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FLOODS IN PAKISTAN 2010
(LESSON LEARNED & WAY FORWARD)
IN AGRICULTURE SECTOR (A SUCCESS STORY)

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ABSTRACT

Floods have devastating effects especially in the developing countries like Pakistan. Floods in Pakistan during the year 2010, was one of the most damaging in the history of the country. Rainfall with unexpected intensity started by the end of the month of July and continued until September. These high intensity rainfall victimized Pakistan of the devastating floods in 2010, which were the worst since 1929, for its extensive inundation and devastation across the country. The death toll was nearly 2000, 1 million houses were either damaged or destroyed, and devastated cultivated land was 5 m acres while more than 20 m people were displaced. The monetary losses due to 2010 floods were US $ 43 billion while estimated losses to the agriculture and livestock sectors were US $ 2.8 billion and 450 million, respectively. The area disturbed by this flood was 100,000 square km comprising 79 districts of Pakistan. Climatic changes like elevated carbon dioxide concentrations and rise in temperature were mainly responsible for the 2010 floods. Agriculture, including crops and livestock sector, was the important victim of this along with the humans and infrastructure. Re-zoning the crop areas as well as agronomic management will be helpful to avoid or lessen the devastating impacts of floods on agriculture sector. The most important challenge is the storage of water available after fulfilling the crop irrigational requirements. Shifting water from Western River to Eastern River of the country is the other important challenge. During the flood 2010, the University of Agriculture, Faisalabad played its part in the flood victim area aggressively. The list of the activities is immense but a snapshot of the activities include vaccination, provision of feed to livestock in Sargodha, Khushab, Rajanpur and Muzaffargarh. 20 truckloads of eatables and day to day useable things for flood affected people, 5 truckloads of Eid gifts for Kot Addu and Muzaffargarh. University contributed in a big way at Atthara Hazari in terms of mosquito control campaign and providing eatables, water, medicines, fodder/Berseem seed, vegetable seed, wheat seed, nutrient package, school bags, animal feeds, vaccination, agricultural inputs, marriage packages, etc.

Introduction

The risk for natural hazards such as floods and cyclones etc. has been increased many folds during the recent decades. The IFRC (2009) reported that climate related disasters have increased at alarming rate and that frequency has really increased to threatening level. The Red Cross / Red Crescent Climate Centre (2007) is of the view that in the past years, there has been a large rise in the number of disasters (from between 200 and 250 in the period 1987-97 to about double that in the first seven years of the 21st century). Stolton *et al.* (2008) reported that every year flooding accounts for two thirds of people affected by natural disaster. The causes of this increase are rapid urbanization, deforestation and climate change. Global warming makes a payment of 85% in rainfall. Pakistan is a country with diverse topographical features. Pakistan is 48th on the list of countries ranked at relatively high mortality risk from two or more hazards. In this regard, Pakistan's 22.8 % of the total area is at risk and 49.6 % population in this area is at risk. The country attains a higher level in the list, when categorized with regard to three or more disasters. In this context, Pakistan stands up 32nd on the list with 1.4 % of total area at risk

having a population size of 5.9 % (WB, 2005). Pakistan has been a frequent victim of natural hazards and disasters throughout its history. Several large scale disasters have struck vulnerable communities in all the four provinces of Pakistan from time to time in the recent past (NDMA, 2007). The glaciers in Hindukush-Karakoram-Himalaya (HKH) region play a key role in the water inflows in the rivers of Pakistan, yet there is considerable uncertainty about the temporal changes in the physical sizes of these glaciers. However, over the last one hundred years the mountain glaciers are found to be retreating worldwide (Haeberli and Hoelzle, 2001), the glaciers in the HKH region are reported to be receding faster than in any other part of the world (Rees & Collins, 2004).

Total Area Affected by Flood 2010

- Around 9.542 m acres have been affected by floods in Pakistan.
- The highest damage area is in Punjab of 3.786 m acres followed by Sindh (3.321 m acres), KPK (1.221 m acres), Balochistan (1.206 m acres) and Kashmir (0.009 m acres).

