014	6.6/6.5
Sex ratio (males per 100 females)	2014	105.7
Life expectancy at birth (females and males, years)	2010-2015	67.4/65.6
Infant mortality rate (per 1 000 live births)	2010-2015	65.1
Fertility rate, total (live births per woman)	2010-2015	3.2
Refugees and others of concern to UNHCR	mid-2014	2,844,283
Threatened species	2014	123
Forested area (% of land area)	2012	2.1
Proportion of terrestrial and marine areas protected (%)	2014	8.6
Population using improved drinking water sources (%)	2012	91.0
Population using improved sanitation facilities (%)	2012	48.0
CO2 emission estimates (metric tons per capita)	2011	0.9
Energy supply per capita (Gigajoules)	2012	17.0

Source: <http://data.un.org/CountryProfile.aspx?cname=Pakistan>

Climate Hazards & Socio-Environmental Vulnerabilities in Pakistan

Climate has been experiencing a rapidly changing trend embedded with the increased frequency and intensity of extreme events in Pakistan due to global warming. The Indus Delta is a vast tract of fertile land feeding a large proportion of population with food and fiber. Although it is composed of low lying areas of the Indus irrigated plain but the changes occurring in the climatic conditions of the extreme north also directly affect due to the risk of water deficit or surplus. The Himalaya-Karakoram-Hindukush region, which hosts world's third largest ice mass after the poles, has warmed up more than 1.5 °C, which is almost twice as much as the remaining parts of Pakistan (0.76 °C) during last three decades (Rasul et al. 2012).

Increased frequency of torrential rains, prolonged heat waves, frequent tropical cyclones, recurring flooding and persistent drought are the phenomenal changes experienced in this deltaic region. Rapid melting of glaciers in the north is contributing to floods downstream in the plains and contributes to coastal flooding.. The intrusion of saline sea water in the lower Indus delta has severely affected the fertile agricultural land. Wind is a great natural resource possessing huge socio-economic benefits if augmented, but increased intensity of storm surges and invasion of tropical cyclones are increasing the threats to infrastructure. Erratic behavior of monsoon precipitation has resulted in degradation of rangeland and further deterioration of the already degraded cultivated land areas, such as those suffering from water erosion, wind erosion, water-logging, and salinity.

Future climate projections indicate that at least 5 °C rise in temperature over the Indus Delta is expected by the end of 21st century. Due to this increase in temperature, domestic, animal and crop water requirements will rise 1.5 times over the present

levels. Over the time, population has increased but water reservoirs have not been developed at the same pace. As a result of this supply-demand gap, Pakistan is listed as one of the typical water deficit countries in a large number of assessment reports and findings. Water availability will further decrease reducing the per capita share. Precipitation pattern is going to be highly variable. Poverty, lack of resources and low adaptive capacity of the local population of the Indus Delta to climate change exacerbates the vulnerabilities and poses daunting challenges to sustainable food production.

Natural disasters in Pakistan have been mainly caused by hydro-meteorological phenomena, such as floods, storms, cyclones, landslides, and droughts as well as geophysical conditions such as earthquakes. Climate change and variability, on top of existing drivers of change such as population growth, rural to urban migration, globalization and haphazard economic development are major dynamic pressures that increase the vulnerabilities of Pakistani society to disasters.

Rapid population growth, one of the highest in the world, has become a major pressure affecting all aspects of social, economic and environmental life in Pakistan. The increased population has affected life in multiple ways in creating hazard vulnerabilities. The increased population has pushed people to move and live in hazard prone areas, which were traditionally considered as uninhabitable, e.g., flood plains, steep slopes and coastal areas. Population growth has increased the demand for fuel wood, fodder and timber, leading to uncontrolled forest cutting, causing intensified erosion and higher peak flows that result in severe flooding downstream. The high population density in hazard prone areas causes greater loss of life and property when comparable extreme precipitation events occur.

Pakistan is in transition from an agricultural and rural society to an urban and industrial society. In fact, rapid urbanization has been experienced in

Pakistan for the last few decades. The urban population has increased much faster than the overall population. The urbanization entails infrastructure development, environmental degradation and water and air pollution, etc. City life demands better services and infrastructure, which consume more natural resources (land, water, forest) to sustain urban lifestyles. Accordingly, disaster management in urban areas is a critical issue in Pakistan. If population growth trends continue at current rates, it is estimated that the population in Pakistan will increase from 184 million in 2010 to 335 million in 2050. A far greater number of people will be living in urban areas and hazard prone areas in the coming years.⁶ This leads to environmental degradation in urban areas and accelerated exploitation of natural resources in the countryside and upstream. Thus, degrading the environment will cause an increased frequency of hazards and greater loss of life and property if disasters occur.

The past disaster events in Pakistan show that the disaster situation in the country is a recurring phenomenon. Climate change and changes in precipitation are likely to bring more hydro metrological disasters to the country with the damage location shifting to the western side of Pakistan. The shifting of damage location is mainly attributed to increased precipitation trends on the western side. Pakistan's future disasters are likely to be more frequent and their impact on social, economic and environmental factors will be greater than that of today. Disasters will be experienced more frequently in Pakistan.⁷

In relation to the physical vulnerabilities, most of the rural housing in Pakistan is adobe, which is extremely vulnerable to hazards like earthquakes, floods and landslides. Mountain people lack access to hazard-resistant building technologies and construction materials. In floodplains along the Indus River, thousands of acres of "Kacha" lands have been illegally encroached upon by local influential people or have been leased out at nominal charges resulting in erection of private bunds. Construction

of houses and other built-up properties have been allowed along riverbanks, canals, etc.

Similarly, there has been a surge of encroachments on acquired lands in pond areas of barrages, which has aggravated the flood hazard. On the other hand, urban housing and infrastructure suffers from a lack of implementation of building codes. The mushrooming of slums and urban poverty has further compounded unsafe construction practices.

Development of infrastructure for health, education, safe drinking water and sanitation is usually overlooked due to high construction costs and the nature of the terrain. Lack of communications infrastructure and critical facilities further aggravate vulnerabilities in communities in post-disaster situations throughout Pakistan. The insufficient Early Warning System (EWS) capacity and the distinction of accuracy of prediction of weather information and disaster warnings also add to vulnerability. In relation to the social and economic vulnerabilities, it is deemed that the main causes of vulnerability to hazards in Pakistan have resulted from high illiteracy and poverty rates. Nearly one-third of Pakistani people are living under the poverty line (Table 2), and many of these poor are living in hazard prone areas. This social segment, which struggles to cope with daily life risks, cannot be expected to make disaster risk reduction a priority, and therefore suffers severely from disasters when they do occur.

Table 2: Poverty headcount ratio at national poverty lines (% of population)

Year	Poverty Ratio
2013	29.5
2011	36.3
2010	36.8
2007	44.1
2005	50.4

Source: <http://data.worldbank.org/country/pakistan>

⁶ National Disaster Management Plan 2012

⁷ National Disaster Management Plan 2012

Table 3: Poverty headcount ratio at national poverty lines (% of population)

Year	Poverty Ratio
2013	29.5
2011	36.3
2010	36.8
2007	44.1
2005	50.4

Source: <http://data.worldbank.org/country/pakistan>

In relation to the environmental vulnerabilities, the fragility of the natural environment in upstream areas of the Indus River basin has also exacerbated existing conditions of vulnerability. Due to massive deforestation, the rate of soil erosion is quite high in the northern areas. Pakistan has been left with only 4% forest and vegetative cover, thereby causing an intense increase in the discharge of water, especially during monsoon seasons. This, coupled with increasing snow melt in the Himalayan glaciers, has intensified flood and landslide risks.

The fragile ecosystems have also been the source of soil erosion, landslides and a loss of bio-diversity resulting in the increase of disaster damage. Overgrazing of marginal lands in Baluchistan and arid areas in other regions, and cultivation of water intensive crops, such as rice and sugar cane, has worsened the drought conditions. A many-fold increase in livestock population in arid zones has led to the overexploitation of rangelands without providing them with time to recover. Simultaneously, the extensive installation of tube wells in Baluchistan accelerated the extraction of groundwater and has lowered the water tables quite rapidly.⁸ Tables 3-5 provide summary information on Pakistan, documented in global climate risk index 2015 prepared by German Watch. Figures 2-3 show Flood and Drought Risk Maps of Pakistan indicating its most vulnerable areas.

Table 4: The Long-Term Climate Risk Index (CRI): the 10 countries most affected from 1994 to 2013 (annual averages)

CRI 1994–2013 (1993–2012)	Country	CRI Score	Death Toll	Deaths per 100,000 inhabitants	Total losses in million US\$ PPP	Losses per unit GDP in %	Number of Events (total 1994–2013)
10 (12)	Pakistan	31.50	456.95	0.31	3988.92	0.77	141

Source: Global Climate Risk Index 2015; German Watch

Table 5: The Climate Risk Index for 2013: the 10 most affected countries

Ranking 2013 (2012)	Country	CRI Score	Death Toll	Deaths per 100,000 inhabitants	Total losses in million US\$ PPP	Losses per unit GDP in %	Human Development Index10
6 (3)	Pakistan	15.50	301	0.16	5419.77	0.65	146

Source: Global Climate Risk Index 2015; German Watch

⁸ National Disaster Management Plan 2012

Table 6: Risk Profile of Natural Hazards and Disasters in Pakistan (Source: EM-DAT, 1980-2008)

Type	Event/Year	Deaths/Event	Affected/Event	Loss*/Event
Drought	0.03	143	2,200,000	247,000
Earthquakes	0.66	3900	339,198	274,552
Epidemics	0.31	27	1712	
Extreme Temperature	0.41	101	48	
Floods	1.72	136	565,236	33,908
Mass Mov. Dry	0.03	50		
Mass Mov. Wet	0.55	33	227	
Storms	0.59	85	128,641	95,937

