PAKISTAN: FLOODS/RAINS 2010

Series No. 1

RAPID CROP DAMAGE ASSESSMENT

September 30, 2010

Pakistan Space & Upper Atmosphere Research Commission

Food and Agriculture Organization of the United Nations

Table of Contents

ACRONYMS

ACRONYM	DESCRIPTION
AJK	Azad Jammu and Kashmir
CLCV	Cotton Leaf Curl Virus
CRS	Crop Reporting Services
CUSEC	Cubic Feet Per Second
FAO	Food and Agriculture Organization
FCA	Federal Committee on Agriculture
GB	Gilgit Baltistan
Ha	Hectare
HYV	High Yielding Varieties
KP	Khyber Pakhtoonkhawah
m	Meter
MAF	Million Acre Feet
MINFA	Ministry of Food & Agriculture
NDVI	Normalized Difference Vegetation Index
PMD	Pakistan Meteorology Department
RIM	Regulated Irrigation Measurement
SPARCENT	Space Applications and Research Center
SUPARCO	Pakistan Space & Upper Atmosphere Research Commission
VGT	Vegetation

Note to the Readers

Pakistan's agriculture is mainly concentrated in the Indus river basin, with the Indus and its tributaries providing much needed water for irrigation. The system, in normal years, is designed to deliver about 103.5 MAF water at canal head works. This quantity of water is short of domestic requirements and water shortages are generally further accentuated in winter, when the surface water supplies shrink substantially. The irrigation system has been devised to overcome this water supply deficiency, through the building of a reservoir capacity of 18 MAF. This capacity is slowly being choked by inflows of sediments along with the river water.

The floods and rains during the summer of 2010 caused colossal damage along the course of the Indus and some of its tributaries. The data reported and opinions expressed in this document are based on rapid assessment techniques and technical inputs of personnel of FAO and SUPARCO. The objective was to provide preliminary information on flood situation and damages to the crops in order to assist planners, policy makers and agencies involved in the mitigation efforts and other exercises.

For this study, Hyderabad includes Hyderabad, Matiari, Tando Muhammad Khan and Tando Allah Yar districts. Larkana includes Qamber Shahdad Kot and Dadu includes Jamshoro district. The district wise data on crop damages are given in the annexure to this report.

1. Weather Systems

The monsoon during the year 2009 was predominantly affected by the El-Nino[1] factor, with rainfall below 26 percent of the normal[2]. The dry season continued into winter, affecting rabi crops. The impact was highly pronounced in the barani areas of Punjab and Khyber Pakhtoonkhawah (KP). The germination of crops in these areas was poor and crop stand was patchy with consequential low productivity.

The monsoon 2010 started with a normal tempo until middle of July. The hammering rains started around 18th July, with severe weather systems up to 10th September. The largest amount of rain was received on 28-29th July, 2010. Another intense rainfall system was observed between 5-9th August. The highest cumulative rainfall during the season, of the order of 800 mm was received in Sialkot, Punjab. The rainfall systems in July-Augaust were due to interaction of monsoon and mid-latitude westerlies. Some of these systems are given overleaf.

The KP, GB and Punjab have relatively steeper slopes than Sindh, making the rain water run-off. The unprecedented rains in the watersheds of rivers and creeks: Swat, Kabul, Indus, Chenab and others, caused these water bodies to cross over embankments in KP, GB, Punjab and Baluchistan at the end of July/ August. In addition, the torrential rains in D.G.Khan and D.I.Khan locally called Rod Kohis, flooded and damaged the surrounding areas. The overall impact was that a huge section of population was displaced in these areas owing to damage to households, agriculture and infrastructure.

1 Drought-inducing phenomenon

2 Source: Pakistan Meteorology Department (PMD) and SUPARCO have a collaborative research program on monitoring of crops. Under this program, SUPARCO has an automated data delivery facility on daily basis for agro-met data. Data on rainfall and river discharge used in this study are taken from the PMD