Table 1: Flood affected areas of Pakistan (in 'km^2' and acres')

Province	Area	
	(Km^2)	**(acres)**
Sindh	13441.57	3321411.31
Punjab	15321.27	3785884.99
Balochistan	4941.9	1205825.6
KPK	4922.907	1220641.03
Kashmir	35.2	8696.9
Total	38662.847	9542459.83

Table 2: Flood affected areas of Punjab province under various land use systems

Land Use	Area		Area as Percent of Total
	(km^2)	(acres)	
Forest	1743.78	430887.25	11.38
Irrigated Agriculture	7602.24	1878514.13	49.62
Rainfed/Rod-Kohi Agriculture	565.00	139610.38	3.69
Rangeland	1996.40	493310.40	13.03
Bare Soil	1980.82	489460.68	12.93
Settlements	16.77	4144.41	0.11
Rocks	58.98	14574.50	0.38
Un-cultivated Land	36.02	8900.81	0.24
River Bed	1298.71	320912.40	8.48
Desert	22.54	5570.04	0.15
Total	**15321.27**	**3785884.99**	**100.00**

Analysis of historical meteorological data (1951-2000) showed that (i) the mean annual temperature has been increasing in most parts of Pakistan; only the Sub-Mountain and Western Highlands and Lower Indus Plains show a decreasing trend, (ii) all the zones show an increasing trend for the pre-monsoon summer months (Apr-May), (iii) all the zones, except Zone V (Balochistan Plateau, which is an arid and hyper-arid region), show a decreasing trend for the monsoon period, (iv) the Greater Himalayan region shows an increasing trend throughout from December to May, and (v) Balochistan Plateau (Zone V) is getting warmer in all the seasons.

Table 3: Mean temperature increase/decrease trends in °C, 1951-2000, Pakistan.

Regions/Seasons	Annual	Monsoon (Jun-Sep)	Winter (Dec-Mar)	Apr-May	Oct-Nov
I (a): Greater Himalayas	0.04	-0.80	0.32	1.09	-0.06
I (b): Sub-montane	-0.19	-0.57	0.00	0.13	0.12
II: Western Highlands	-0.72	-1.48	-0.65	0.17	-0.47
III: Central & Southern Punjab	0.11	-0.25	0.03	0.83	0.31
IV: Lower Indus Plains	-0.08	-0.55	-0.07	0.35	0.15
V (a) : Balochistan Plateau (East)	0.11	0.46	0.63	0.79	0.50
V (b): Balochistan Plateau (West)	1.17	1.3	0.43	2.17	1.80
VI: Coastal Areas	0.00	-0.18	0.05	0.03	0.30

(GCISC, 2009)