*US \$ 1000

Figure 2: Flood Risk Map of Pakistan

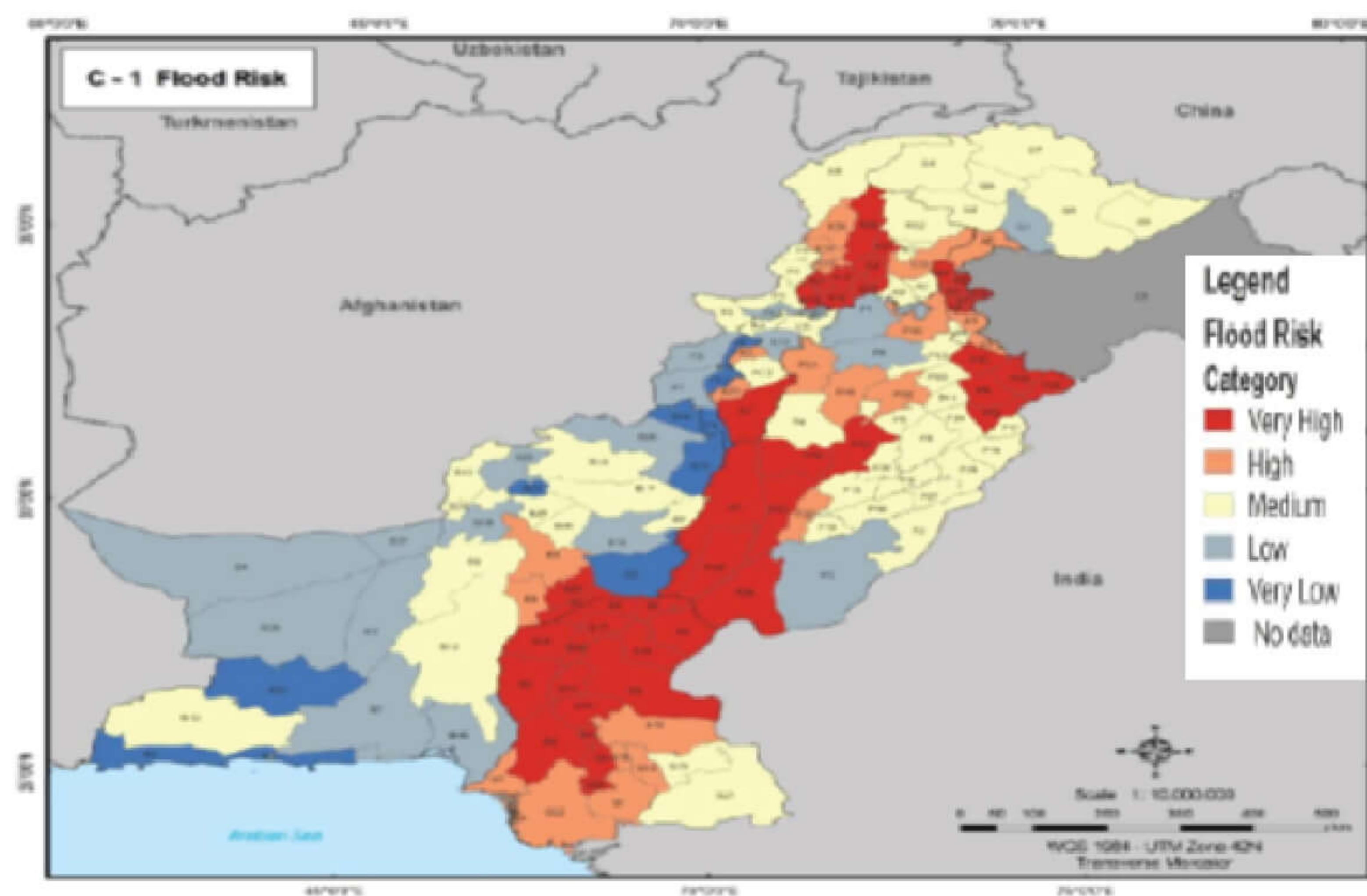
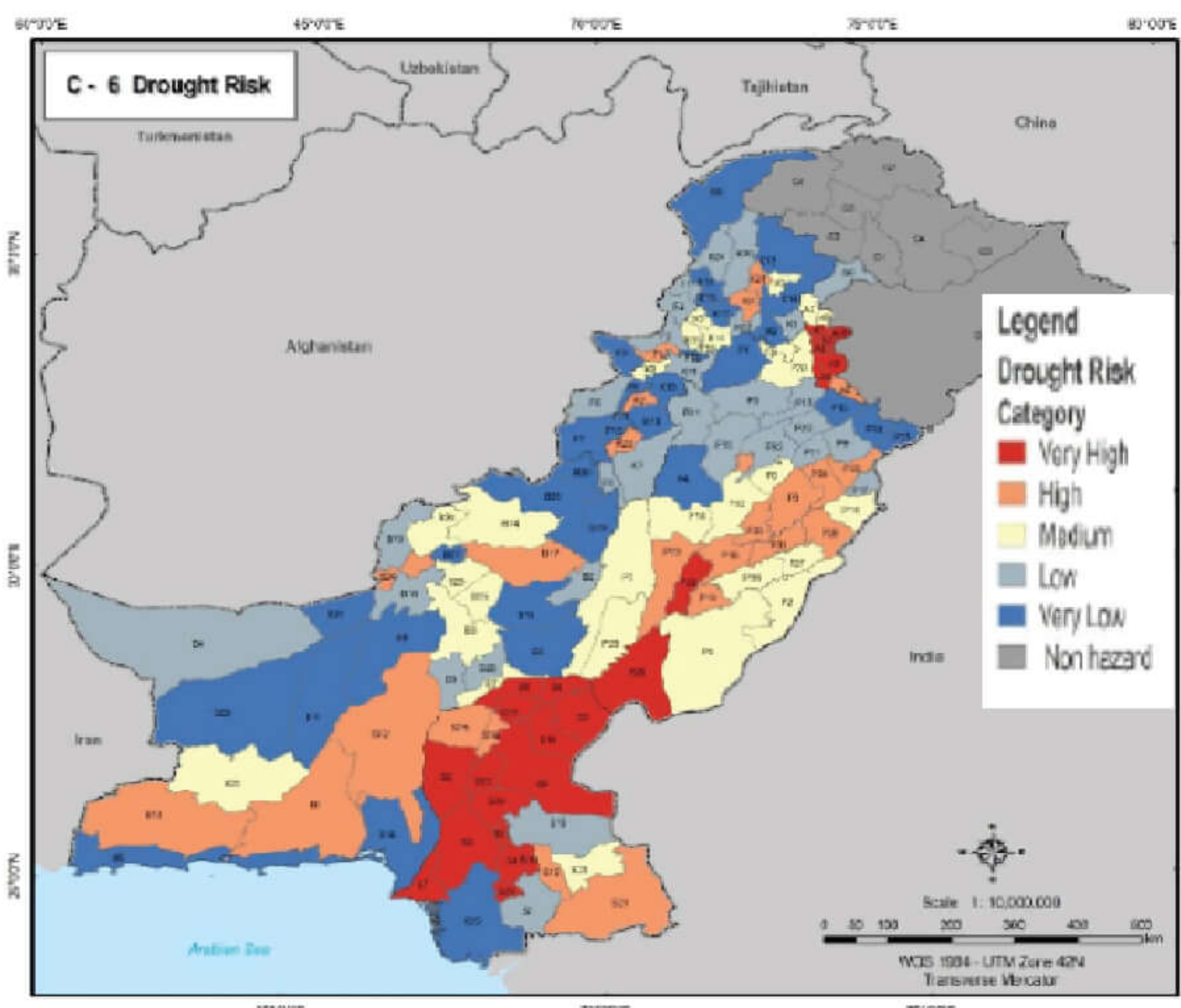


Figure 3: Drought Risk Map of Pakistan





THE
SCIENCE

Existing Knowledge and Research about El Nino & Its Impacts in Pakistan:

Pakistan is an agrarian country and 80 % of the population depends on the expected monsoon rainfall that is essential for the good crop yields. Our key synthesis finding is that both the suppressed monsoon rainfall during El Nino years and surplus monsoon rainfall during La Nina years affect the crop yield adversely. The cumulative seasonal (April to September) analysis by Zawar and Zahid (2013), for example, showed the suppressed rainfall with spatially variable intensity during El Nino and surplus amount of rainfall in La Nina years. Therefore, droughts can be associated with the El Nino years and floods with La Nina years during monsoon in Pakistan.

Under the influence of El Nino, precipitation tends to drop drastically throughout Pakistan resulting into scanty rainfall both in the summer and winter seasons. The El Nino 1997-98 induced shortfall of precipitation triggered Pakistan history's worst drought in terms of length and intensity which prevailed from fall of 1998 to spring 2003, well beyond the 1997-1998 El Nino (Naheed et al. 2013). Rashid (2004) also found El Nino has a negative



effect on winter rainfall over Pakistan. The results of comparing bi-monthly Multivariate ENSO Index (MEI) to monsoon monthly rainfall showed suppressed rainfall for the whole Pakistan (Haroon and Imran 2013). This was consistent with Rashid (2004) who concluded that in an El Nino year, if there is warming in April, May, June and it is likely to continue or increase in July, August, September, then there is likelihood that monsoon rainfall over Pakistan will be in deficit.

Mahmood et al. (2006) found the deficiency in % rainfall is statistically significant up to 90 % level during July and September months. Interestingly enough, Mahmood et al. (2006) also found Pakistan receives more than normal rainfall during the summer monsoon season in the immediate following year after the El Nino event. The correlation analysis is also performed on the summer monsoon months for individual provinces of Pakistan. All provinces receive deficient rainfall during monsoon months. The deficiency in rainfall over Punjab during all monsoon months is significant, whereas the deficiency in rainfall is significant during July and August over NWFP and Sindh, respectively. No significant impact of El Nino on the summer monsoon rainfall over Baluchistan is observed (Mahmood et al. 2006). In a related earlier study, Mahmood et al. (2004) calculated the correlation between monthly rainfall of summer monsoon season and the bi-Monthly Multivariate ENSO Index (MEI) in order to see the influence of El Nino on the summer monsoon rainfall in Pakistan. The El Nino years considered for this study were 1953, 1957, 1965, 1972, 1982, 1986, and 1991, 1997-98. Monthly correlations were computed for percent departure of summer monsoon rainfall with MEI values pertaining to the period from the first week of the previous month to the 1st week of the month under consideration. The estimated correlation

coefficients between monthly summer rainfall and corresponding MEI values for Northern Pakistan, Southern Pakistan and for all Pakistan are presented in Table 6. It shows that during summer monsoon for all Pakistan basis, the July, August and September % rainfall are deficient, shown through negative correlations -0.183, -0.157 and -0.167, respectively. However, deficiency in rainfall during July and September is significant up to 90% during El Nino Years. Over Northern Pakistan, the reduction in % rainfall departure is significant in July and September during El Nino years. Whereas in the case of Southern Pakistan, July and August rainfall shows significant reduction during El Nino years (Mahmood et al. 2004).

CORRELATION Coefficient (CCs)			
	MEI _{ij} - July % Rainfall	MEI _{ja} - August % Rainfall	MEI _{as} - September % Rainfall
Pakistan	-0.183*	-0.157	-0.167*
Northern Pakistan	-0.188*	-0.118	-0.193*
Southern Pakistan	-0.170*	-0.175*	-0.110

*Significant up to 90% level

The negative CCs indicates less than normal rainfall, whereas the positive CCs show the higher than normal rainfall.

The time series of July, August and September % rainfall departures and corresponding MEI values are shown below in Figures 4-6, respectively. In all sampled El Nino years, Pakistan received deficient rainfall during month of the July. The same is true for the months of August and September. The rainfall over Pakistan during July of 1957, 1987 and 1991 was deficient, i.e. -64.7 %, -53.5 % and -62.9 % respectively. July rainfall was also below normal during other El Nino years. Similarly, almost the same pattern in rainfall is observed during September of El Nino years. During September of severe El Nino years such as 1957, 1965, 1982 and 1987, Pakistan received below normal rainfall and the % departures were -76.5, -80, -80.5 and -76.3, respectively. Maximum deficiency of August rainfall, i.e. -70.2, was observed in the year 1993. However, the correlation between the MEI and August % rain-

fall departure over Pakistan during El Nino years is not statistically significant (-0.157) (Mahmood et al. 2004).

Figure 4: Time series of MEI Jun-Jul and Rainfall-Departure Jul all over Pakistan (Source Mahmood et al. 2004)