Monsoon and Mid-Latitude Westerlies: July 2010

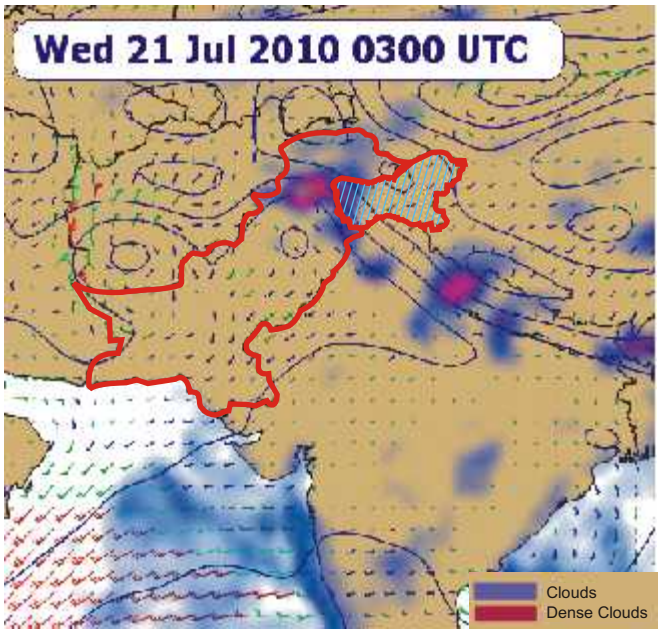

Figure 1: Cloud System on 21st July 2010

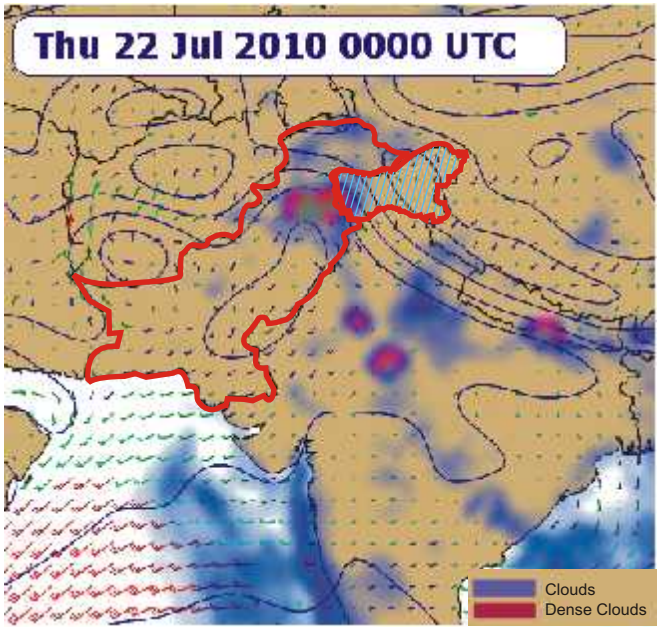

Figure 2: Cloud System on 22nd July 2010

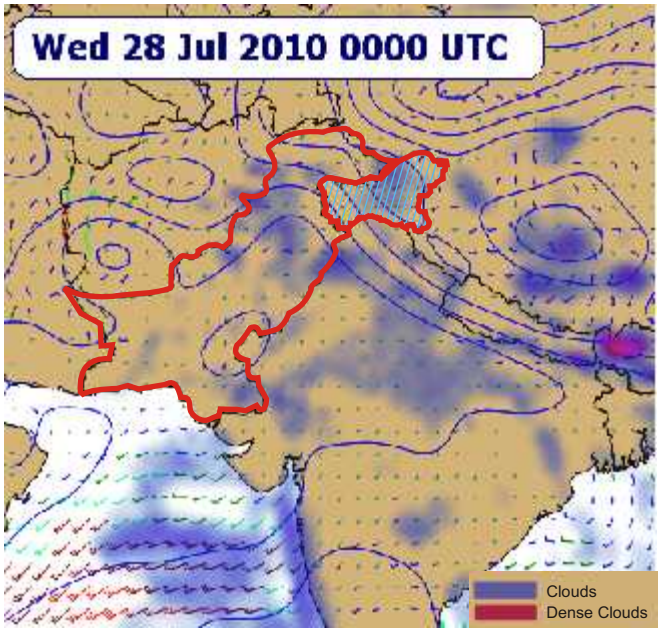

Figure 3: Cloud System on 28th July 2010

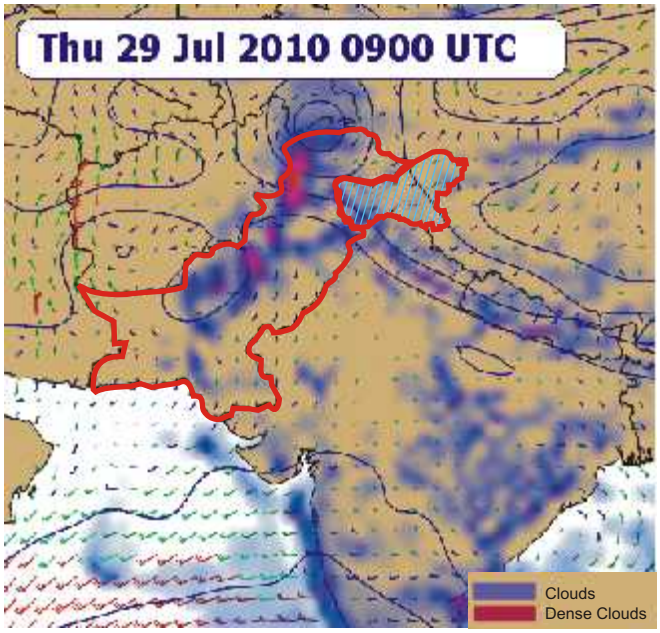

Figure 4: Cloud System on 29th July 2010

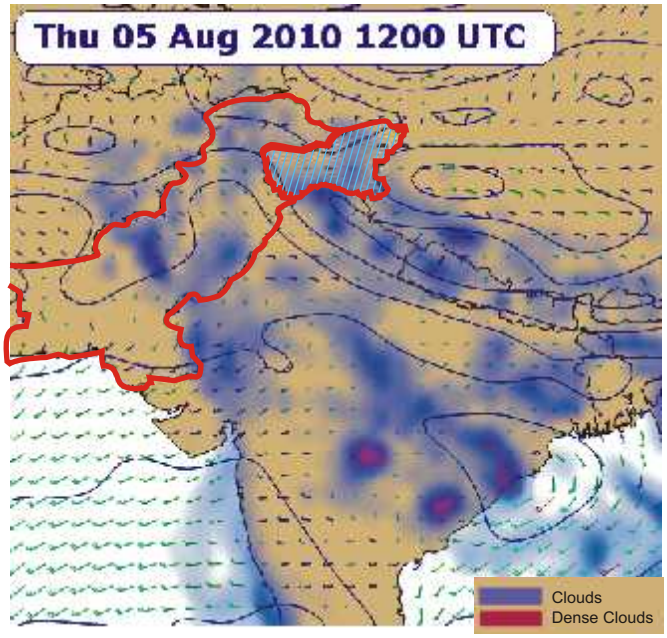

Figure 5: Cloud System on 5th August 2010

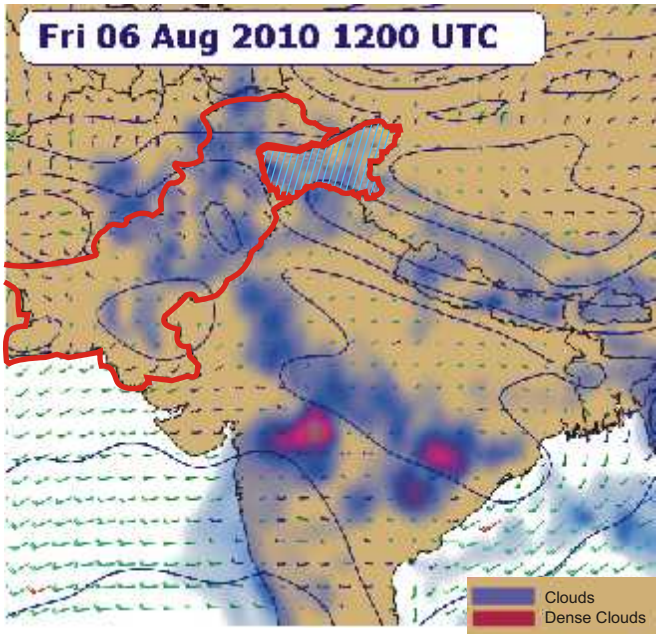

Figure 6: Cloud System on 6th August 2010

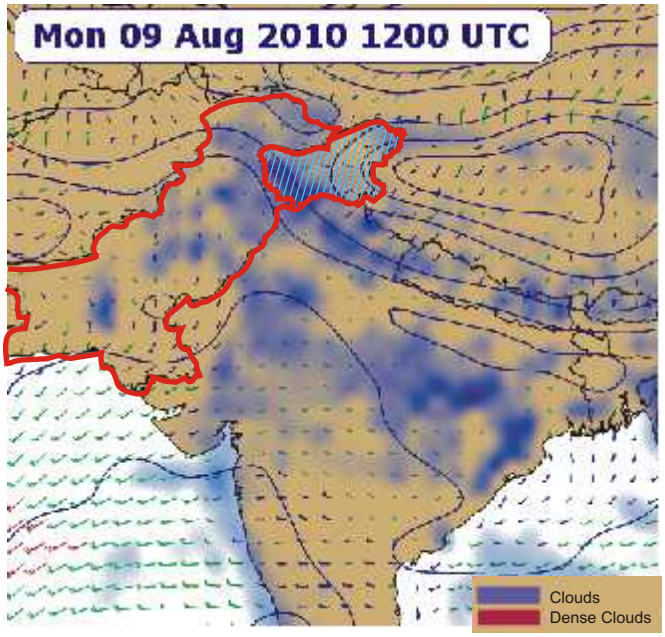

Figure 7: Cloud System on 9th August 2010

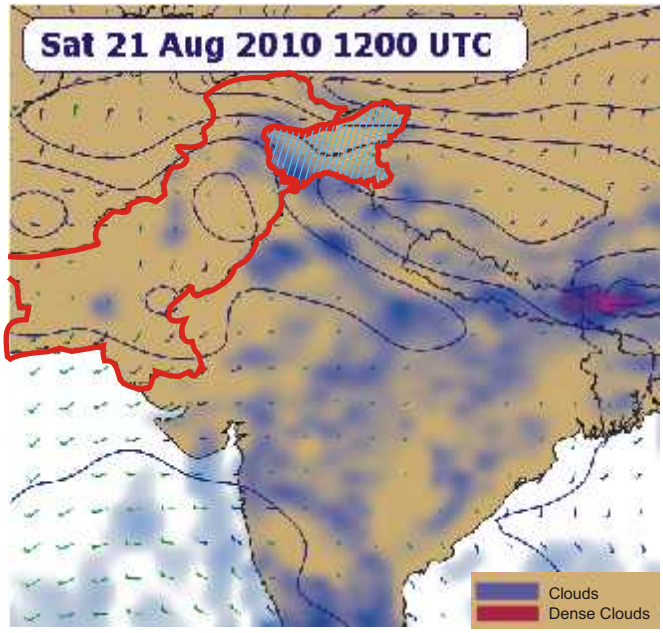

Figure 8: Cloud System on 21st August 2010

The cumulative rainfall for various regions of the country is given in the following image.

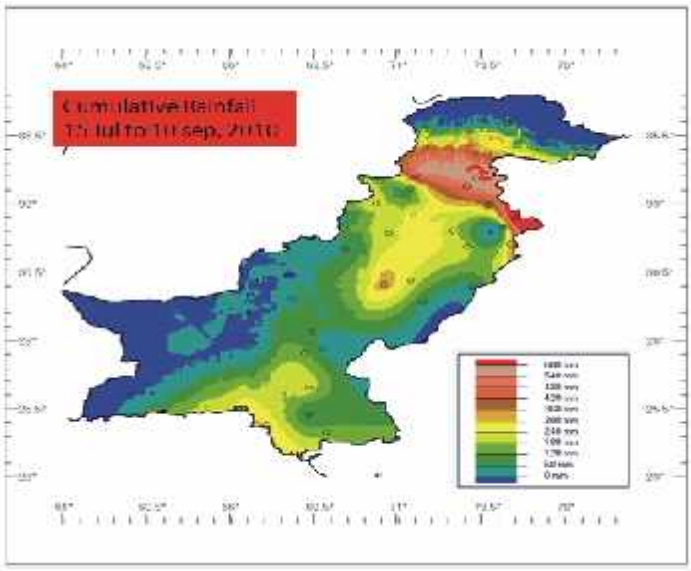

Figure 9: Cumulative Rainfall for Various Regions in the Monsoon System 2010

The inundation water caused heavy losses to infrastructure, households and agriculture in Sindh also. It almost took 6 to 8 weeks for ultimate discharge of water in the sea. The tidal waves of the order of 3 meter height, brought about by peak lunar system, from 24th to 28th August, resulted in back flow of water in the Indus delta. The cumulative rainfall received at various meteorological stations from mid July to 10th September 2010 is depicted below.