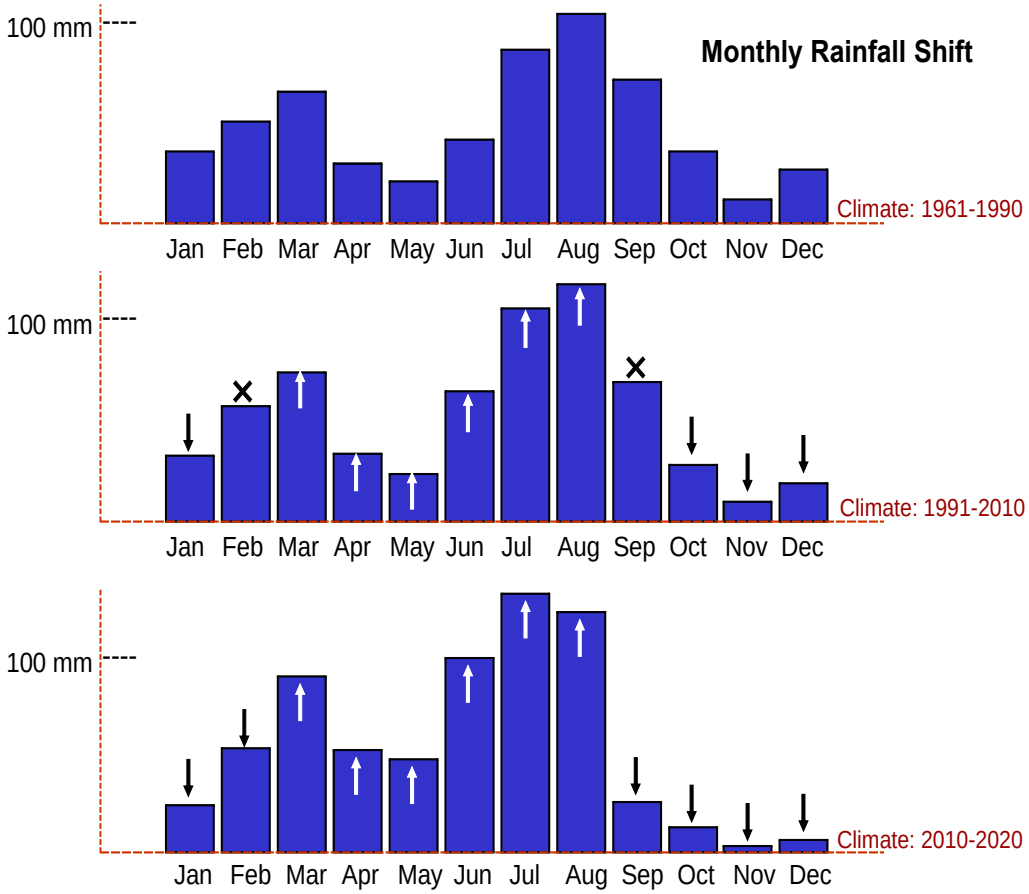
Table 4: Precipitation trends, 1951-2000, Pakistan.

Regions	Annual	Monsoon (Jun-Sep)	Winter (Dec-Mar)
Percentage Precipitation Changes (on yearly basis)			
I (a) : Greater Himalayas	0.49	1.73	-0.04
I (b) : Sub-montane	0.3	0.38	0.53
II : Western Highlands	0.02	0.22	0.00
III : Central & Southern Punjab	0.63	0.57	0.99
IV : Lower Indus Plains	0.22	0.45	-0.27
V (a): Balochistan Plateau (East)	1.19	1.16	1.14
V (b): Balochistan Plateau (west)	0.1	-0.2	-0.4
VI : Coastal Areas	-0.82	-1.34	0.00

(GCISC, 2009)

Regarding precipitation, Table 2 shows that (i) the mean annual precipitation has generally been increasing except in Coastal Areas, (ii) the monsoon precipitation also shows essentially the same trend, (iii) the winter rains show a mixed pattern with decreasing trend appearing in western highlands and a part of Balochistan province (Sulaiman & Kirthar Ranges), and (iv) the Greater Himalayas show a trend of increasing precipitation during Monsoon period

(June-September) and that of slightly decreasing precipitation in winter months (December-March) monsoon precipitation (Fig1.).



(Courtesy: PMD)

Fig 1: Monthly rainfall shift trends in Pakistan.

Increasing rainfall, lack of storage and decreasing existing storage capacity by 0.2 MAF annually due to silting is posing serious threats of floods in Pakistan.

These unexpected meteorological events are also the outcome of climate change caused due to rise of CO_2 level from 280 ppm – 550 ppm, rise in temperature about 0.8C in 20th century and projected rise in temperature towards the end of 21st century i.e. 4^{o}C (2.8 - 5.2^{o}C) and change in rainfall pattern 10.1% (7.1 – 15.8%) in the South Asia (I.P.C.C., 2007). Global climate impact study centre (GCISC and Pakistan Meteorological Department (PMD) has also projected a drastic change in climate of Pakistan up till 2080. (GCISC, 2009). These projections are presented in Table 5. Pakistan Meteorological Department is providing short term and medium term forecasting which embody very useful meteorological data for the use of farmers/end users, but there is severe need to develop long term weather forecasting (3 – 6 months) in collaboration with SUPARCO and agriculture universities.