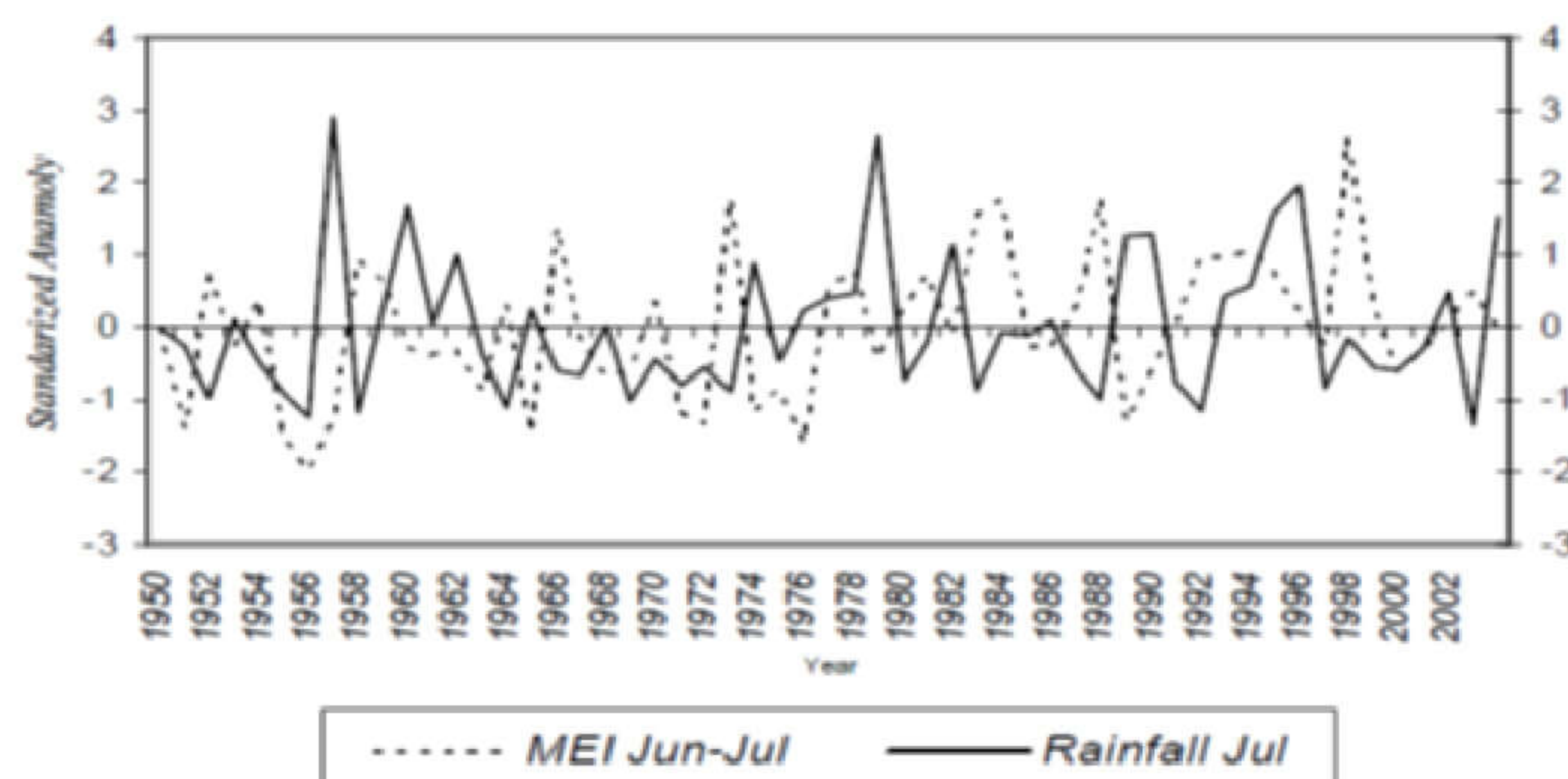


Figure 5: Time series of MEI Jul-Aug and Rainfall-Departure Aug all over Pakistan (Source Mahmood et al. 2004)

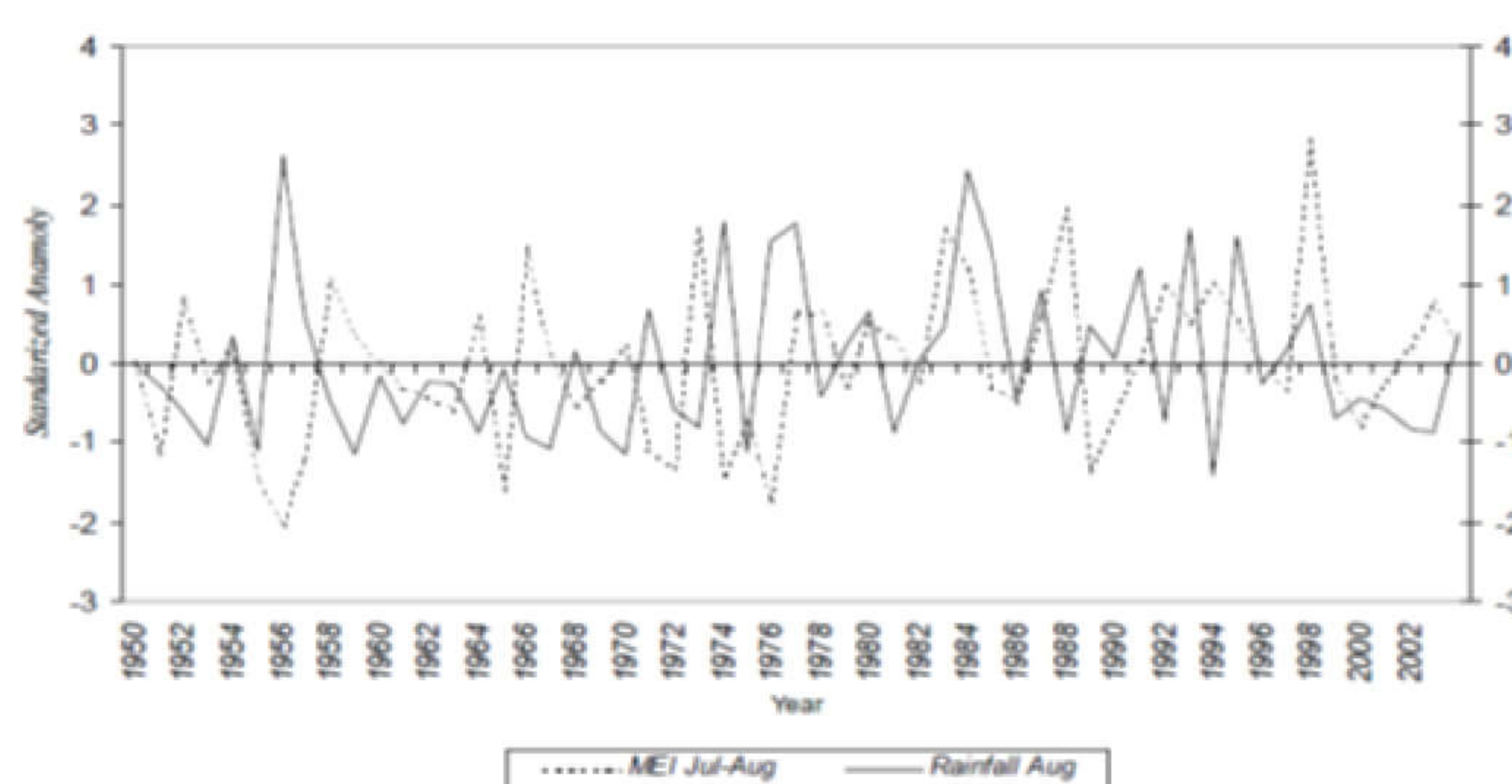
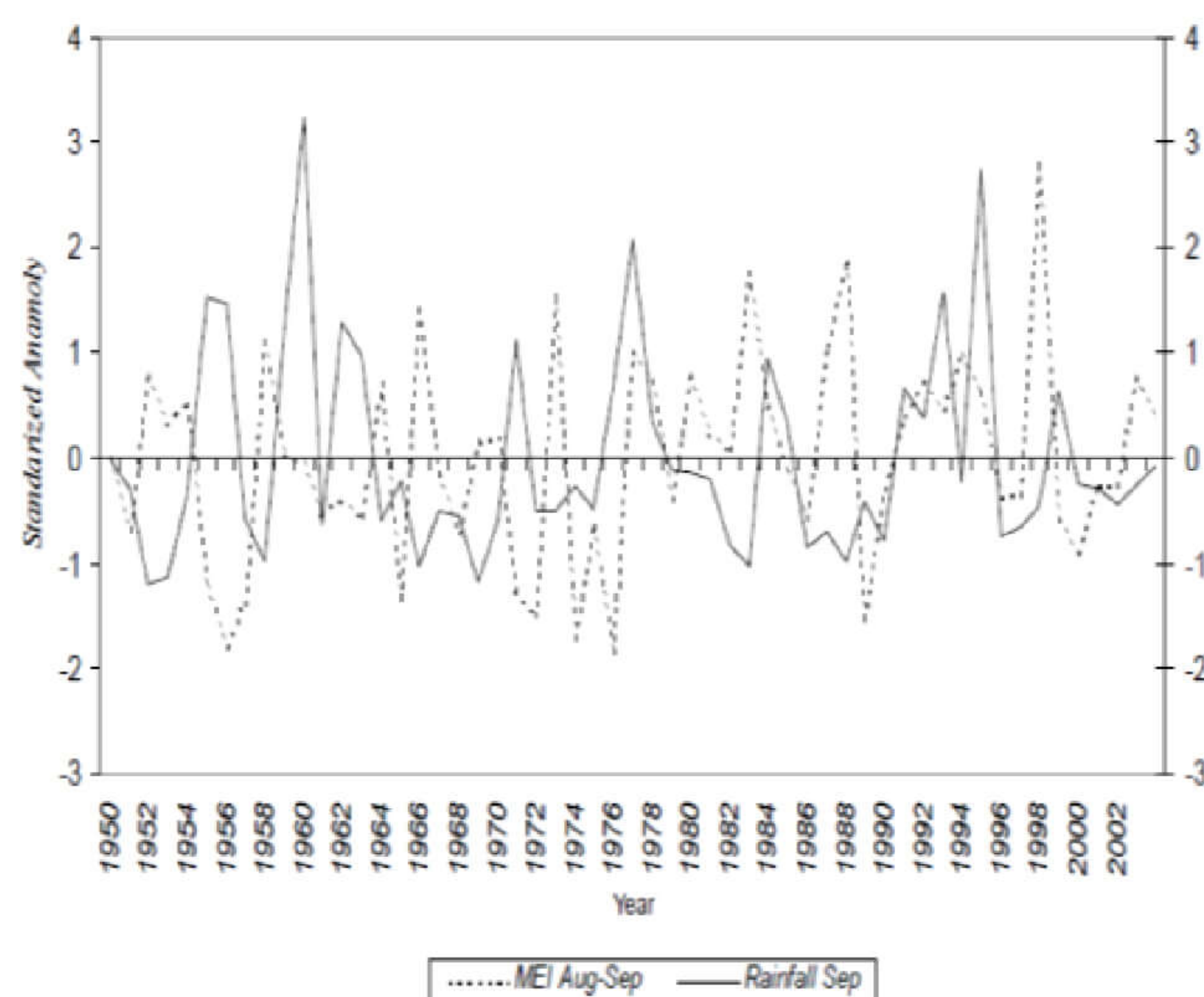


Figure 6: Time series of MEI Aug-Sep and Rainfall-Departure Sep all over Pakistan (Source Mahmood et al. 2004)



Zawar and Zahid (2013) investigated six months (April- September) rainfall patterns over Punjab, Khyber Pakhtunkhwa, and Kashmir during El Nino and La Nina years from 1960-2008 (see Figure 7 for overview). The monthly analysis showed that April and May have a 53% probability of above normal average rainfall and a 47 % probability of below average rainfall during El Nino years. The El Nino years have shown the probability of above average rainfall around 26.6 % and below average rainfall probability around 73 % have been observed in June, July and September over the study region. The El Nino years in August showed above normal rainfall with a 33.3 % probability and below normal average rainfall with a probability of 66.6 %. The La Nina years with above normal rainfall showed 38.5 % probability in April, May and September and 54 % probability in the months of June, July and August. The probability of La Nina years with below average rainfall is 61.1 % in April, May, 46 % in June, July, August and 61.5 % in the month of September (Zawar and Zahid 2013).