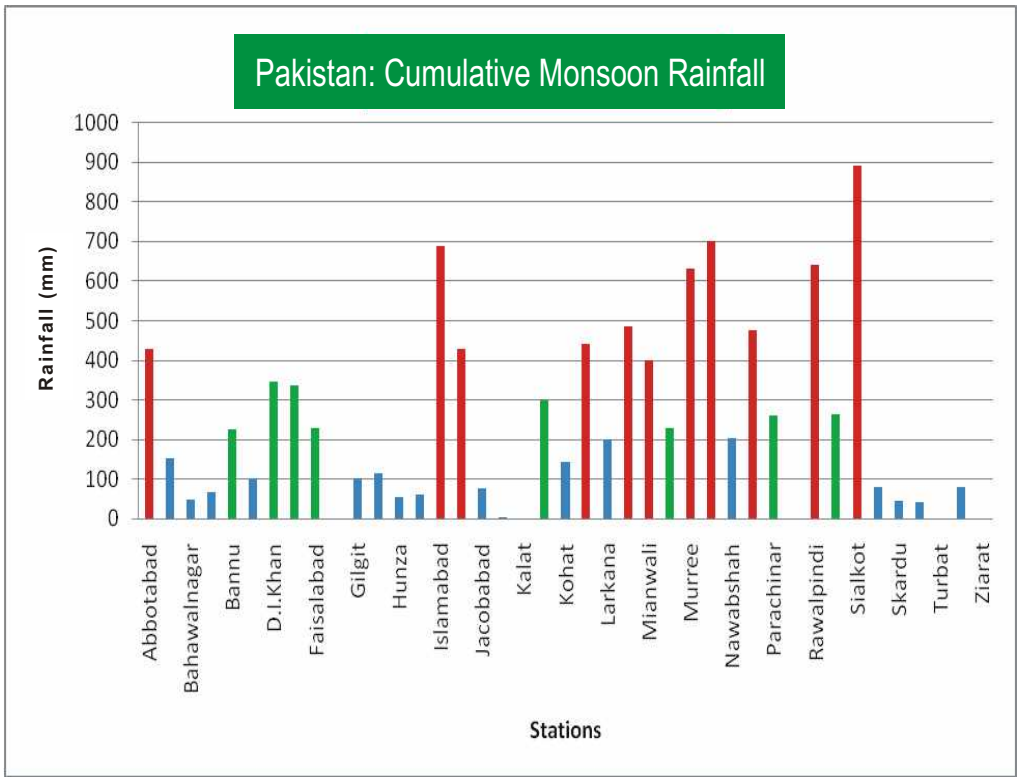

Figure 10: Cumulative Rainfall for Various Meteorological Stations

2. Flooding Upcountry

Pakistan has a large irrigation network with number of dams, barrages and other irrigation structures. The initial outbursts of the river system started from river Swat, causing damage in Swat valley during last week of July. This coupled with high speed outbreaks in river Kabul, caused devastation to urban and agricultural property in Charsada and Nowshera.

The areas in GB, AJK and Baluchistan were also affected in these days by high intensity rains and overflow of rivers and creeks. After flowing down the mountainous regions, the mighty Indus became unmanageable, immediately after entering the plains. The embankments of Indus river breached at Mullanwala and Dibwala sites upstream Taunsa Barrage . A wave of about 3 to 5 meter height from the river system hit Kot Addu, Daira Din Panah, Basira, Mehmood Kot, Rangpur and other areas in Muzaffargarh district. Other high profile inundation areas in Punjab included D.G.Khan and Rajanpur districts. Downstream, a part of Rahim Yar Khan district was flooded, with Sadiq Abad, Kot Sabzal and other areas subjected to flooding. Most of these areas in Punjab are home to an excellent quality of cotton although some sugarcane, rice and other crops are also grown in these areas. The discharges of these rivers at various RIM station and photographs of flooded areas are as follows:

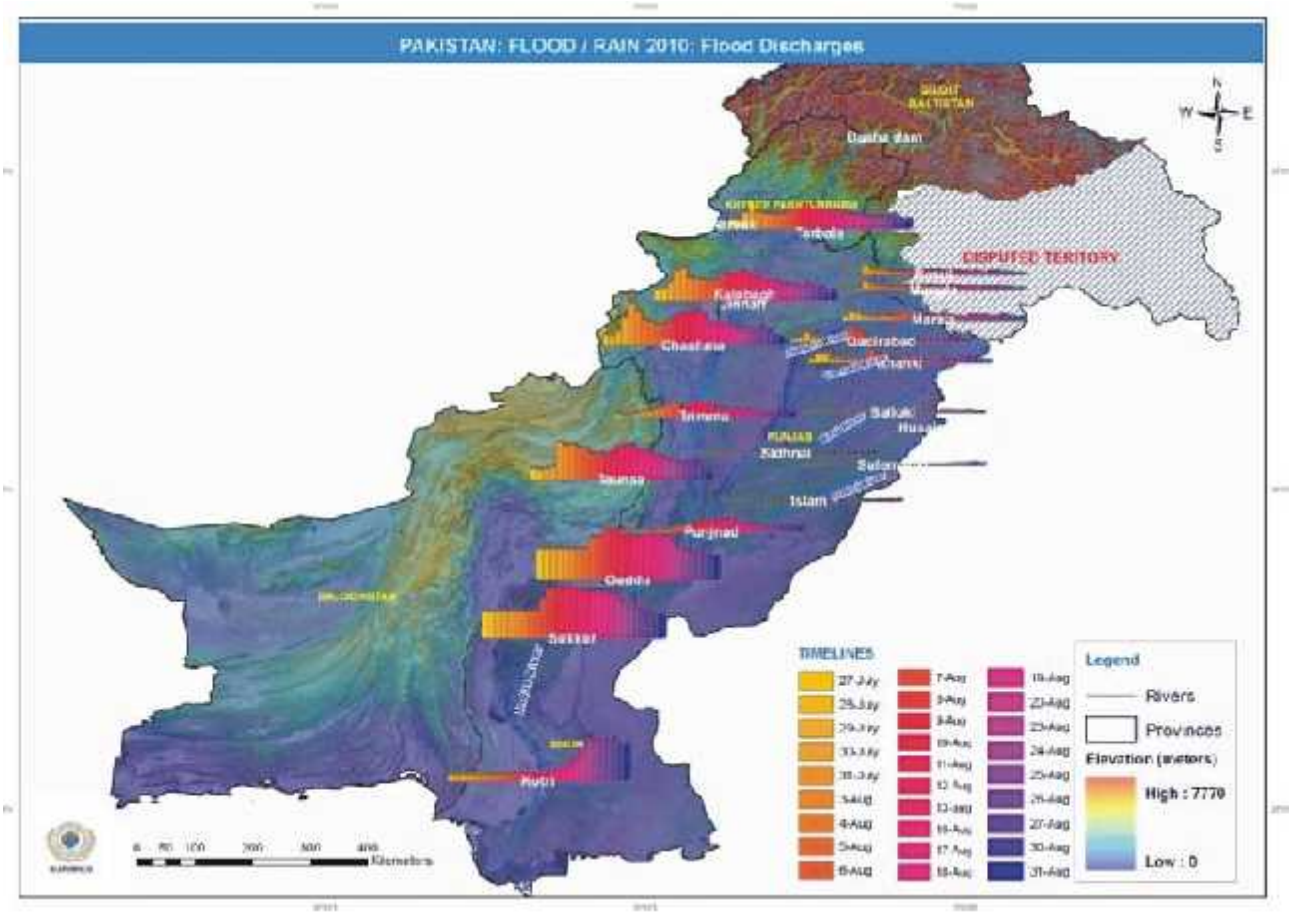

Figure 11: Water Discharge at Various RIM Stations

Photographs of Flood Affected Areas

Figure 12: Sargodha: Inundation of Agricultural Area

Figure 13: Rajanpur: Damage to Orchards

Figure 14: Ghotki: Damage to Cotton Crop

Figure 15: Mehar-Dadu: Agricultural Area under Flood Water

Figure 16: Johi: - Dadu: Connection through Boats

Figure 17: Khairpur Nathan Shah-Dadu: Flood Damage

Water Discharge at Important RIM Stations

a) Indus River System

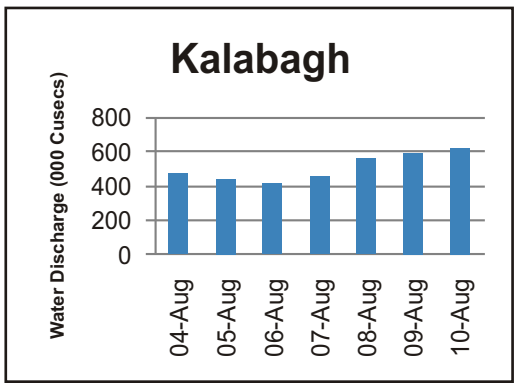

Figure 18: Indus at Kalabagh

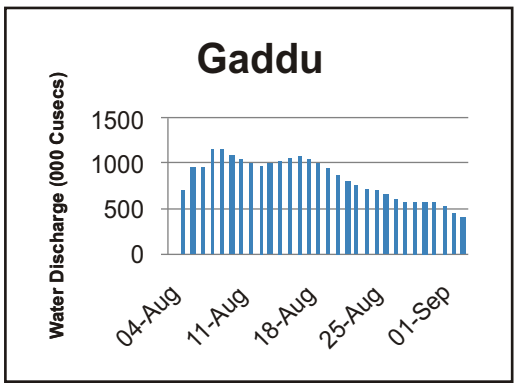

Figure 19: Indus at Gaddu

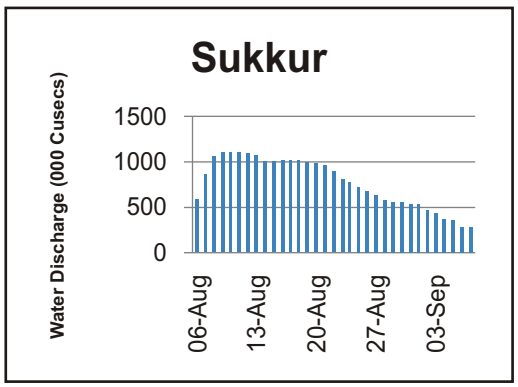

Figure 20: Indus at Sukkur

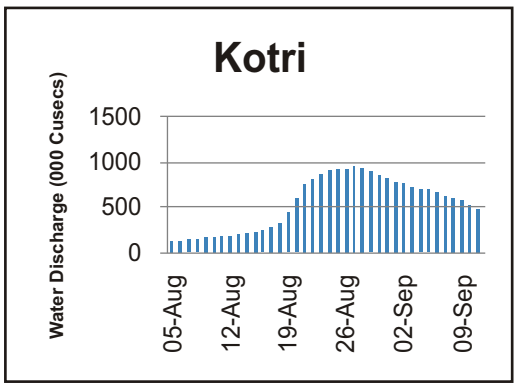

Figure 21: Indus at Kotri

b) Chenab River System

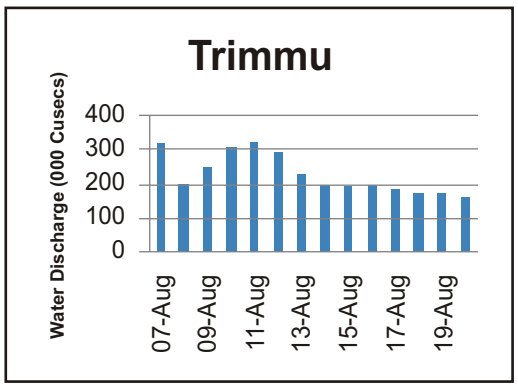

Figure 22: Chenab at Trimmu

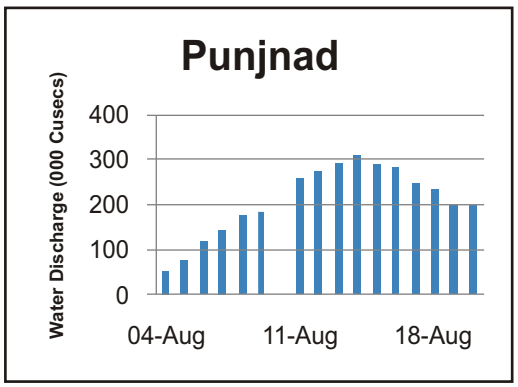

Figure 23: Chenab at Punjnad

3. Peak Flows in River Systems

There were two peaks of water flow in rivers. These peak[3] flows for various river systems and RIM stations are given below:

Barrages	Peak flow-1		Peak flow-2	
	Date	Water Discharge (000 Cusecs)	Date	Water Discharge (000 Cusecs)
Indus River System				
Tarbela	4th Aug 2010	527.0	10th Aug 2010	569.8
Kalabagh	4th Aug 2010	473.6	10th Aug 2010	624.5
Chashma	4th Aug 2010	582.6	10th Aug 2010	755.1
Taunsa	4th Aug 2010	790.0	16th Aug 2010	677.2
Gaddu	6th Aug 2010	1148.8	17th Aug 2010	1076.7
Sukkur	12th Aug 2010	1132.0	17th Aug 2010	1026.0
Kotri	26th Aug 2010	965.0	Second Peak Not Observed	
Chenab River System				
Trimmu	7th Aug 2010	319.7	11th Aug 2010	293.1
Panjnad	14th Aug 2010	310.1	Second Peak Not Observed	

4. Flooding in Sindh

The river bed of Indus in Sindh commands a huge area and a large number of villages, households and other set -ups had been established there. The flood water arrived in Sindh at the onset of August. Furious Indus at Gaddu and later at Sukkur barrage, in a size of more than a million cusecs of water uprooted / damaged crops and almost everything that was occupying its bed and around. In addition, water breached the embankments at Tori and Ghauspur in Kashmore district. Large areas on right bank of Indus came under water in a few days with the worst at Jaffarabad in Baluchistan, Jacobabad and Qamber Shadadkot in Sindh province. The receding water from the flooded areas threatened large chunks of land in right bank districts particularly the coastal district of Dadu. Of late, large areas in Dadu were flooded. Major installations at Sehwan in Dadu district as airport and Pak Arab Refinery also came under water.

Last of all, the Indus river flood system arrived at Kotri around the end of August, with a peak flow of about one million cusecs. Thatta district which is part of deltaic region of Indus was badly affected. Desperate attempts were made to save urban areas. These were partially successful. The city of Thatta was saved but diversions of water were not successful in Sajawal, and other areas. Floods destroyed large areas in Chohar Jamali and surrounding areas.

3 There were two peaks of flood in Indus and Chenab rivers

5. Chronology of Inundation

A repeated query has been made by planners and policy makers regarding inundation and time frame of recession of water from the inundated areas for mitigation programs. The SPOT satellite data was utilized to develop temporal information for inundation and recession of water from the affected areas. Some detail are as follows.

18-24th July

The first monsoon rainfall was received on 21st July. The cumulative rainfall during this period was of the order of 1716 mm. The maximum rainfall of 179 mm was noted at Mianwali on 22nd July. Other areas receiving rains during this period are Abbotabad, Bannu, Muzaffarabad, Faisalabad, Gujranwala, Murree and others.

The Swat, Kabul and Indus rivers started rising. Flooding of Mianwali and Layyah districts occurred during this period.

28-30th July

The cumulative rainfall of 1944 mm was observed with maximum of 312 mm in Peshawar on 29th July. Other areas receiving rainfall during this period were Abbotabad, Chitral, Islamabad, Jehlum, Murree, Muzaffarabad, Rawalpindi, Sialkot, and Karachi. Torrential rainfall occurred on 29th July causing the rivers to spill over the embankments.

Outflows from Swat and Kabul rivers affected Swat valley and Charsada/ Nowshera districts. Indus river flooded areas in Mianwali, Layyah, D.G.Khan and Rajanpur districts.

The main events during this period were (a) torrential rainfall on 29th July (b) colossal loss to economy in KP, particularly Nowshera.

2 - 9th August

There were rains for eight incessant days between 2 to 9th August in the catchment areas of the rivers. The cumulative rainfall was 2518mm during this period with maximum of 134mm on 7th August at Larkana. These rains set in motion unprecedented floods in Pakistan's history.

In Southern Punjab, the breaches in Indus river took place on 2nd August at Mullanwala and Dibwala villages upstream Taunsa barrage. These breaches caused a wave of 3 to 4 meter high, hitting Daira Din Panah, Kot Addu, Rangpur and other rural areas in Muzaffargarh district.

On 4th August, the river flows were at 474 thousand cusecs at Kalabagh and around 700 cusecs at Gaddu, on 5th August. The incremental water at Gaddu is explained by merger of Chenab river into Indus river at the juncture of Mithankot. The peak discharge during this period was noted on 8th August and was 562 thousand cusecs at Kalabagh; 1149 thousand cusecs at Gaddu and 1075 thousand cusecs at Sukkur. The flood did not reach Kotri during this period and discharge was 169 thousand cusecs at this RIM station on this date.

The main events during this period were (a) breaches in Indus river, upstream Taunsa barrage, setting a high wave of floods in Muzaffargarh district (b) a peak flood in the Indus river extending beyond Sukkur barrage (c) flooding of the katcho areas in upper Sindh thus damaging everything that was occupying the river bed.