Table 5: Scenarios of temperature and precipitation change in Northern and Southern parts of Pakistan as worked out by GCISC from an ensemble of six GCM outputs.

Time Horizon	Global CO_2 Concentration (ppm)	Northern Pakistan		Southern Pakistan	
		∆T (˚C)	∆P (%)	∆T (˚C)	∆P (%)
		Scenario A2			
2020s	430	1.41 ± 0.14	4.58 ± 2.01	1.07 ± 0.11	17.82 ± 4.17
2050s	545	3.10 ± 0.30	5.43 ± 3.65	2.53 ± 0.15	19.44 ± 8.15
2080s	720	5.35 ± 0.56	5.30 ± 5.36	4.42 ± 0.30	26.47 ± 12.04
		Scenario B2			
2020s	415	1.57 ± 0.23	4.27 ± 1.91	1.22 ± 0.15	16.58 ± 5.76
2050s	485	2.91 ± 0.27	6.03 ± 1.78	2.36 ± 0.17	21.78 ± 9.68
2080s	565	4.13 ± 0.46	8.83 ± 5.21	3.49 ± 0.33	20.43 ± 8.28

(GCISC, 2009)

History of floods in Pakistan:

Pakistan has faced severe floods in 1973, 1988, 1992 and 2006. These floods have damaged our economy to a considerable extent.

Challenge of the Super Flood -2010

Pakistan witnessed an exceptional high rainfall in July and August of 2010, extending till the month of September. This rainfall proved to be one of the major contributing factors that led the country to be a victim of devastating flood in the midst of the year. According to Akram (2010), Monsoon rain, which started in Khyber Pakhtunkwa on July 27, 2010 caused flood and damages in many areas. The flood 2010 has been assessed to be the worst since 1929 for its extensive inundation and devastation across the country. Floods 2010 stretched to an area of 100,000 square km, which encompasses 78 districts of Pakistan. The enormous loss includes more than 2000 precious human lives, loss of one million houses, devastation of 5 million acres of cultivated land and more than 20 million people displaced (ADB and WB, 2010). Already economically down trodden country has to bear the monetary loss of more than US $ 43 billion.

The estimated losses to the agriculture and livestock sectors were US $ 2.8 billion and 450 million, respectively.

Causes of Flood

Floods are a natural hazard caused by at least two main factors namely rainfall and topographical condition (BNPB, 2010). According to Khan (2007), a combination of one or more of four factors cause river floods in Pakistan. (i) Monsoon torrential rains in the month of July and August. (ii) Westriles from the Arabian and Mediterranean seas in the winter. (iii) Excessive melting of snow in spring and early summer. (iv) Natural damming and subsequent outbursts because of landslides, debris flows, or glacier advances (glacial lake outbursts can be an additional cause of flood in Pakistan). Monsoon rains produced huge volume of water in northern areas and broke 80 years old record. Global warming contributes 85 % in rainfall. More than 200 mm rainfall was occurred in Khyber Pakhtoonkhwa during 24 hours. A record rainfall 274 mm was recorded in Peshawar. Cutting of trees on rivers and canal embankments, construction of houses and roads in river belts (bat areas) and raising of crops in pond areas are also major causes of floods.

Losses / Damages

The enormous loss entails 2000 lives lost, one million houses collapsed, 5 million acres of cultivated land devastated and more than 20 million people dislocated. The damage in monitory terms was around US $ 43 billion. Calamity was so severe and rampant that Pakistan alone could not fight against the affliction. Therefore, during this time major international aid came from Saudi Arabia, USA, UK and Canada.

Punjab was the severely damaged province especially districts Jhang, D.G. Khan, Rajanpur and Muzaffargarh. Terrible scenes were witnessed in these areas. Villages were disappearing under water and hoards of people were running to save and rescue their lives. Large number of people left their inundated houses and migrated to safer places. There was a situation of chaos, distress and affliction. People were frenziedly leaving their homes on trolleys, carts, or on whatever they could get their hands on.