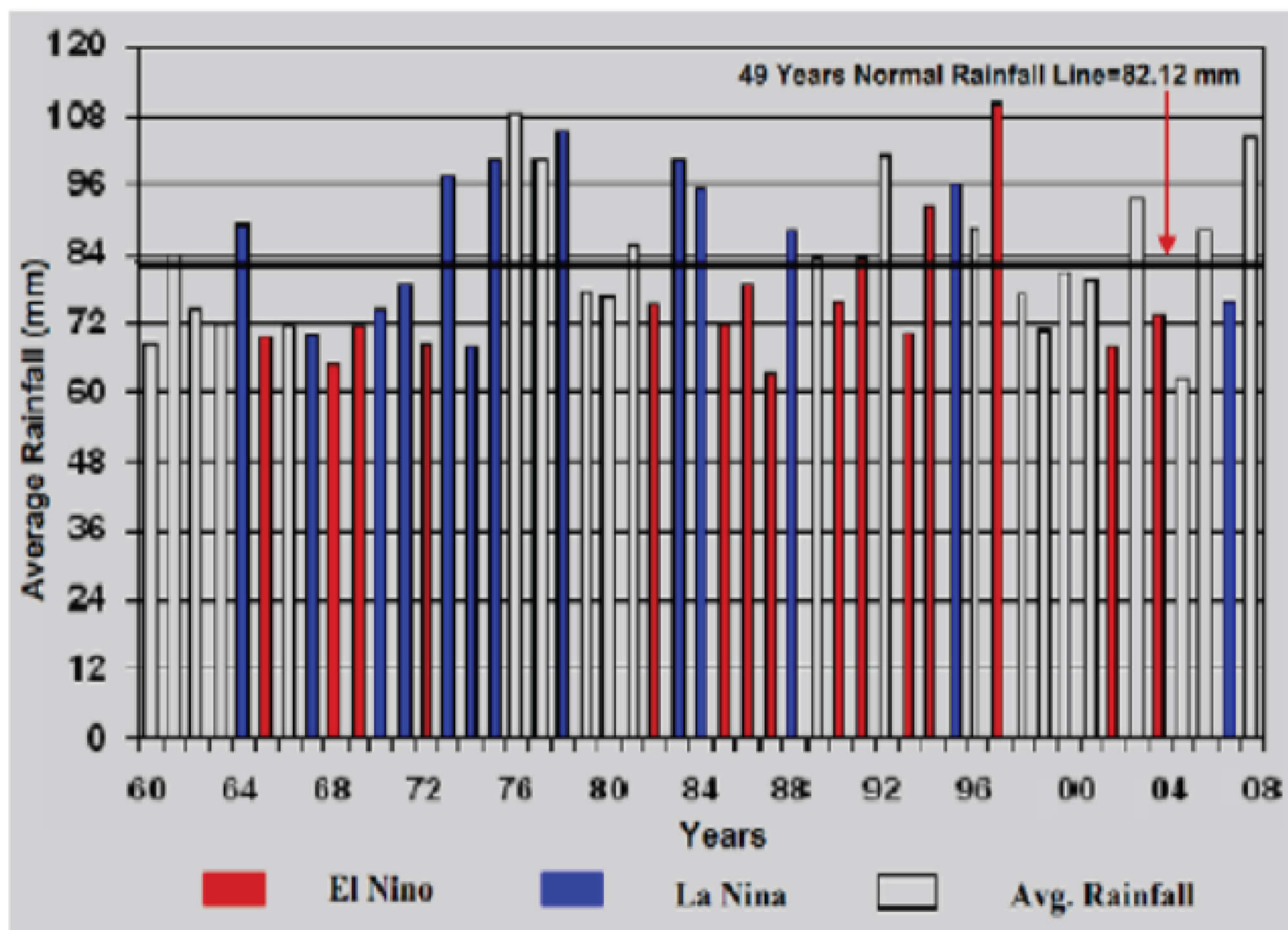


Figure 7: Average Rainfall with El Nino (Red) and La Nina (Blue) episodes April September over Punjab, Khyber Pakhtunkhwa and Kashmir from 1960-2008 (Source: Zawar and Zahid 2013)

In summary, Zawar and Zahid (2013) found the inadequate amount of rainfall during El Nino years and excess amount of rainfall during La Nina years was experienced over the study domain from 1960-2008. Zawar and Zahid (2013) found a strong evidence that the monsoon success and failure is linked with the El Nino and La Nina years in Pakistan.

Sea Surface Temperature (SST) patterns in the Pacific, Atlantic and Indian Ocean are also related to rainfall anomalies across the Indian Ocean basin (van Ogtrop et al. 2014). Variability of SST and its linkage with El

Nino needs to be understood with more fine-grained models. Khan et al. (2008) used satellite-derived SST data to understand the annual and seasonal variations and then spatial distribution in the vicinity of Pakistan's coastline located in the North Arabian Sea, during the period of 1985-2006. The SST variations were linked with El Nino and La Nina events. The trend analysis of annual mean SST showed that the inter-annual mode of SST variations dominated and the oscillations of 2-3 years and 5-6 years were dominant in the annual mean. Khan et al. (2008) assessed the influence of the El Nino and La Nina on the SST of Pakistan's coastal areas and found that SSTs were lower at the start of El Nino events; however, as the El Nino events progress, the rise in SSTs was observed. The year-to-year variability of Indian Summer Monsoon Rainfall (ISMR) has a large impact on the economy and agriculture of the region. As stated above, a large part of the population depends on agriculture, which is mostly rain fed. Therefore, accuracy in the prediction of ISMR has an immense importance, which can help the society to manage with the adverse effect of the monsoon, particularly the drought conditions. The Inter Annual Variability of ISMR is associated with variations in Sea Surface Temperatures (SSTs) over the equatorial Pacific (i.e. El Niño –Southern Oscillation (ENSO)) but land surface variability such as Eurasian snow cover and medium to long term climatic variability also influences the Inter Annual Variability of ISMR that needs to be investigated with more fine-grained models (Khan et al. 2008).

Uncertainties of El-Nino Events and Their Socio-Economic Impacts

During key informant interviews (list of interviewee names and positions in Annex I) and focus group meeting (list of participants in Annex II), many interviewees reported the perception that the direct impact of El Nino is mainly faced by the Pacific Ocean countries, whereas countries in South Asia like Pakistan are mainly facing the secondary level

impacts of El Nino. They also expressed the concern that there are still scientific uncertainties in relation to the explanations of El Nino phenomenon such as its generation, travel extent, and linkages with the cyclone, typhoon, hurricane, reversal of earth poles, tilting earth angle, cloud burst, and Abasyl factor (Magnetic waves from earth to upwards). Interviewees displayed strong interest and need to explore linkages and interactions between El Nino and Climate Change. Generally, both in-person and focus group participants identified that there is lack of a regional level knowledge base (portal) on El Nino and its impacts on South Asian countries.

The interviewees with relevant scientific expertise clearly expressed their perceptions that El Nino has potentially negative impacts in Pakistan in the form of extreme weather events such as droughts and floods. The changes in Monsoon weather patterns in the form of reduced rains in Pakistan are empirically established in various research studies (noted above). The interviewees however expressed a strong research need to explore the socio-economic impacts of El Nino in different parts of Pakistan. Broadly, experts anticipate that southwestern and northern Punjab, lower Sindh, Eastern Baluchistan, and entire Khyber Pakhtunkhwa (KPK) province, as well as northern Pakistan including Kashmir are hypothetically more vulnerable to the impacts of El Nino events. The changes in weather patterns in the form of extreme heat and cold waves and increased frequencies of floods particularly in the last six years adversely impacted these regions. The existing research work on socio-economic impacts is limited in a sense that it's mainly concentrated on El Nino's Impacts on summer monsoon rains but unable to develop region-specific physical, social and economic impacts of El Nino and its associated anomalous weather patterns. Broadly, focus group participants concurred there is a lack of rigorous research on socio-economic impacts of El Nino and La Nina and related vulnerabilities in Pakistan.



DETECTION

Earliest Warning of the Onset of the 2015-16 El Nino in Pakistan

PMD is mainly responsible to monitor El Nino events and issue early warning to NDMA. The warning of the onset of the 2015-16 El Nino was issued by PMD in 2014 and reported in the national media. Below is one of the El Nino early warnings reported in The Daily Tribune Pakistan on May 18, 2014.

El Nino: More severe weather in store

The prevailing unusual weather patterns across the country supplemented with developing indicators of El Nino phenomenon in the Pacific Ocean are likely to trigger severe weather conditions in Pakistan, experts said.

As the warm Pacific currents near the coasts of Peru and Ecuador developing El Niño events – a phenomenon that occurs every three-to-six year, dramatically affecting weather conditions worldwide – the indications are that it will dramatically affect weather patterns in Pakistan.

The current rains and dust storms occurring in South and central Punjab, Khyber-Pakhtunkhwa (K-P) and Northern Baluchistan have resulted in a temperature drop, which in turn has seen temperatures in these areas far lower than the norm for May. Meanwhile, other parts of the country are likely to remain hot and dry, which experts said were indicators of the first phase of El Niño.

Isolated heavy rains were expected in the upper parts of K-P, Malakand and Hazara divisions and Kashmir, which may also trigger flashfloods and landslides in vulnerable areas. Moreover, due to the low temperatures in the upper parts of the country, lower snow-melt was also predicted during the current month.

Speaking to The Express Tribune, Chief Meteorologist Dr Ghulam Rasul said that with a five-degree drop in temperature, the country is going through the coldest recorded month of May in two decades. According to a statement issued earlier this month by the National Weather Forecasting Centre (NWFC), Pakistan Meteorological Department Director Dr Muhammad Hanif the prevailing unusual weather conditions and the evolving indicators of El Niño conditions during the coming few months pointed towards an erratic monsoon in Pakistan, which may lead to lower rainfall during the season.

“Abnormal weather is appeasing the urban population, but farmers are likely to witness adverse effects on their crop yields,” said Rasul. All stakeholders have been alerted to keep checking the latest medium-term weather advisories from the Met Office during the season. Farmers have also been advised to take precautionary measures, particularly for harvesting and threshing of wheat and sowing of cotton until the end of May. “Due to abnormal weather conditions, the crops are likely to be damaged. The harvested crops are getting wet, which is also deteriorating the overall quality of the yield,” said Rasul.

“The weather patterns that will follow due to this El Nino effect can sometimes be very dry and or even very wet. There is also the likelihood that in future, floods and droughts might occur at the same time,” warned Rasul. In 1997-1998, El Niño resulted in abnormal heavy snowfall, followed by the country's worst and longest drought that stretched for four years in Baluchistan, lower Punjab and K-P. The 2009 El Niño resulted in a severe drought followed by devastating floods in 2010-2011. “Both extremes are

associated with the phenomena," said Rasul.

According to the Met Office's latest weather report, low pressure patterns were hovering over western parts of Baluchistan and adjoining areas, while a westerly disturbance was affecting upper and central parts of the country. No severe weather warning of flashfloods, tropical cyclones or heavy rainfall has been predicted by the Met Office so far.

Sources of El Niño warning & Its Disseminating Agency

Key informant interviewees confirmed that the scientific sources of El Niño warning in Pakistan are international agencies which mainly include the WMO and the Climate Prediction Center (NOAA/CPC/NCEP). The regional level weather forecasting agencies in India and other South Asian countries are secondary sources in relation to the early warnings about El Niño in the region. Process wise, interviewees told us that NDMA first receives information from PMD and later circulates it to disaster management structures and government departments at national and provincial scales.

Essentially, all experts agreed that PMD mainly relies on NOAA and Regional Forecast centers. There is a basic level of coordination among PMD and NDMA in disseminating a country-level national early warning. The focus group participants however bemoaned the fact that there is as such no formal level of cooperation/coordination among all concerned stakeholders in terms of communication of El Niño early warnings to civil society and relief/humanitarian organizations and/or implementation of preparedness measures in response to El Niño early warnings. From the interview and focus group data, we conclude that the present El Niño early warning activity is a fairly linear process of disseminating secondary information and primarily restricted to the issuance of early warning on El Niño by PMD/NDMA to a select list of national and provincial level public sector agencies. No specific research has been conducted to ascertain whether and how these public agencies respond to the early warnings. Expert interviewees expressed the need that there is an enormous amount of room to improve the capacity of PMD to generate high resolution flood and drought forecasts that include both El Niño and La Niña years. Improved understanding of localized socio-economic impacts of El Niño events requires that the forecast capability of PMD be tracked, improved and evaluated over the long haul. However current PMD financial and technical resources do not permit such an expansion of PMD capacity.





PREPAREDNESS/
READINESS

PREPAREDNESS/ READINESS

Many interviewees affirmed that national & provincial disaster management agencies have shown marked improvements in generating early warnings, executing emergency response measures, and implementing short-term recovery in a series of large, medium, and small scale natural disaster events in Pakistan over the last five years; however, disaster preparedness and risk governance is still widely neglected. Although there are risk governance and preparedness strategies and policies on paper, many interviewees expressed that these policies are not implemented in practice due to a host of issues such as lack of financial resources, human resources, technical expertise and political will. In relation to the El Nino, PMD issues early warnings and provides seasonal weather forecasts based on the impacts of El Nino. Our interview data revealed that there are no El Nino specific preparedness policies that are either developed or implemented in Pakistan.

For example, focus group participants pointed out that in case of the El Nino induced drought in 1998, no pre-drought interventions or preparedness activities were taken. The excessive extraction of groundwater in the initial drought onset period further aggravated the situation as it negatively impacted the livelihood of thousands of families' particularly in Baluchistan and forced their migration to other parts of the country. The livestock population, agriculture, and large fruit orchards perished in that prolonged drought period. Although, later on World Bank implemented a drought mitigation program in the worst drought affected areas of Baluchistan in which structural and non-structural interventions were undertaken. The structural activities were related to construction of small dams and irrigation wells, water

course lining, and rehabilitation of Karez (Traditional underground irrigation channels). The non-structural activities were related to capacity building of public and community institutions and advocacy campaigns on behavioral changes. The impact of the World Bank project on improving the preparedness of Baluchistan for the future El Nino events, however, needs to be evaluated.