10 - 20th August

The cumulative rainfall during this period was 1072 mm; with maximum of 75 mm at Islamabad on 20th August. The peak flow during this period of 625 thousand cusecs at Kalabagh was observed on 10th August. The flood water started receding thereafter at this RIM station and was 452 thousand cusecs on 17th August. At Gaddu, the peak discharge of 1077 thousand cusecs during this period was noted on this date. At Sukkur barrage two peaks were observed during this period: first on 12th August with a discharge of 1132 thousand cusecs and second on 17th August with a discharge of 1026 thousand cusecs. At Kotri Barrage, the water discharge was 188 thousand cusecs on 9th August. It started rising exponentially thereafter and touched 614 thousand cusecs on 20th August.

The main events during this period were (a) floods touching a peak in Punjab (b) Breaches in embankments of Indus River at Tori and Ghauspur exposing vast fertile agricultural tracts between the river and Kirthar range in Baluchistan and Sindh to inundation (c) the rice crop of this area which is predominant cash / food security crop was destroyed.

21st August - 18th September

The cumulative rainfall during this period was 2026 mm with a maximum of 113 mm at D.I.Khan on 25th August.The river Indus had already normalized at Kalabagh in Punjab. The river flows started falling at Gaddu and Sukkur barrages. However the major thrust of flood was at Kotri where it was still surging. The peak discharge at this RIM station of 965 thousand cusecs was observed on 27th August. The water entered the deltaic region destroying crops and infrastructure in Thatta district which is predominantly a rice growing area.

The main events of this period were: (a) KP and Punjab were cleared of the flood water except localized low lying pockets. These areas were available for cultivation of rabi crops subsequently. The degree of slope being low in Sindh, the flood water continued receding from the flooded areas to the Dadu district (b) the deltaic region in Thatta District was inundated.

19-30th September

Large areas in flood affected Sindh and some areas in Jaffarabad, Baluchistan were under deep flood water and will not be available for sowing of rabi crops. The Kharif crops, mainly rice, were already destroyed in this area. The opportunity to grow rabi crops such as wheat and others will also be lost. This is likely to set in motion the serious issue of food accessibility to the resource poor farmers and other communities living in this area. This matter requires to be addressed through social mobilization by NGOs and public sector.

The temporal flood maps developed from the Modis satellite images during the above mentioned period, are given overleaf.

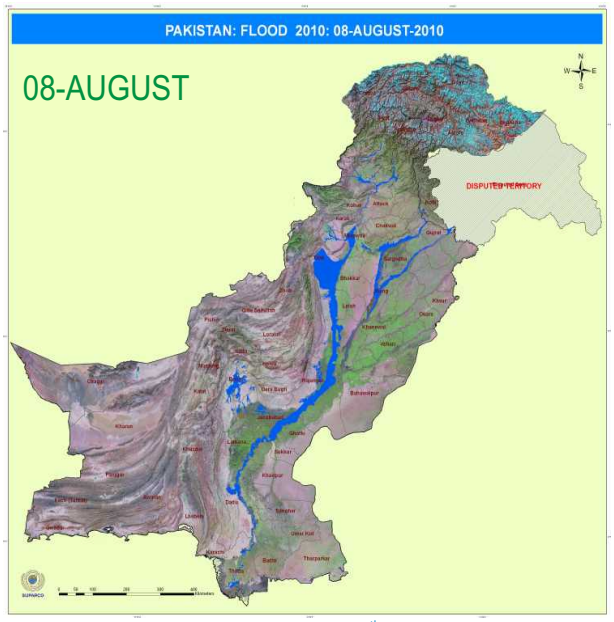

Figure 24: Flood Extent on 8th August 2010

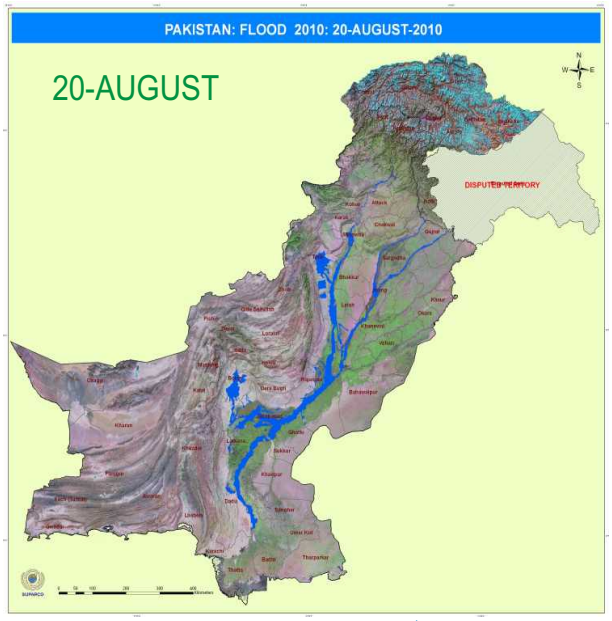

Figure 25: Flood Extent on 20th August 2010

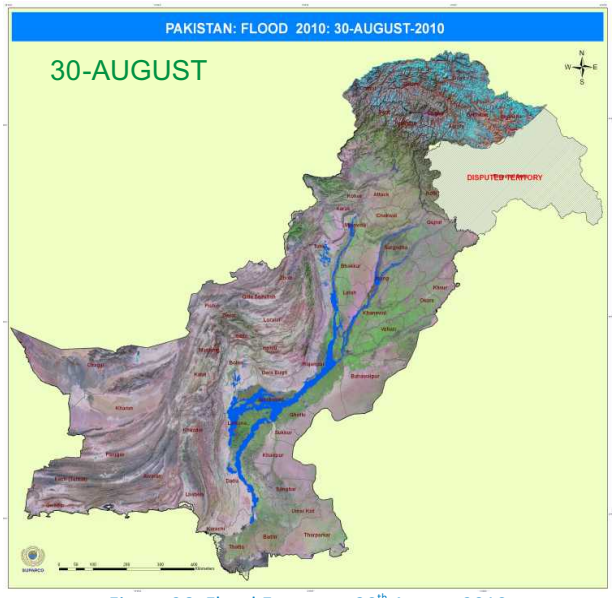

Figure 26: Flood Extent on 30th August 2010

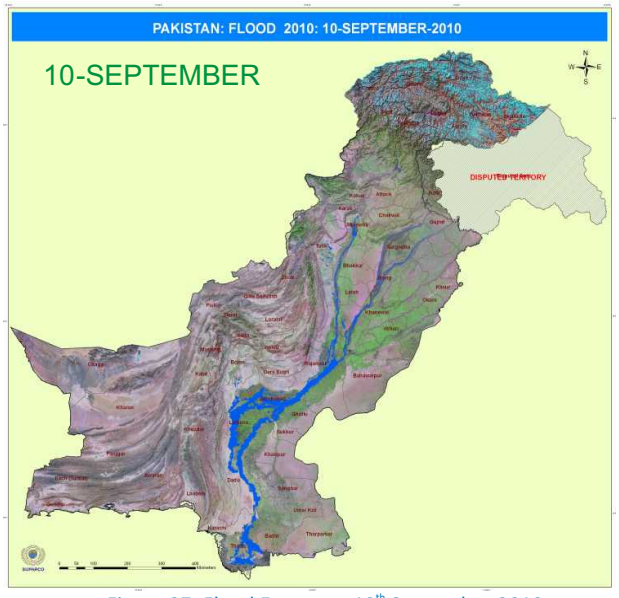

Figure 27: Flood Extent on 10th September 2010

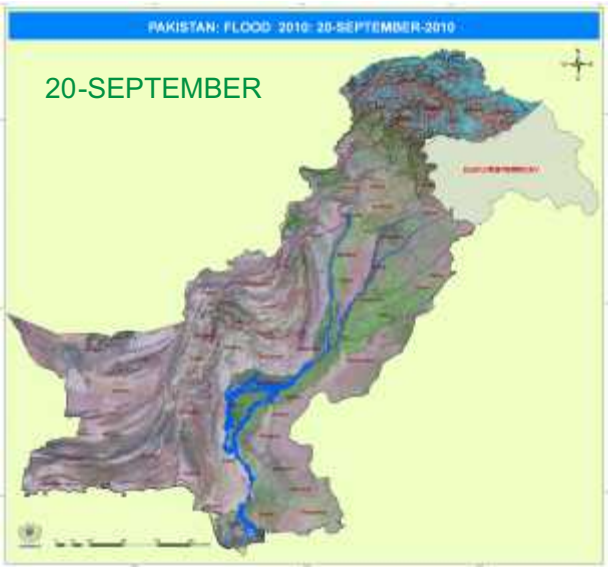

Figure 28: Flood Extent on 20th September 2010

Figure 29: Flood Extent on 30th September 2010

6. Flood Monitoring System in SUPARCO

Initially Modis data of 250 m resolution were acquired once daily in the afternoon at 1400 hours by SUPARCO, Space Application and Research Center, Karachi. These data were used to develop daily vector layers for inundation and inundation maps. These vector layers were forwarded to SUPARCO Space Application and Research Center, at Islamabad where there is expertise for agricultural work. This station has developed agricultural masks for crops by districts. These agricultural masks were overlaid on the inundation vector layers to estimate part of the geographic area that was under agriculture and was affected by floods. Moreover, the data from SPOT constellation of satellites were also acquired to further improve the quality of the spatial output.