According to MINFAL (Ministry of Food, Agriculture & Livestock), floods caused widespread damage to the standing crops (about 30% of cultivated land). Estimated losses to the agriculture and livestock sectors were US $ 2.8 billion and 450 million, respectively. FAO reported that highest losses were recorded in Punjab where about 661,637 ha of land with standing crops was destroyed that included 1.5 m ha of rice, 0.5 m ha of sugarcane and large areas under fodder, oilseed, pulses and vegetables. According to official estimates, cotton which is the main earner of foreign exchange suffered heavy losses and it is expected that the country may have to import 3.5 – 4 million bales during this year.

Major Challenges, Constraints And Issues Related To Agriculture Especially Due To Floods, 2010

Challenges

- Have to achieve food self sufficiency
- Self reliance rather than dependence
- Poverty reduction [linkages with food security].
- Enhanced productivity on sustainable basis through sustainable delivery

Constraints

- Degradation and inability to develop and implement actions for marginal areas [coastal zone, desert, riverain and wastelands etc.
- Fragmentation of land holdings to very small parcels
- Non-availability of site-specific technologies; slow diffusion of technological advances. Shortage of rural infrastructure, inaccessible markets, Grading, Storage etc.
- Illiteracy in rural areas.

ISSUES

Crop Related Issues

- Low economic yields of crops / Gap in potential and average yield.
- Change in Agro-Ecological zones/Cropping Pattern quality produce.
- Poor monitoring, fore-casting of disease and insects epidemics after flood 2010.
- High costs of agricultural inputs and black marketing by middle men after flood 2010.
- Unavailability of quality inputs like seed, Fertilizer, Pesticides etc.
- Poor purchasing power.
- Inaccessibility to credit/loans.

Damage to Crops e.g. Cotton

- Major distortion took place in cotton-growing areas of the Central Punjab and Southern Sindh.
- The highest losses were recorded in Punjab where about 661,637 hectares of land with standing crops destroyed.
- Over 1.31 million hectares of the cultivated area has been destroyed by floods in Cotton.
- The officials estimate that the country will have to import 3.5 to 4 million bales.
- Two million bales have only been destroyed in the floods in Punjab.
- 1.5 m ha of rice, 0.5 m ha of sugarcane and large areas under fodder, oil seeds, pulses, fruits and vegetables have also been destroyed.

Soil Related Issues

- Demarcation of land holding is wanting due to flood.
- Disintegrated and small holdings
- Decline in organic matter / Degradation of soil in rural areas after Flood.
- Salinity / Sodicity – needs external source of Ca^{2+}
- Nutrients management – adequate and balanced fertilizer required.
- Soil structure has been deteriorated.

Irrigation Water Related Issues

- Water Channel infra structure completely destroyed by flood 2010.
- Agriculture largely dependent upon artificial water.
- Acute shortage of good quality (canal) water i.e. only 30% is available because of increase in cropping intensity.
- Brackish water: About 80% ground water used for irrigation is hazardous.
- About 68 percent of the geographical area has annual rainfall of 250 mm, whereas about 24 percent has annual rainfall of 251 to 500 mm.
- Thus supplemental water is required for profitable agricultural production, either from irrigation or through water harvesting.
- Under emphasis of optimum leaching fraction.
- Innovative technologies like drip irrigation do not match with our soil properties.

Market Related Issues

- Small marketable surplus of small farmers.
- Severe shortage of storage facilities especially for perishable commodities.
- Monopolistic role of middle men/ agents/ Arties.
- Limited awareness among farmers about market prices.
- Grading and packaging of products to get opportunity benefit is wanting.
- Control on Agri-produce prices but de-regularized input prices.