The Responsible Agency to oversee national El Nino related preparedness

As per the existing legislations, NDMA working under the Ministry of Climate Change should have the main responsibility to oversee national El Nino-related preparedness. However, there are as such no El Nino specific preparedness activities or functional positions that were observed for except the dissemination of early warning issues by PMD.

Government El Niño-related reports or statements issued before the impacts of the 2015-16 El Nino first appeared

Reports are mainly with issuing early warning in a general as well as broader sense. It was briefly mentioned in the seasonal contingency plan for the Monsoon issued by PMD.

Barriers and Issues in Preparedness/Readiness:

There is a lack of technical knowledge, skilled human resources, high tech computers for advanced model simulation, coordination, and financial resources, all of which restrict El Nino preparedness/readiness activities. El Nino is not included in the national risk matrix. PMD and concerned academic centers need capacity building to undertake more scientific work on measuring the impacts of El Niño in various region of the country.

Similarly, both the Ministry of Climate Change and NDMA need to be mobilized to build their capacities on El Niño preparedness and El Niño response programs.

El Nino should be incorporated in the national risk matrix of Pakistan. A vast range of opportunities also exists to make improvements in the drought early warning system in Pakistan. There is an acute need to strengthen the capacities of concerned institutions at the national and provincial levels in the form of establishing El Nino Experts (from different sectors) Cell in the Ministry of Climate Change/NDMA and establish its chapters at the concerned provincial institutions. Similarly, a special working group on El Nino should also be established within the PDM which can undertake future research about

spatially explicit impacts of El Nino in different regions of Pakistan. The proposed Cell can work on improving the inter linkages among all concerned public departments and civil society organizations in relation to undertaking El Nino preparedness and mitigation activities.

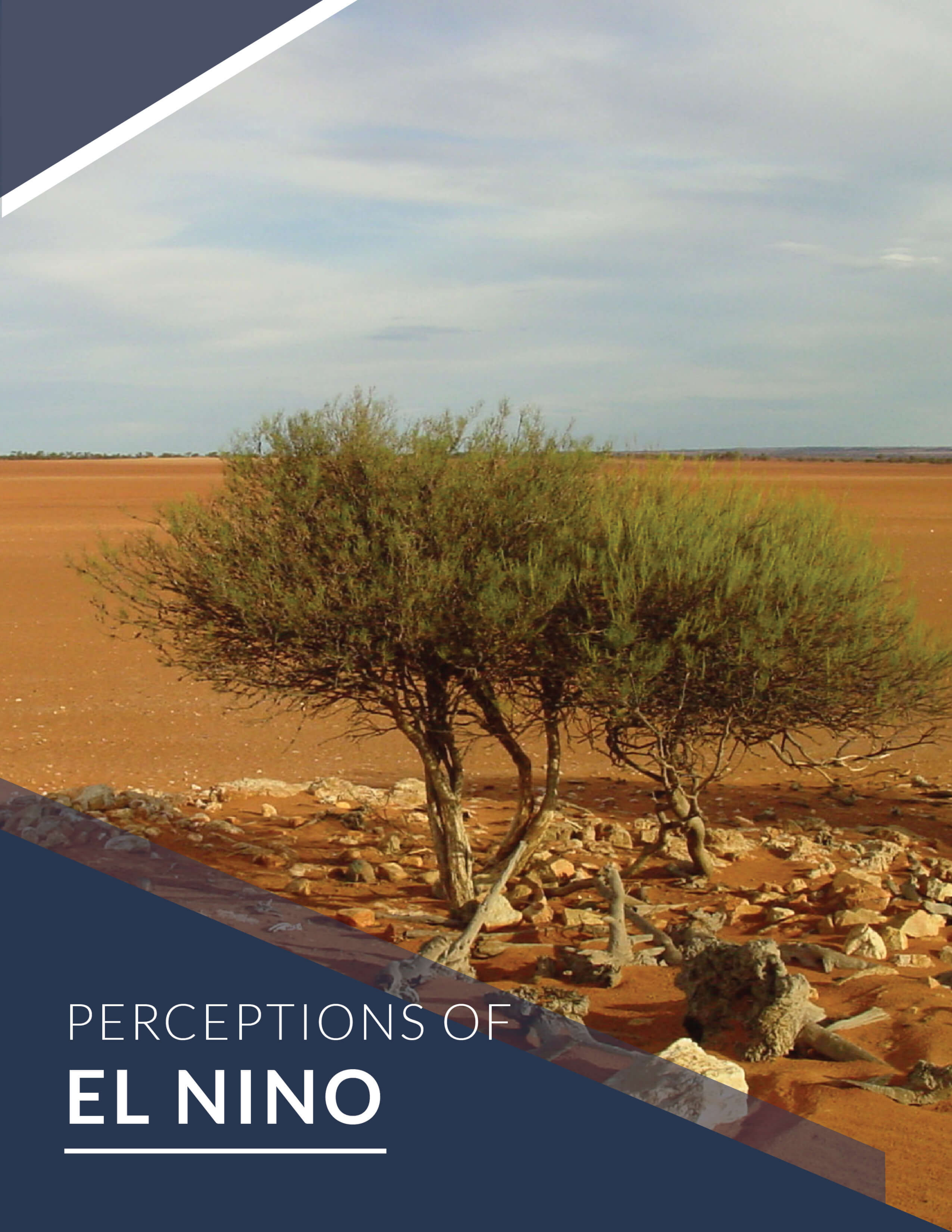
There is a vast potential of cooperation/coordination on El Nino preparedness that exists in Pakistan in terms of building the capacities of Ministry of Climate Change, NDMA, PDMAs, Ministry of Planning and Reforms, and Finance Ministry. There are also ample opportunities for integrating El Nino preparedness in the national level Disaster Risk Reduction (DRR) program and promoting social safety nets for the vulnerable communities living in the El Nino impacted regions.





IMPACTS OF RECENT **EL NINO**

There is an acute shortage of research work on analyzing the impacts of El Nino on various development sectors in Pakistan like water, health and agriculture. The economic survey of Pakistan (2015-16) identified negative growth in the agriculture sector mainly due to the low productivity of cotton crops. The survey linked it to the impact of climate change in the cotton producing areas in the southern Punjab and lower Sindh. A key informant from the UN identified that the current El Nino and its associated drought conditions affected agriculture in the rain-fed areas of the country and it also exposed the vulnerabilities of the irrigation system in the country. More systematic research that identifies first-order, second-order and even tertiary impacts of El Nino events on Pakistan's socio-economic and health sectors needs to be undertaken. For example, lower cotton crop productivity may lead to higher debts for small to medium scale farmers, which in turn can affect their long-term ability to survive as farmers or they may decide to migrate to urban areas. Further, drought in the southern and south-western Pakistan has demonstrably led to serious famine, displacement and public health issues. Similarly, winter floods in the northern Pakistan early in 2016 led to the secondary effect of mudslides (noted below). The interviewees and focus group participants, in general, displayed a sense of vagueness whether the observed famine, mudslides and displacement were caused by El Nino, climatic change, natural weather variability or persistent socio-political phenomena.



PERCEPTIONS OF
EL NINO

PERCEPTIONS OF EL NINO

Frequency and Destructiveness

The frequency and destructiveness of El Nino Events have increased in Pakistan. A number of expert interviewees attributed the increased frequency of El Nino in the last decade with the global climate change. As a consequence of current decaying phase of El Nino 2015-16, unexpected heavy rains occurred in March and April 2016 all across the country which adversely affected wheat crops in Punjab and Sindh. The landslides in northern Pakistan, KPK and Kashmir during March 19-20, 2016 widely damaged mainly villages. 86 people died in these heavy rains and landslides events in Kashmir. The extreme level of heat waves was also observed during the Months of May and June across the country. The PMD recently issued a seasonal weather forecast on above-average Monsoon rains during July-September 2016 which may cause floods in the upcoming rainy season. The expected increases in Monsoon activity correlate with the increased rainfall activity in the Monsoon seasons immediately following a strong El Nino year, e.g. 2015. The local experts are interested in understanding and mitigating the impacts of the ENSO cycle, i.e. variations in flood, drought and storm frequency and intensity compared with "normal" years, including both El Nino and La Nina events.

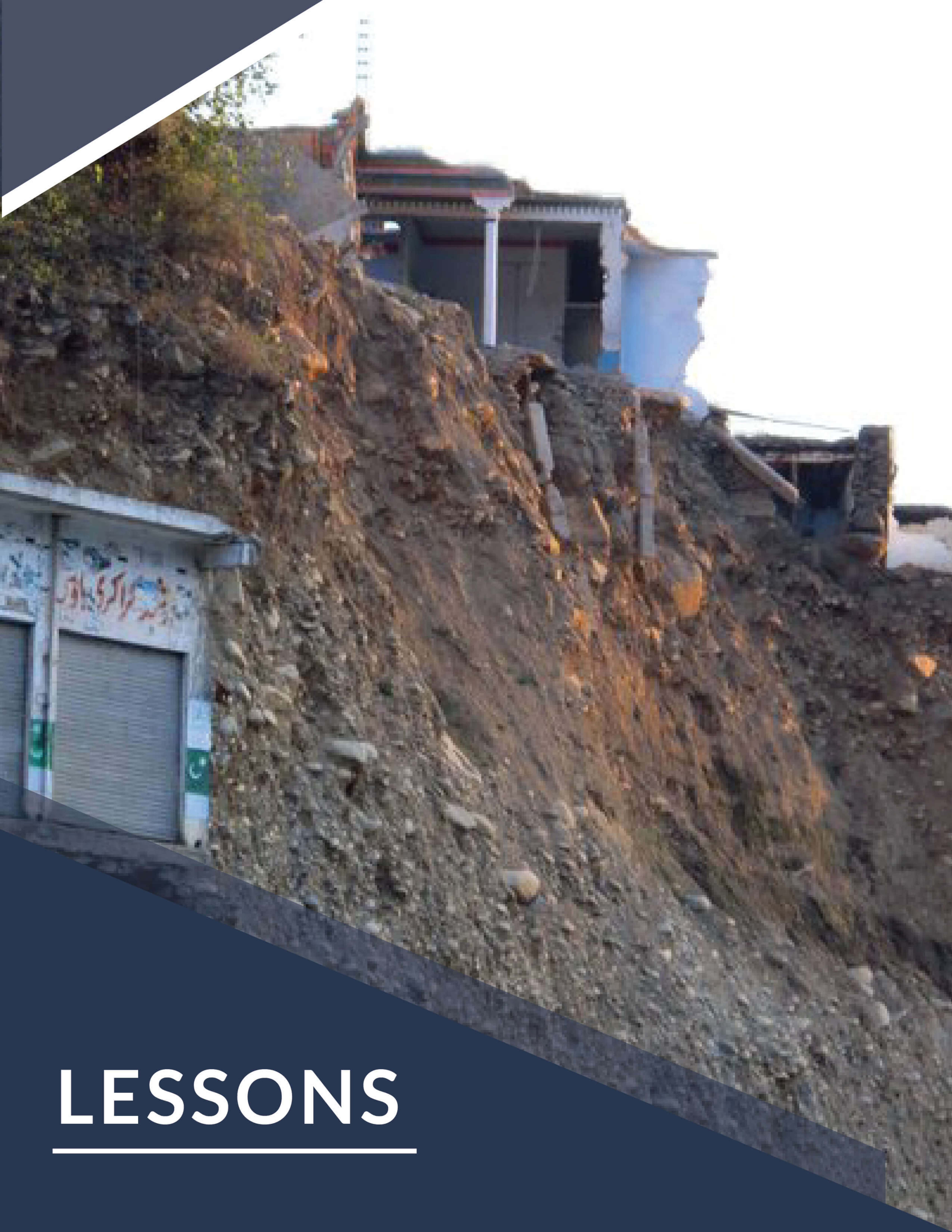
Responses to forecast

As mentioned earlier, there is as such no mechanism in place to respond on the El Nino forecast or early warning. The forecast is mainly issuing a set of statements on potential drought conditions or excessive rains. According to the interview and focus group data, we conclude there is no El Nino readiness or preparedness related activities that

have been taken up in Pakistan. However, in recent times there has been a growing informal debate among experts on developing a better understanding of the impacts of El Nino in Pakistan and what types of responses and preparedness would be needed to reduce its impacts on the potentially vulnerable areas. This informal debate, however, needs to be translated into a meaningful preparedness/response plan of action.