The vegetation indices, NDVI data were used to have a second look at the situation on ground and on crop health. August was the worst month for inundation of agricultural areas.

7. Inundation Maps and Reporting System to MINFA and Planning Commission

SUPARCO, during the flood, revised inundation map of Pakistan, on daily basis. The district wise information on inundation of geographic areas and agricultural areas was developed on the same frequency. The information on agricultural areas was further apportioned into crops: cotton, sugarcane, rice and other crops. All these data and the maps developed were provided to Ministry of Food and Agriculture and Planning Commission on regular basis.

The inundation started in late July particularly after the devastating rains of July 29. It started increasing in early August and reached its crescendo in September. This is visible in the inundation maps and is supported by the VGT decadal images of July and August given below.

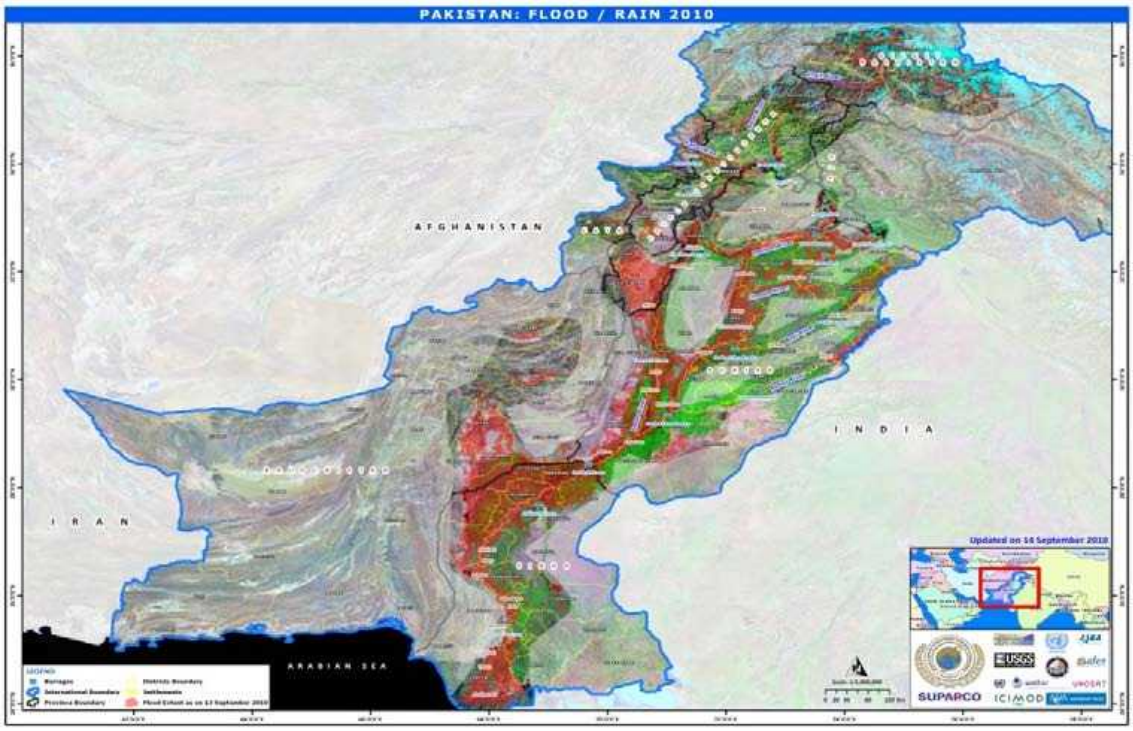

Figure 30: Inundation Map of 14th September, 2010

8. VGT Data

The rapid damage assessment was done by Modis 250 m resolution data. It was further complimented by use of data from SPOT VGT (resolution 1000 m). The raster files are given below.