Livestock Related Issues

- Shortage of Livestock
- Health Services of Animals
- Semen Storage/ A.I. Centers
- Fodder Shortage, Feed Shortage
- Bank Loans/Credit on livestock

Farmers Related Issues

- Illiteracy.
- Resource poor nature of growers / Uneconomical Holdings
- Inefficient credit facility and differential access of farmers
- Lack of farmer organizations and collaboration
- Dependency on interest vested middle-man.
- Transfer of technology at very limited scale.
- Very poor mechanized farming.

- Gender complex.
- Unavailability of timely/quality inputs.

Policy Related Issues

- Inadequate accountability of culprits/ Non-availability of site specific technologies.
- Lack of sustainable policies related to agriculture
- Shortage of trained manpower in research and extension.
- Unattractive service structure in Agri. Sector.
- Inefficient processing industry/ Small units is rural areas are wanting.
- Export markets, their issues and policies of countries (W.T.O)
- Govt. shift in policies/ priorities.
- Gaps in research. Macro and Economic indicator do not reflect the effects of rural economy.

In addition to that:-

Inspecting bodies compete for territory to gain external income from certification and are subject to political influence and corruption. Inspectors' technical knowledge and skills are almost outdated. State supported testing laboratories, mostly ill-equipped and under-staffed. Laboratories with the technical standards to carry out reference functions are wanting. Lack of co-ordination in various Agri. Organizations. Lack of seed exchange centre. Lack of diagrammatic labs and advisory services.

PROPOSED SHORT TERM REHABILITATION PLAN ESPECIALLY FOR AGRICULTURE SECTOR AT FLOOD AFFECTED AREA OF DISTT. JHANG

- Provision of day to day utilities.
- Redemarcation of Agriculture land from Revenue Department be ensured on zero cost if required.
- Rehabilitation of watercourses and minors/distributaries
- Soil and water testing concerns.
- Provision of Heavy Machinery to provide tillage.
- Provision of certified Seed of various crops especially Wheat, Fodder and vegetable, free of cost alongwith fertilizer, pesticide and minor implements.
- Package may include plantation of 1-2 acres of Rabi concerns.
- Health covers including provision of clean water may also be addressed alongwith Fogging for malaria eradication
- Animal feed should also be included as per requirement of the focused area
- Provision of School bags to needy students of the focused area.
- De-worming & Vaccination
- Marriage Packages

- House Utensils
- Mineral Water & Pickle etc
- Rabi Drill for wheat sowing
- Growth regulators, Weedicides etc
- Monitoring & Management concerns

Short Term Master Plan for Rehabilitation for the Focused Area ATTHARA HAZARI (Dist. Jhang) in Agriculture

Item	Quantity	Cost Rs.	Fertilizer DAP+UREA Rs	Herbicide Rs	Cost for 1 acre/animal/ House Rs	Total/Cost Rs/Family	Total cost for 3000 families
Wheat seed * (For 2 Acres)	30kg	1233/-	3500	1000	5733	11466	2,29,32,000
Fodder seed (10 Kanal each)	6kg	50/-	1350	X	4050	4050	81,00,000
Vegetable seed for 10 Marla (Turnip, Radish, Mustard, Fenugreek, Spinach, Carrot, Corriander)	100gm Per Family		-	-	-	50	1,00,000
Flower seed						20	40,000
Farm tools (Spade, Sickle, Khurpa)	1 pack				650	650	13,00,000
Animal vaccination	5 animals	13 per animal	-	-	13×5	65	1,30,000
Animal De-worming	5 animals	100 per animal	-	-	100×6	600	12,00,000
Human Health Mosquito control / Fogging / Medicine	I family				650	650	13,00,000
School bags	I				500	500	10,00,000
Animal Feeds	2 / Family	3300/-				3300	66,00,000
Miscellaneous	1	2000				2000	40,00,000
TOTAL						23351	4,67,02,000

*Price includes packing, packing charges, transportation

Total cost for the rehabilitating 2000 families = 23351 X 2000 = 4,67,02,000/-

Tentative Date of Action: 3rd October, 2010.