Responses to impacts

There is as such no specific research or documentation available which can provide quantitative estimations or qualitative descriptions on El Nino impacts in Pakistan or what responses might have been undertaken by concerned institutions to mitigate the impacts of El Nino. It was identified that there is lack of awareness among national and provincial level public institutions and humanitarian organizations on the potential impacts of El Nino in Pakistan. At the community level, the concerned grass root organizations are not aware about the intended impacts of El Nino in their respective regions.



LESSONS

LESSONS

One fundamental lesson derived from previous El Nino events is that the lack of response, absence of risk governance mechanisms and preparedness contributed heavily to the increased level of damages in the El Nino related droughts that have affected various areas of Pakistan in the last fifty years. The extent and volume of all such damages could be reduced, provided that an integrated risk governance approach was to be processed and comprehensive responses were taken up by the concerned public institutions. The slow onset of drought in Sindh and Baluchistan during 1998-2002 is one glaring example in relation to the poor forecast and lack of response after a mega-El Nino event in 1998. Another complicating problem is the linkage of timing of drought events in places like Baluchistan with the political and demographic cycles. The current insurgency in Baluchistan, for example, according to interview data, may play a bigger role in governmental inaction than the availability of El Nino forecast. Socio-political contextual conditions of forecast use are as important as the forecast itself. Such factors are especially critical in tribal conditions such as those prevalent in Baluchistan. Although in relation to the El Nino in 2015, there have been improvements in relation to the issuance of the early warning by the PMD/NDMA and the communication of its general impacts. However, there were no effective response, preparedness, governance or mitigation actions that were taken up at the national or provincial level. Another main reason behind such a lackluster response has been the lack of technical, financial, and human resource capacities at federal, provincial, and local levels. Even if the political will were to exist in more favorable political conditions (e.g. the end of insurgency), the ability to generate accurate, spatially explicit forecasts would be limited due to poor technical and financial capacity in the relevant agencies. Various empirical research studies reviewed for this

project highlighted that there is strong probability of increased Monsoon rains in the year after the El Nino. The recent seasonal weather forecast for Jul-Sep 2016 predicted the same pattern and indicated the risk of floods. However, we do not see any proactive response strategy or even tactics to minimize the impacts and damages of floods that have been forecasted in the upcoming rainy season, except for some conventional contingency planning activities. In other words, flood forecast and mitigation capacity (as well as political will) are severely lacking in the current political and security environment described at the outset of this report. In view of the increased frequencies of El Nino events in last decade and its associated natural disaster events, Pakistan now needs to fill the huge prevailing gaps and devise and implement an integrated risk governance approach as well as a national level action plan on El Nino preparedness and readiness.

Media

The potential impacts of recent El Nino events on Pakistan did receive coverage in national print media; however, such coverage was quite rare in the previous history. The PMD early warning about El Nino 2015 was generally published in a couple of the English print media. No systematic search on El Nino was conducted in Urdu or regional language print or electronic media in the present study. A more systematic media sample collection needs to be undertaken for a better understanding of the risk perceptions of local populations to El Nino related forecasts. Given that many indigenous and local people do not speak or read English, the English media findings described below must be taken with this major limitation in mind.

Like other national and provincial concerned stakeholders, there is an apparent lack of awareness among media on El Nino and less exclusive reporting available on El Nino impacts or its related

preparedness issues. There is a need to organize exclusive training and sensitization and awareness programs about El Nino Impacts for print and electronic media.

During our research, we undertook a media review of Dawn, a leading English newspaper. It indicated a low level of coverage on El Nino events over the past 30 years. In most cases, Dawn published stories on El Nino in the international context, that is, its impacts on countries in and around the Pacific Ocean and much less El Nino in the context of Pakistan. The attached Annex II on our El Nino Media Review of Dawn provides some selected articles of the last 30 years. A formal discourse or content analysis of this sampled English media data could be done in a future study. In addition, a thorough analysis of Urdu and regional language media, both electronic and print, would help to get a broad handle on the population's risk perceptions of El Nino and its forecasts and impacts.

Identify Country specific El Nino related Information

El Nino events have highly significant impacts on Pakistan in the form of extreme weather and weather-related events like drought, floods, landslides, and so forth. It affects the agriculture and water resources of the country as well as the health of the population. There is lack of region and sector specific quality research work on the various levels of impacts of El Nino in Pakistan. PMD and NDMA are mainly involved in issuing early warning and seasonal forecasts, but there are as such no El Nino specific preparedness activities or emergency response and resilience building activities that are observed in Pakistan.

A large scope exists to improve the level of cooperation and coordination among UN agencies/NDMA/Planning Ministry on El Nino preparedness. It is also crucial to mobilize national and provincial governments to give serious commitments on building the capacities of district governments/DDMAs in vulnerable hazard prone areas in order to prepare them for El Nino on short, medium,

and long-term basis. The socio-economic infrastructures in vulnerable regions need to be made more resilient, including the building of social safety nets for the ultra-poor population groups.

One of the highlights of the Pakistan study team's contribution to this project was convening a high-level meeting that was organized in Islamabad on April 21, 2016. It coincided with the Earth Day 2016 activities. The meeting was held in the Pakistan Humanitarian Forum Secretariat. Annex I show the names of workshop participants and their respective affiliations that broadly covered the international and national level emergency and humanitarian relief agencies operating in Pakistan. The purpose of the workshop was to ascertain the level of awareness amongst the humanitarian agencies about the El Niño and La Nina and their impacts around the globe and more specifically on Pakistan and engage in discussion about the governance and policy actions that can be taken to make Pakistan an El Nino Ready Nation. The workshop setting enabled us to share preliminary research findings on the El Nino Readiness Pakistan Case Study with the participants and to get feedback and suggestions on the study. The following set of observations and recommendations that came from this workshop could lead to a comprehensive set of capacity building and policy & administrative actions to improve El Nino/La Nina forecasts, early warning communications and resilience building activities in all regions of Pakistan.

Observations/comments from workshop participants

1. El Nino and La Nina are not a familiar phenomenon in Pakistan: village or urban communities are not well aware of the phenomenon and its impacts.
2. This topic is more directly of interest for PMD and humanitarian organizations.
3. International and local Humanitarian organizations should get knowledge of these phenomenon and its impacts, changing pattern of climate and occurrence of disasters like flood, drought affecting the livelihoods.

4. The terminology should be easy to understand. Research on what could be done to predict the localized impacts of this phenomenon would be valuable, that is, localized impact studies are needed.

5. El Nino and La Nina phenomenon are co-mingled with climate change making it difficult to determine the reason of increasing disastrous events. It is important to differentiate El Nino impacts from what can be attributed to climate change.

6. El Nino and La Nina are predictable phenomena and they are observed at the global and regional levels. There is need to build the capacity of PMD /institutions to predict its impacts at national and local level.

7. El Nino is highly important on a scientific level, as El Nino can trigger hydro met natural disaster. If it can be better predicted, then predictions can be used to protect livelihoods decreasing floods and droughts.



CONCLUSION

CONCLUSION

Conclusion

1. El Nino events have highly significant impacts on Pakistan in the form of extreme hydro-meteorological events like drought, floods, landslides, etc.
2. It affects agriculture and water resources as well as adversely affects the health of local population.
3. There is a lack of regional and sector-specific rigorous research work on the primary, secondary or tertiary impacts of El Nino in Pakistan.
4. The PMD and NDMA are mainly involved in issuing early warnings and seasonal forecasts but there is no such El Nino specific preparedness activity or emergency response/resilience building activity observed in Pakistan.
5. A large scope exists to improve level of cooperation and coordination among Pakistan's Humanitarian Agencies/NDMA/PHF/DRR Forum/Planning Ministry on El Nino preparedness.
6. It is crucial to mobilize national and provincial governments to give serious commitments to building the capacities of district governments and DDMA's in hazard prone vulnerable areas in order to prepare them for El Nino on a short, medium, and long-term basis.
7. The socio-economic infrastructure in these vulnerable regions needs to be more resilient including building of social safety nets for ultra-poor population groups.

Recommendations:

1. The study findings recommend that more specific research work is required on impacts of El Nino & La Nina in Pakistan. Differentiate and clarify the linkage of El Nino & La Nina with climate change.
2. Forecast and early warning for hydro met hazards (Climate, Water and weather) communication as well as proposed preparedness actions should be communicated in such a way that it is easy for a layman to understand.

3. El Nino preparedness planning should be ideally done by NDMA/PDMA, i.e. build the capacity of existing federal agencies. New DRM/DRR initiatives and their linkage with El Nino and La Nina events need to be clarified.
4. Future technical sessions should be organized by the NDMA, PHF or NHN on emergency preparedness and on NGOs, efforts in progress in order to link relief, rehabilitation and development "Best case studies, Lessons learnt"
5. The study also recommends to develop mitigation strategies on hydro met natural disasters and response and preparedness in Pakistan
6. NDMA to coordinate with regional countries to develop regional level preparedness plan for El Nino as early as possible to get benefits of regional information and expertise.
7. Build the capacities of Disaster Management Authorities (DMAs) on El Nino and La Nina impacts at local level
8. There is a need of urban resilience initiatives; WASH, Livelihoods and health particularly require to prepare for climate induced catastrophe.



Picture 1: Meeting Participants in Consultative Session on El Nino Readiness Pakistan Case Study Organized by PHF and PEDA International

COUNTRY CASE STUDY

ANALYSIS AND SUMMARY

BY THE COUNTRY TEAMS

Regional Studies

1. In regional scale studies it is observed that large-scale SST patterns in the Pacific, Atlantic and Indian Ocean are related to rainfall anomalies across the Indian Ocean basin.
2. The large-scale shifts in convection over the Pacific affect the atmospheric circulation over the Indian Ocean. The tropical Indian Ocean gradually warms during El Nino episodes.
3. It is well known fact that the Indian summer monsoon is adversely affected by El Nino and the Indian subcontinent seems to receive below normal rainfall during El Nino years.
4. The El Nino-Southern Oscillation (ENSO) extremes in recent time are now becoming more frequent. Therefore, their impact on the Asian monsoon could lead to high inter-annual variation in rainfall characteristics.

National Studies

1. Over the last two and half decades, some national/provincial/local level research work has been done on the exploration of the El Nino relationship with Summer Monsoon rainfall patterns, SST variability along the Pakistan Coast, and historical warming trends in annual mean temperature in Pakistan.
2. This research work is mainly done by Pakistan Meteorological Department (PMD) published in its Pakistan Journal of Metrology.
3. These Studies (noted in the Science section) have revealed the trends in annual and seasonal patterns of precipitation over the last several decades. It

reflected a large variability in the monsoon rainfall pattern on both space and time scales.

4. It shows that the decade of 1960s was much drier than the recent decades and that low rainfall episodes continued until the mid-1970s followed by a wetter period until the El Nino event of 1997-98.
5. Under the influence of El Nino, precipitation dropped drastically throughout Pakistan resulting into scarce rainfall both in the summer and winter seasons.
6. That El Nino induced shortfall of precipitation triggered Pakistan history's worst drought in terms of length and intensity which prevailed from fall of 1998 and prevailed well beyond El Nino event to spring 2003.
7. Rashid (2004) studied the impact of El Nino and declared that El Nino has negative effect on winter rainfall over Pakistan.
8. The results of comparing bi-monthly multivariate ENSO index (MEI) to monsoon monthly rainfall showed suppressed rainfall for the whole Pakistan (Mahmood et al., 2004).
9. El Nino phenomena suppress monsoon rainfall activity over Pakistan.
10. There is a tendency of reduction in summer monsoon rainfall over Pakistan during El Nino years. The deficiency in % rainfall is statistically significant up to the 90 % level during July and September months.
11. There seems to be an association between El Nino and weak monsoons in Pakistan due to which

Pakistan experiences droughts events. Over more than hundred year's period 1871-1988), 11 out of 21 drought years were El Nino years.

12. During last 100 years, 7 strong, 10 moderate and 7 weak EL-Nino events occurred in Pakistan.

13. There is 17-64% departure of rainfall from normal during strong El Nino events.

14. Pakistan receives more than normal rainfall during the summer monsoon season in the immediate following year after the El Nino event.

15. The cumulative seasonal (April to September) analysis showed the suppressed rainfall during El Nino and surplus amount of rainfall in La Nina years. Therefore it is deduced that drought conditions can be associated with the El Nino years and floods with La Nina years during monsoon in Pakistan.

16. The suppressed monsoon rainfall during El Nino years and surplus monsoon rainfall during La Nina years affects the crop yield badly.

ELRNs Project - Pakistan Case Study

1. The frequency and destructiveness of El Nino Events has been increasing in Pakistan.

2. South west and north Punjab, lower Sindh, Eastern Baluchistan, the entire KPK, north Pakistan, and Kashmir are more vulnerable to the impacts of increasing El Nino events.

3. The changes in weather patterns in the form of extreme heat and cold waves and increased frequencies of floods particularly in last six years have adversely impacted these regions.

4. As a consequence of the currently declining phase of El Nino in 2016, unexpected heavy rains occurred all across Pakistan.

5. The landslides in north Pakistan, KPK and Kashmir widely damaged villages and road infrastructure. More than 100 persons died in these current heavy

rains and landslide events in Kashmir.

6. Existing research work is limited in the sense that it is mainly concentrated on El Nino Impacts on summer monsoon rains but unable to develop region-wide anomalies in climate change, water and weather specific physical, social or economic impacts of El Nino and its associated unusual weather patterns.

7. There is lack of quality research work on spatially explicit impacts of El Nino on Pakistan.

8. There is as such acute shortage of research work on analyzing the impacts of El Nino on various development sectors in Pakistan such as water, health, energy and agriculture.

9. There is growing research interest to explore the societal impacts of El Nino in different parts of Pakistan

El Nino Early Warning & Dissemination

1. In the case of Pakistan the PMD is mainly responsible to monitor El Nino events and issue early warning to NDMA. PMD also provides seasonal weather forecast based on the impacts of El Nino.

2. The main sources of El Nino warnings are international agencies which mainly include WMO and Climate Prediction Center (NOAA/CPC/NCEP).

3. The warning of the onset of the 2015-16 El Niño issued by PMD in 2014 and reported in the national media.

4. El Nino related early warning issued by PMD is generally published in some English print media.

5. There is a lack of awareness among media on El Nino and less exclusive reporting on El Nino impacts or its preparedness issues.

El Nino Preparedness and Readiness

1. In the case of Pakistan, the national/provincial disaster management structures showed marked improvements in early warning, emergency response, and short-term recovery in responses to a series of large, medium and small natural disaster events in Pakistan during the last five years.
2. Disaster preparedness and DRR are still widely neglected. Although there are strategies and policies on paper, so far they are not implemented in practice.
3. In relation to the El Nino, there are as such no El Nino specific preparedness policies that are developed or implemented in Pakistan.
4. El Nino is not included in the national risk matrix.
5. As per the existing legislations, NDMA should have the main responsibility to oversee national El Nino related preparedness. However, there is no such specific preparedness observed, except the dissemination of early warning issued by PMD.
6. There is a lack of technical knowledge, skilled human resources, and high tech computers for advanced model simulation, coordination, and financial resources restricting El Niño preparedness activities.
7. PMD and concerned academic centers need capacity building to undertake more scientific work on measuring the impacts of El Nino in various regions of the country.
8. El Nino should be incorporated to the national risk matrix of Pakistan. A scope also exists to bring vast improvements in the drought early warning system in Pakistan.
9. There is a great potential for cooperation/coordination on El Nino preparedness in Pakistan in terms of building the capacities of the Ministry of Climate

Change, NDMA, PDMAs, Ministry of Planning and Reforms, and Finance Ministry; in integrating El Nino preparedness to the national DRR program; and promoting social safety nets for vulnerable communities living in the El Nino impacted areas of the country.

10. There is as such no specific research or documentation available which can provide quantitative estimations or qualitative descriptions on the El Nino impacts in Pakistan or what responses undertaken by concerned institutions to mitigate the impacts of El Nino. It was identified that there is a lack of awareness among national and provincial level public institutions and humanitarian organizations on the potential impacts of El Nino in Pakistan. At the community level, the concerned grassroots organizations appear to be unaware about the impacts of El Nino in their respective regions.

11. There is an acute need to strengthen the capacities of concerned institutions at national and provincial levels in the form of establishing El Nino Cell in the Ministry of Climate Change/NDMA and establish its chapters at the concerned provincial institutions. Similarly, a special working group on El Nino should also be established within PMD which can undertake future research on the impacts of El Nino in different regions of Pakistan. The proposed Cell can work on improving the linkages among all concerned public departments and civil society organizations in relation to undertaking El Nino preparedness and mitigation activities.

12. Similarly, the NDMA & the PHF/DRR Forum need to be mobilized to build their capacities on El Nino preparedness and preparing El Nino response programs.

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LIST OF ANNEXURES

Annexure 1: Consultative Meeting and Interviews for El Nino Readiness Pakistan Case Study

The national and international humanitarian sector organizations participated in the consultative meeting includes;

1. Rabia, PHF
2. Megan Herweryer, Country Director ACTED
3. Andrea Bindel, Country Director Arche Nova
4. Shahwal, Program Coordinator Arche Nova
5. Nasr Ullah Khan, Acting Country Director Catholic Relief Services
6. Khadim Nabi, Program officer CESVI
7. Ahmed Arbab, Director Operations HOPE 87
8. Arbab, Security Adviser International Rescue Committee
9. Asma, Project officer International Rescue Committee
10. Sumayya Sajjad, Head of Programs Islamic Relief
11. Raza Nanejo, MEAL Specialist Islamic Relief
12. Ihsan, Program officer Norwegian Church AID
13. Saeed Akhtar Khan, Trocaire
14. Nadeem Bukhari, Team Leader livelihoods program Inter Cooperation

Key Informant Interviews

1. Dr. Azmat Hayat Khan (Director, National Drought Mitigation Center), Pakistan Metrological Department (PMD), Islamabad
2. Dr. Muhammad Hanif (Director, National Weather Forecasting Center), Pakistan Metrological Department (PMD), Islamabad
3. Neil Buhne (UN Resident & Humanitarian Coordinator), Islamabad
4. Muhammad Abid (Floods and Drought Expert), World Bank, Islamabad
5. Rabia Sabri (Coordinator), Pakistan Humanitarian Forum (PHF), Islamabad
6. Iftikhar Sherazi Dawn TV

ANNEX II: SAMPLED ENGLISH MEDIA ARTICLES RELATED TO EL NINO WARNINGS

This treacherous weather!

Date: 22 July, 1983, Dawn News

The main news bulletin on T.V before Eid day devoted considerable time to the unusual weather the world is going through this year. The storms in California (USA) in March (we could see 'a soaked Queen Elizabeth in torrential rains' being escorted by President Reagan on Karachi TV), the famine in Indonesia, the scorched continent of Australia all it said, are the result of a quirk in the global weather machine.

Though the bulletin did not mention it, even Pakistan seems 'to be having some share of the treacherous weather through our world. It had an unusual hot June, and the Karachites are now facing a rather rare hot

and sultry July, a month which generally cool and pleasant in the metropolis. The weather-men (meteorologists) attribute the changed complexion of weather everywhere to a big mass of warm water known as El Nino.

Topsy Turvy

El Nino builds up in the eastern part of the Pacific Ocean near the South American coast after every decade or so; the surging warm water affects the climate of South America and North America. Since the weather in any one part of the globe cannot remain an isolated event, it causes destruction in the normal weather pattern elsewhere as well.

This time El Nino's magnitude perhaps is more, and so, the weather pattern everywhere is topsy turvy. Those of the children who might have studied geography, may be aware that all weather conditions largely result from moving masses of air, and temperature is the chief villain in the whole drama. All air movements are caused by the unequal heating of the land and water areas. The land gets hot more quickly and also cools down quickly, while water takes longer to get heated or cooled.

There are some sort of relationship and pattern between the temperatures on land and in the sea. This makes the movement of air possible both vertically and horizontally and that determines the usual weather. But if that usual balance gets disturbed by some quirk, as has been done by the large mass of El Nino water surging forth in a great area in the Pacific, the weather turns erratic -storms somewhere, hot weather elsewhere more rains where rain was scarce, and drought where it used to rain.

Why does El Nino with greater fury this year? No one knows for certain the weather machine is so complex. But one plausible explanation being offered by weathermen is the intense volcano eruption of El Chichon in southern Mexico (please refer to "Science To day " of October 15, 1982).

Last year, El Chichon was in unusual fury. It sent some 10 million tons of gas, Sulphur fumes, and other material into the atmosphere.

Catalyst

As a result of so much of fumes into the atmosphere, 5 percent of sunlight was cut down in the region. That caused a major change in the heat balance on earth.

The cloud moves north and affected the northern hemisphere as well. Meteorologist think that it is the volcano eruption which has acted as the catalyst for the many changes, and El Nino warm water is one. It appears that the Trade winds over the ocean almost stopped and caused El Nino.

Anyway, it looks funny that a volcano erupts in Mexico; it creates a dent in the Trade winds which cause massive surge of warm water in the Pacific, and that finally enacts weather changes all over the globe. But that is that!

The atmosphere around the earth is one gigantic physical system. Change at one place has to induce changes in other parts. A.K.

Abnormally warm current changing world weather

Date: 05 Aug, 1983, Dawn News

WASHINGTON Aug 4: An abnormally warm water current in the Pacific has been causing havoc to the world weather for a year now, and despite some hopeful signs fears have been expressed, it might last another year. This is based on the readings made by AP-3 aircraft, packed with ultramodern electronic equipment that has just completed a weeklong survey of the Pacific current from a base in Ecuador in South America.

Evidence of weather reversal is offered by the Ecuadarian base town itself. It has been hit by 100 times more rain than normal, 13 feet of water since last fall. Torrential rains have flooded and destroyed life and property in the comparatively dry areas of Peru and Bolivia and reached as far north as USA, while on the other side of

the Pacific, droughts have devastated Australia, Philippines and Indonesia, and affected areas as far as Sri Lanka and Southern India.

Explaining the phenomenon, PPI special correspondent Ghani Erabi quotes experts as saying, normally trade winds push warm Equatorial water into the Western Pacific and cooler water wells up from the ocean depths to replace the warm surface water. But if and when the trade winds fail or diminish, the warm surface water slashes back the warm water and generates huge towers of cumulous clouds that burst into rain towers of cloud. Known in Spanish as "El Nino", the normally fickle current has now flowed for a full year and kept sea surface temperatures 12 to 15 degrees above normal and touched off catastrophic floods in some countries and devastating droughts in others, destroying thousands of lives and billions of dollars' worth of property. For some unknown reason, the flow becomes unusually severe every 8 to 10 years and could run to more than two years as during 1940-42 and 1977-79.

The experts just back from their research mission over the Pacific current report readings that suggest conflicting conclusions. Their measurements north of the Equator still show the water to be warmer than normal, generating "huge tower of cumulus clouds, "El Nino" is still there though not as strong as a few months ago. However, just south of the Equator, the P-3 flying laboratory noted a distinct cooling, with the sea surface temperature falling from 84 to 77 degrees. The experts observed cooler water welling up from the depths as warm water was pushed by trade winds back into the Western Pacific. But the area of cool water is still small and it is still 4 to 6 degrees warmer than usual.

The conflicting evidence thus holds hope of relief and prospect of prolongation of agony for another year.
-PPI

Warmest year in the century alarms theorists

By James Gerstenzang

Date: 10 January 1998

WASHINGTON, Jan 9: The year 1997 was the warmest of the 20th century, the federal government announced on Thursday, fueling fears that pollution caused by such sources as cars and factories –the so-called greenhouse effect –is contributing to global warming.

The new figures are even more in the view of many scientists, when combined with other data showing that the warmest five years of the century –when such recordings began –have all occurred since 1990.