Short Term Rehabilitation Programs in Actions

- A Base camp at a suitable place in focused area was established to run the activities of our teams
- Mobile Plant Clinic/Mobile Animal Clinics were Developed and Advisory Services for all agro-oriented services in focused as well as in adjoining flood affected areas.
- Provided 3000 mounds wheat seed, 50 mounds vegetable seeds, alongwith a Herbicide/Fertilizer Package, cattle feed and 2000 school bags in focused area.
- Comprehensive spray program for the focused area alongwith technical input by internees and faculty members was also offered for couple of months.
- Provision of all inputs etc.
- Vaccination, De-worming of animals was done twice.
- School bags.
- Fogging was carried out thrice.

Lessons Learnt

- There is an urgent need to review and restructure the Flood Control Commission.
- Flood protection works should be given due importance in resource allocation irrespective of the infrequency of floods.
- Establishment of new bench-marks in terms of protection works heights and strengths and a fresh drainage plan for quick draining of flood waters from affected areas
- Governance at local level is non-existent during emergencies. Need for a fresh look at our district and tehsil administration system to bring back the ability for effective leadership and coordination during emergencies.
- Keeping river pathways newly witnessed in Flood 2010, flow chart be reshaped.
- As such regular updating of SOPs, regular drills for disaster management, regular capacity building/training of managers for flood protection, barrage management and public handling during crises is needed.
- Promotion of spirit of Self Reliance in emergency relief and post disaster rehabilitation
- The flood situation indicated that there is hardly any strategy for breaching the bunds to save the Headworks.
- The flood control programmes as well as weather forecast failed during recent flood to save the peoples from natural disaster.
- The watersheds have degraded to an extent that peaks are enhanced and there is an urgent need to develop a comprehensive and practical strategy for watershed management.

- A Code of conduct for media during natural disasters to harness their outreach for effective management rather than incitement to anarchy.

Recommendations Focusing on Agriculture Concerns in Flood Affected Areas of Pakistan

- There is a dire need to survey and re-identify the pathway of rivers and canal network in the light of current floods.
- Improve and extend the Flood Forecasting System to include upper Indus above Tarbela and Kabul River above Nowshera (Telemetry System on Tributaries and additional weather radars).
- Development of flood management guidelines for Tarbela and Mangla reservoirs so as to enhance their flood mitigation role.
- Identification of future reservoirs that would have high flood mitigation role in addition to their Agriculture and hydropower benefits.
- Identification of Flood release channels/escape channels to desert areas/off channel storages that would provide major reduction in flood peak discharge in main rivers.
- Flood plain Mapping/Zoning along all the Indus River and its tributaries for restricting/prohibiting by law, permanent settlements in high and medium flood risk areas (Provinces to enact laws).
- Review and revise the design criteria for the design of Bridges/Communication infrastructure and flood protection bunds keeping in view the likely damages to the populated area and agriculture.
- Re-identification of Agro Ecological Zones as well as cropping patterns of Pakistan are urgently required.
- Establishment of new bench-marks in terms of protection work heights and strengths are fresh drainage plan for quick draining of flood waters from affected areas.
- Biodiversity survey in all dimensions direly needed for better crop productions.
- Promote innovative and integrated applied and site- specific research/technologies.
- Land demarcation and infra structure be ensured on top priority to avoid conflict in farming community.
- Comprehensive survey relating to Soil/Water, Fertility/Fitness is of immediate concerns for flood affected areas.
- Establishment of seed exchange centers alongwith other inputs in rural areas is also required.
- Network of Diagnostic Labs and Advisory Service.
- Replacement of Seeds of all crops in Flood affected areas and provision of Nursery/ Plants for agro Forestry be ensured.

- Introduction of water harvesting technologies at farmers' field for making its best use for agriculture purposes on one hand and energy production concerns on the other.
- Land leveling through Laser land leveler also be ensured.
- Provision of interest free loaning in terms of kind not cash must be encouraged.

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