"Are there reasons to be skeptical that greenhouse gases are having an impact? No. there are no reasons to be skeptical." said Tom Karl, the senior scientist of the National Oceanic and Atmospheric Administration's National Climatic Data Centre.

President Clinton seized on the new data, saying at a political fundraising event in New York: "We need a national consensus to do something on global warming. It is significant and what we need is an understanding that we can grow the economy and still preserve the environment."

His administration is embarking on what is likely to be a difficult campaign to win Senate approval of an international agreement to reduce emissions of carbon dioxide and five other gases negotiated last month in Kyoto, Japan. These gases, many scientists say, trap heat in the atmosphere much the way a greenhouse roof holds in the sun's warmth.

Still, the announcement of the new temperature data prompted skepticism from longtime critics of the theory that global warming is real, and that it is being brought on by such center pieces of modern life as the automobile, refrigerators and energy-demanding televisions.

"The surface of the ocean has warmed, obviously the effect of El Nino," the periodic warming of ocean waters

that wreaks havoc as it has for the past several months with global weather patterns, said S. Fred Singer, an atmospheric physicist and president of the Science and Environmental Policy Project, an organization of mostly retired academics that has questioned the evolving theory of global warming.

"El Nino will last only a year I'd bet next year will be much cooler. One year does not make a trend, he said.

As for the steadily warming temperatures reported throughout the decade, he said they were based on data contaminated by recordings made at airports close to cities that reflect the "heat-island" effect that warms urban areas where cooling shade trees, lawns and meadows are lacking.

According to the National Climatic Data Centre's figures, the mean temperature of the Earth's surface, based on readings on land and at sea around the globe, was 62.45 degrees Fahrenheit, an increase of three-quarters of a degree over the mean temperature during the previous three decades. In 1996 it was 62.06 degrees, and in 1995 it was 62.30 degrees. This latter reading was the previous high yearly temperature for this century and was also recorded in 1990.

On land, the 1997 figure was 58.06, down from the 58.29 figure in 1995 and the modern record of 58.31 in 1990; at sea, the 1997 figure was 64.25, the highest yet recorded.

While the yearly variations may appear minuscule, climatologists consider them significant because an increase of barely two degrees could introduce such feared results of global warming as flood-inducing higher sea levels and drought-producing shifts in weather patterns.

Indeed, during the most recent Ice Age, approximately 18,000 years ago, scientists have calculated that the Earth's temperature was perhaps no more than 10 degrees cooler than now. –Dawn/LAT-WP News Service (c) Los Angeles Times

El Nino, where are you?

Art Buchwald

Date: 04 April 1998

DO you always have to write about the Lewinsky affair? I'm getting tired of it," thus wrote Haley Breene Huxley the other day.

I replied by telling her she was right, and instead of dealing with an infamous scandal, I would talk about El Nino the most important story of the year.

El Nino first came to the public's attention when it blew through the Whitewater housing development in Arkansas. This bankrupted a bank outside Little Rock and half of a law firm.

The governor of Arkansas, whose concern was with acts of God, called in several deputy sheriffs, who had dealt with El Nino disasters before.

He also called in a flood damage expert named Paula Jones to discuss what could be done to turn El Nino in a different direction.

Unfortunately, they met alone in a hotel, and Paula said El Nino was hardly discussed.

Then the governor was elected president, and a special prosecutor was appointed to find out why there was so much warm water in the Pacific Ocean.

At this point in time, a White House intern, who had majored in freezing weather, told her best friend that she and the president spent all their time talking about El Nino.

The friend taped everything the intern said, including the reports of a weird storm system over Alaska.

She took her tapes to the special prosecutor, who was trying to find out how much water El Nino was dumping on Los Angeles.

But the prosecutor needed confirmation before he could charge the president with lying about the high tides

and misdemeanors.

Apparently one other woman knew about the president's role because she had gone to see him about a job. When she raised the question about the cold masses of air coming into Canada and meeting the warm winds from El Nino, the president grabbed her and said, "The country salutes you." It was "60 Minutes' " finest hour. The question now is, has El Nino hurt the president? His pollsters say it hasn't. His job is to make sure the weather does no harm to the people.

And if he does it right, no one can impeach him. –Dawn/Los Angeles Times Syndicate

1990s warmest years since the Middle Ages, say experts

Date: 23 April 1998

LONDON, April 22: Three of the past eight years have been the warmest in the Northern Hemisphere for at least 600 years and greenhouse gases are the primary cause, scientists said on Wednesday.

Natural factors such as solar radiation changes and volcanic activity have contributed to global warming and to the record years of 1990, 1995 and 1997. But greenhouse gases are being blamed as the dominant form in recent climate change "We found that the warming of the 20th century and especially in the past few decades did not show any relationship with the possible natural factor that govern climate change, but instead had a very strong relationship with the human increase in greenhouse gases concentration," said Michael Mann, a climate scientist, in a telephone interview.

Mann and scientist at the University of Massachusetts in Amherst used historical records of temperature, rain and data from tree ring ice cores and ice melt indices to make a reconstruction of past temperatures dating back to 1400.

Their research, reported in the scientific journal Nature, extended previous climate records much further into the past. Mann believes it may even be possible to reconstruct mean global temperatures back over the entire millennium.

"What this study gives us in particular that we really didn't have before is perspective of global patterns of climate change," Mann said.

"We've been able to construct with relatively small uncertainties the global climate back 600 years that gives us a longer term perspective to try to attribute the unusual warming trend of the 20th century," he added.

The reconstruction showed that the rate of global warming in the 20th century was unprecedented since 1400. Most of this century has been unusually warm while the 19th and 17th centuries were much cooler.

According to the study, in the year 1816 there was virtually no summer, which was probably influenced by the eruption of the Mount Tambora volcano in Indonesia the year before.

Mann described 1719 as a prime example of the global pattern for a "historically documented, very strong El Nino year" with characteristic warm eastern tropical Pacific sea and cold central North Pacific sea surface temperature patterns.

He said the results of the research supported current predictions of the effects of greenhouse warming.

"We found a relationship between greenhouse gas concentrations and climate warming that is quite consistent with the relationship produced in model simulations of the effect of carbon dioxide on the climate."

Industrialised nation agreed at the Kyoto summit last year to cut emission of carbon dioxide (CO2) and other gases by an average 5.2 per cent between 2008 and 2012, with a seven per cent cut for the United State and eight per cent for the European Union.

Gabriele Hegerl, of the Joint Institute for the Study of the Atmosphere and Ocean at the University of Seattle in Washington, stressed the importance of the research, saying it reduced the gap in knowledge of temperature

variability.

"Such work can not only provide a window on the past but it can also deliver invaluable information for a more reliable detection of anthropogenic (human factors influencing) climate change. This in turn brings u closer to glimpsing what the future may hold for a world with increasing in levels of greenhouse gases," she said in an accompanying report in Nature.—Reuters

Today is World Environment Day Smouldering silence of blackened forests

By Harry Surjadi

Date: 05 June 1998

Jakarta: The silence of the blackened rain forest is eerie evidence of an environmental disaster. Tropical rain forests are normally among nature's noisiest places -teaming with insects chirping, birds singing, monkeys calling, deer barking and leaves and twigs falling as wind and rain swirl through the verdant wilderness. But Kutai National Park, in the Indonesian province of East Kalimantan, was deathly still when I visited recently. A few days beforehand, this stretch of forest had been devastated by one of the many fires roaring across the province this year.

Almost 4,000 square kilometres have gone up in flames since January, and at least five times this area is thought to be at risk.

The vegetation is bone dry because of the drought caused by El Nino, the periodic Pacific warming which affects world climate. Some sporadic rain has fallen recently, but not enough to extinguish all the fires. Further trouble could be caused by the annual dry sea.

More than 700 square kilometres of Kutai National Park caught fire. In many areas, the flames have destroyed the shorter vegetation, but left most of the intact.

These can produce seeds next year which can start to regenerate the lower forest. While many of the larger animals can run away from the flames, smaller ones and insects perish.

Hundreds of rare orangutans have died –some killed by famine –hit local communities, either for food or to protect their crops from the hungry, foraging animals. Before last year's fires, 30,000 of these apes were thought to be living wild on the islands of Borneo and Sumatra. They have been under threat from development in recent years.

"The orangutan was already critically endangered before this crisis, having lost 50 per cent of its population in the past 10 years," says Ed Matthew, of the World Wide Fund for Nature. "Many orangutan population may never recover."

While much wildlife has perished in the fires, a great pall of smoke is causing health problems to humans again. Last year's blazes in several pans of Indonesia threw a choking cloud of smog across much of South-east Asia and the fresh fires in East Kalimantan are providing an unwelcome encore.

Most have been started by companies and individual clearing land to make way for plantations and other agricultural development. The authorities have moved to ban the practices of using fire to clear land, but law enforcement is weak.

The government is now being urged to reconsider its policies on land use and tenure to reduce the likelihood of future devastation.

A shift towards more sustainable use of the forest, and the involvement of indigenous communities in its management, is being recommended by Ludwig Schindler, a German-Indonesian technical cooperation project. Under laws passed in the 60s all forests are state owned and the government can designate usage and award economic rights. For instance, some of former president Suharto's fellow retired generals have been awarded

concessions for logging, mining and establishing plantations.

In all, such economic rights have been granted on more than half a million square kilometres, almost half the current forest cover of Indonesia. A major forest conversion programme has earmarked 200,000 square kilometres –an area larger than Syria –for use as agricultural land and timber. But Schindler says Kalimantan's soil is not really suitable for cash crops such as palm oil, and, in any case, such land clearance inevitably involves the use of fire –by far the cheapest method.

Far better, he suggests, would be to market the cane, resins, nuts, fruits, orchids, medicinal plants and other wild products. "Sustainable forest use involves harvesting without exceeding the forest's capability to grow," says Schindler.

The country's current economic crisis is a major drawback here. With Indonesia desperate for foreign exchange to pay its debts, officials may fall under pressure to plough on with the conversion of forest to reliable cash crops, such as palm oil, rubber and timber.

Nevertheless, Schindler's organization is striving to develop a sustainable management programme. The involvement of local people is seen as essential for its success.

Many indigenous forest dwellers have been pushed off their traditional territory by development projects in recent years –just as the orangutans have. In Desa Sugapa, northern Sumatra, for instance, several people were even jailed after they protested against a pulp and Paper Company's clearance of their land.

Ethnic groups such as the Dayak have been practising shifting, slash-and-burn agriculture for centuries. They have strict rules governing their use of fire. They are experts at controlling the small blazes by using early warning systems, fire breaks and beaters. After harvesting an area for three to five years, they leave it for up to 50 years to regenerate.

But large numbers of settlers from other islands and plantation companies are not so careful with fire. And the locals have made little effort to help combat the larger blazes.

The opinion of the Dayak people I spoke to was: "It is not our forest any more. Why should we care? Let fire destroy it."

A number of people are now urging the government to recognize local people's traditional land rights and involve them in fire-management schemes. Schindler says: "If there is no change in land use policy and the land-tenure system, and no strong law enforcement, there will be (uncontrolled) forest fires every year."

Klaus Toepfer, executive director of the United Nations Environment Programme, also wants the government to "take appropriate steps with regard to land-use policies".

In mid-May, he repeated an urgent appeal to International donors to help provide fire-fighting equipment, training and support to fight the immediate problem.

"Clearly the recent rainfall has not been adequate," he said. "This issue must stay at the top of the international agenda or we may be faced with a disaster of extreme proportions." –Dawn/Gemini News Service © News-Scan International.

About PEDDA

PEDDA is a development consulting organization (social enterprise) aiming to provide alternative and innovative solutions to private, non-profit and public institutions on development and humanitarian issues. Our mission is to research, innovate and inform policy and practice that lead to poverty reduction, alleviate the suffering and achieve sustainable integrated development.

PEDDA provides technical assistance to public institutions, donors, international organizations, national civil society and local grass root communities' networks to leverage the impact of programs/projects on the targeted populations to achieve sustainable development goals.

PEDDA has experienced leadership team in the field of Global Change and Resilience; Climate Change, Disaster Risk Reduction, Humanitarian Assistance and Civil Society.