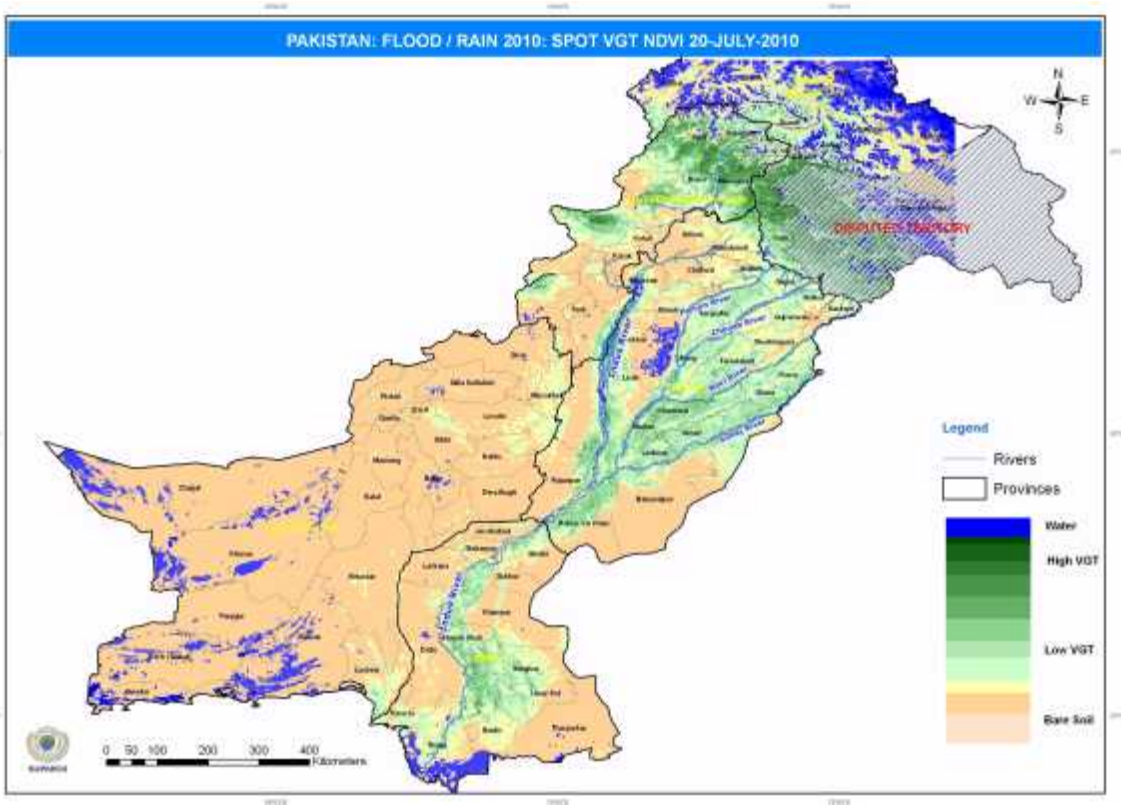

Figure 31: Satellite Vegetation Index Map of Pakistan: 20th July, 2010

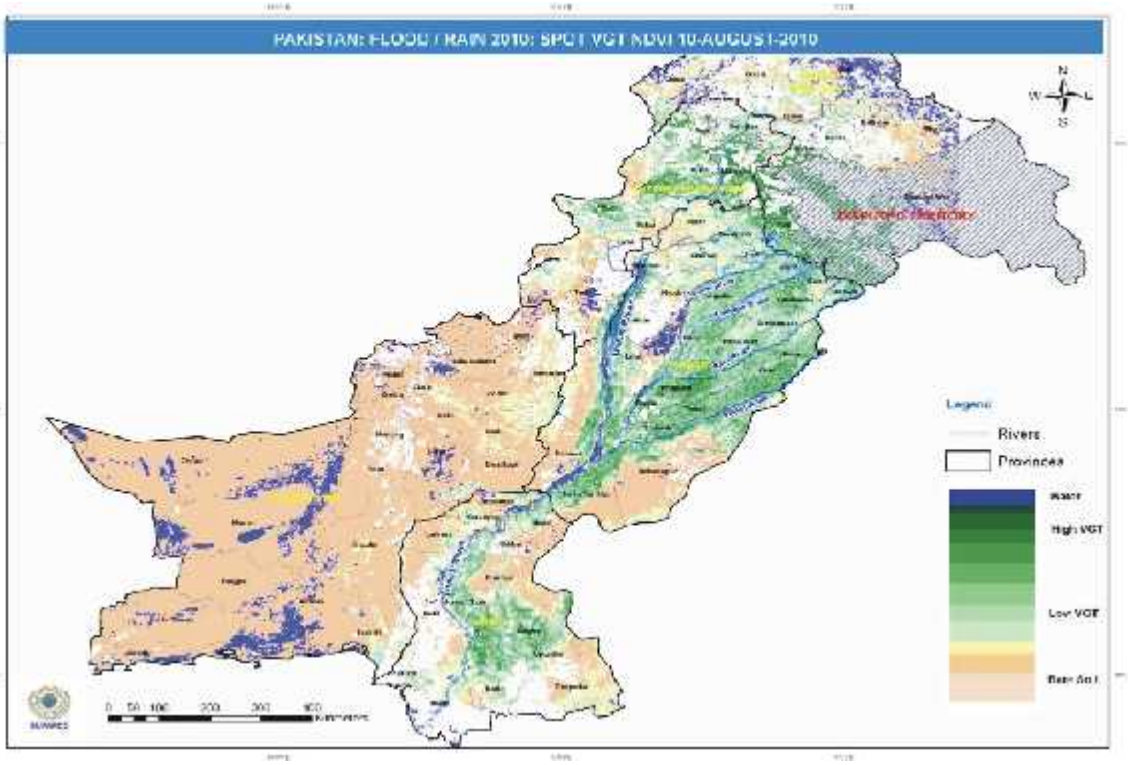

Figure 32: Satellite Vegetation Index Map of Pakistan: 10th August, 2010

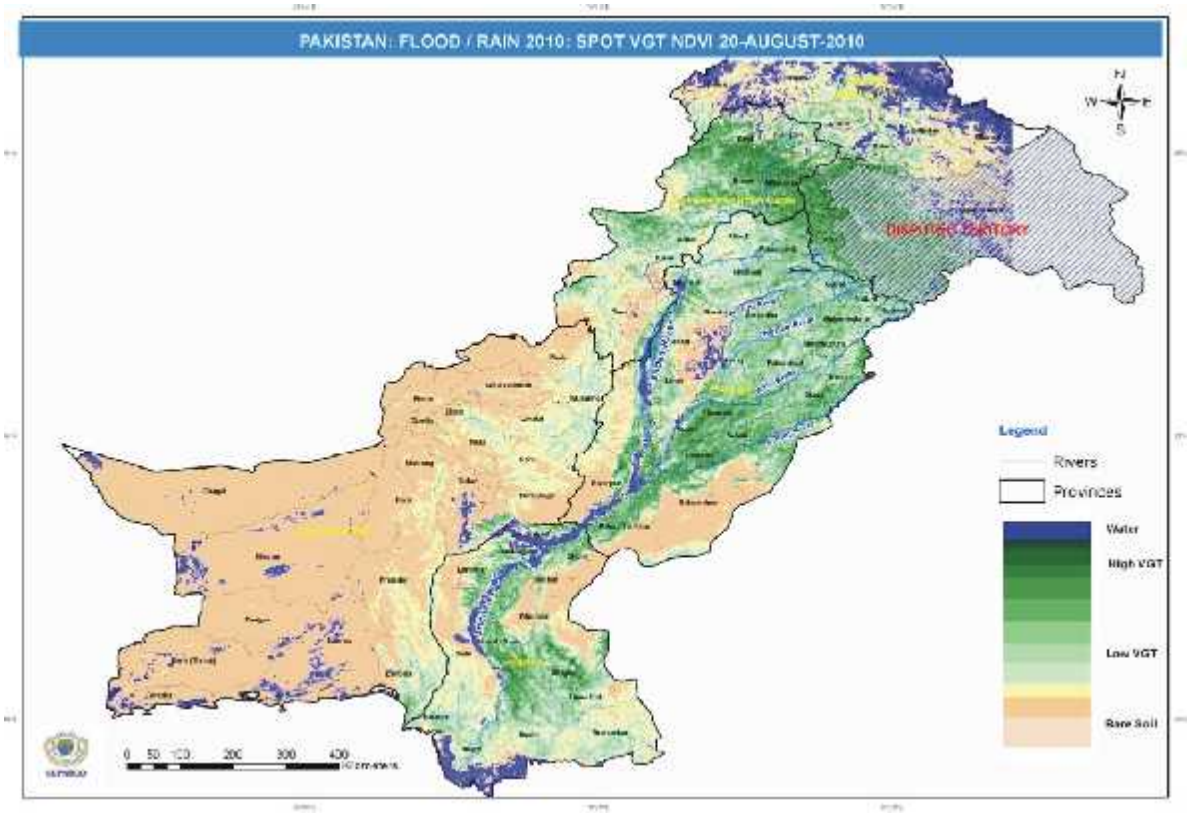

Figure 33: Vegetation Index Map of Pakistan: 20th August, 2010

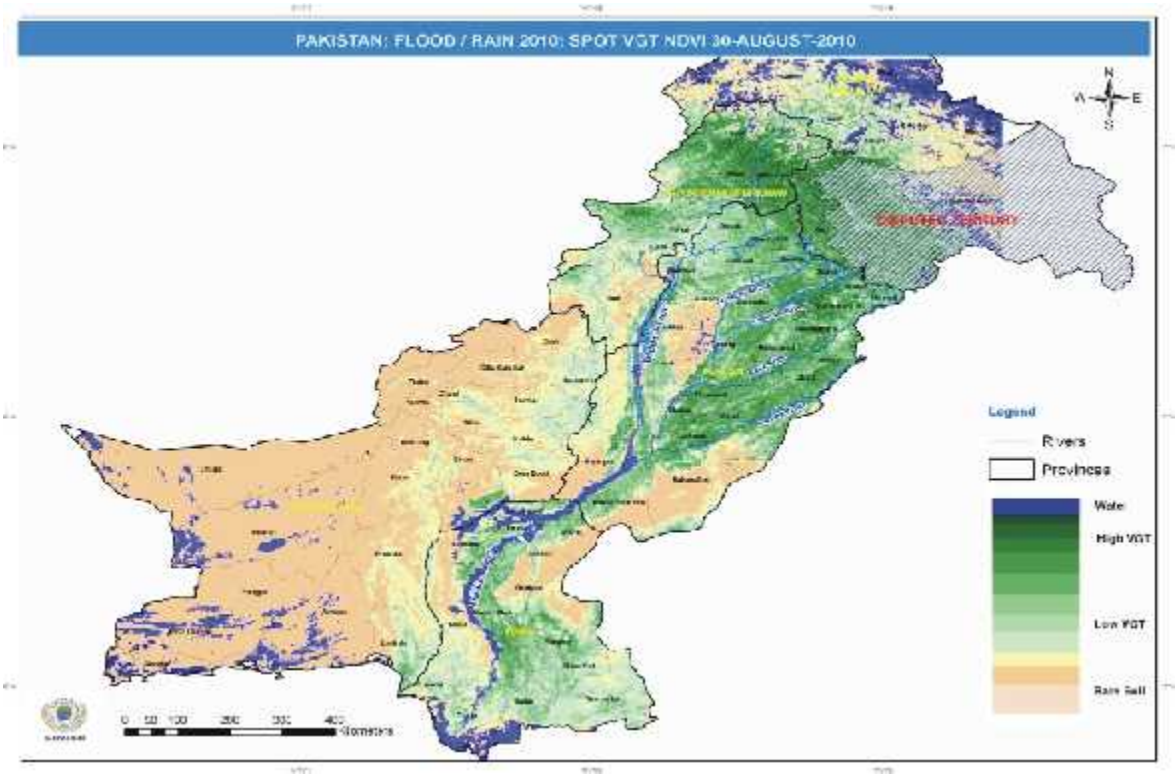

Figure 34: Satellite Vegetation Index Map of Pakistan: 30th August 2010

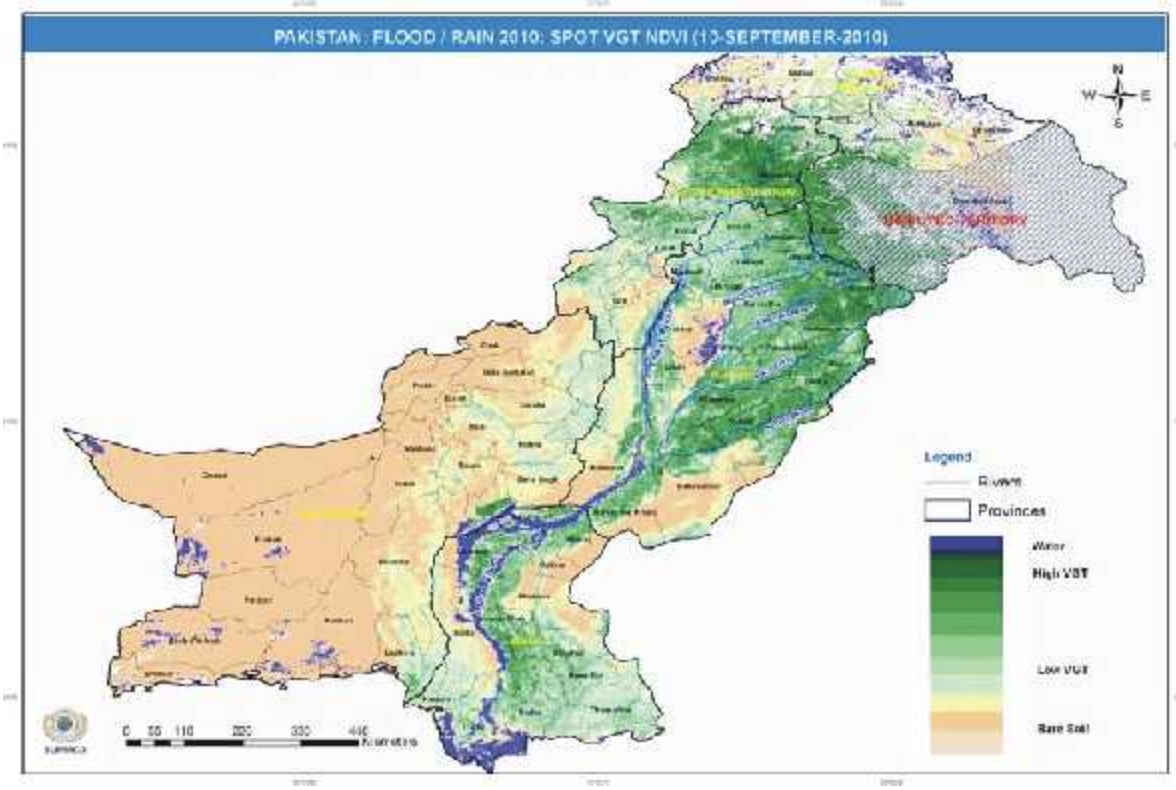

Figure 35: Satellite Vegetation Index Map 10th September 2010

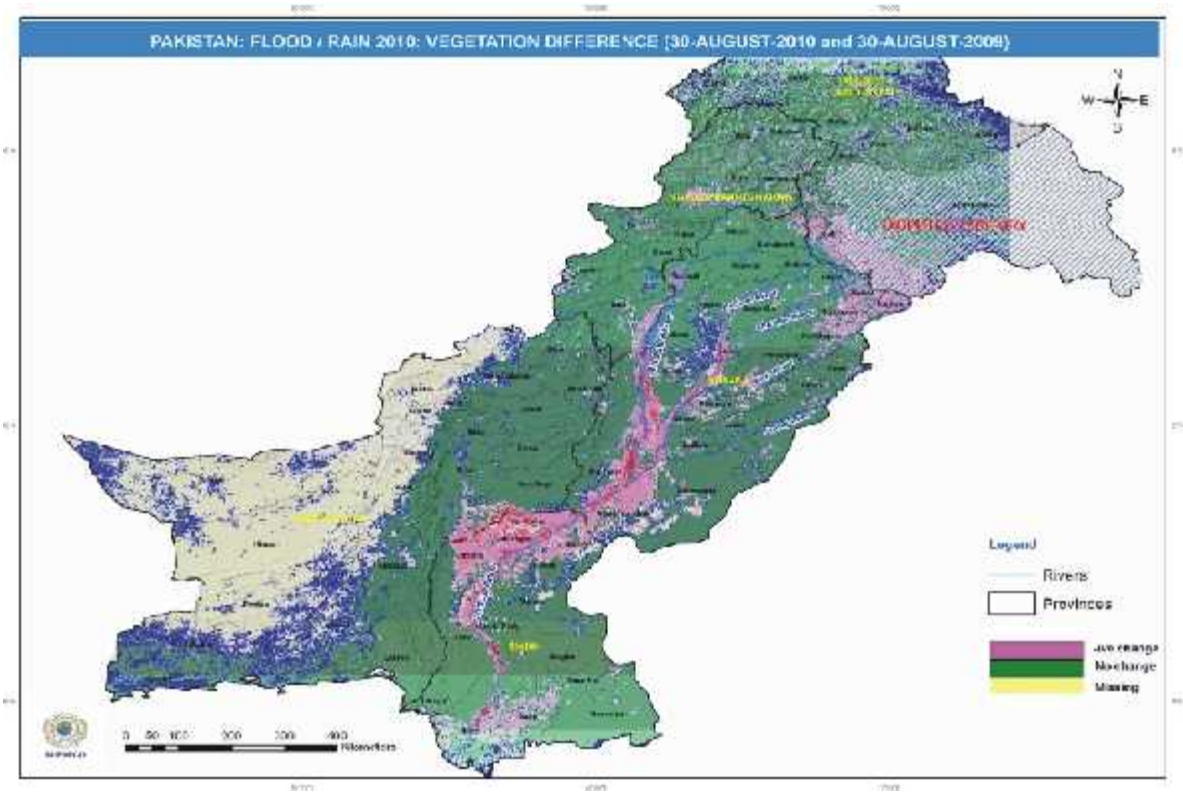

Figure 36: Vegetation Difference on 30th August over last year extracted from NDVI

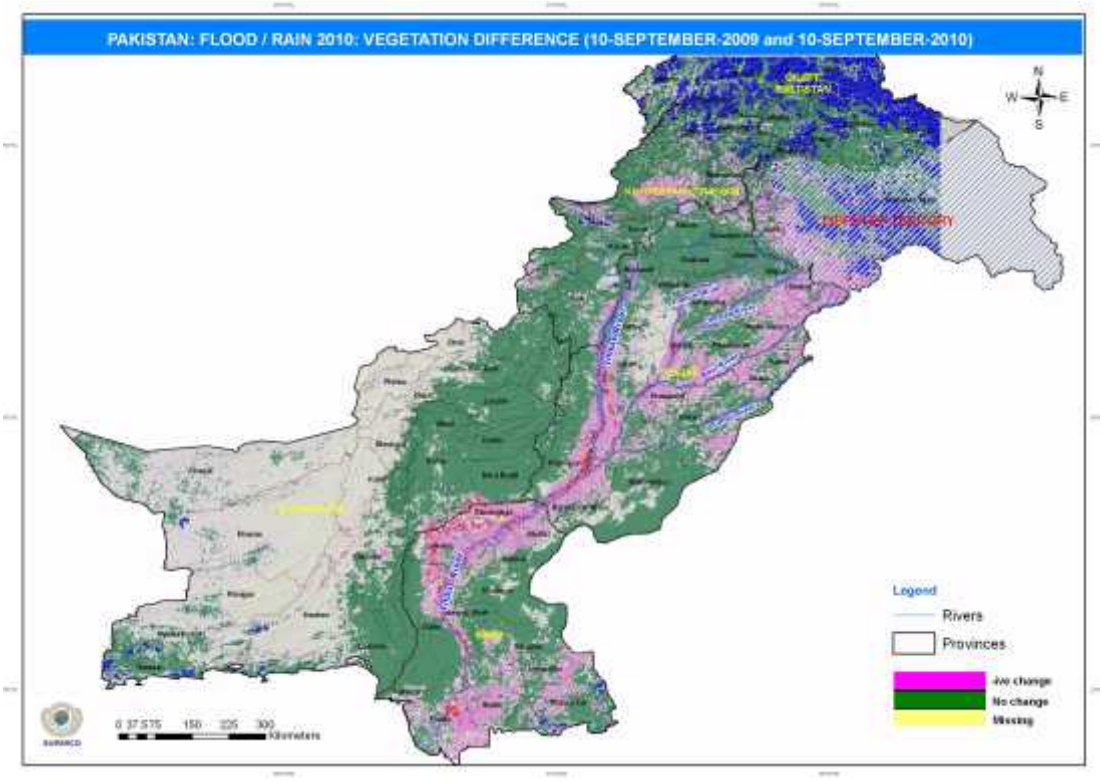

Figure 37: Normorlized Vegetation Difference Indices Map (10-September of 2009 vs 2010)

The differential NDVI shows that most of the damaged (magenta color) is along the river course. The crops situations in areas beyond the inundation show that health of the crop is at the level of last year or better. The statistical crop data of the 2009-10 was used to draw trend lines on proportionate basis, for each district for various crops.

9. Recession of Floods

The inundation and recession position of the flood affected areas is given overleaf. The summary of description of recession is as follows

a. Khyber Pakhtoonkhawah

Given the deep slopes in the mountainous regions, most of the inundated areas were cleared of standing water within a week. However southern plains of KP as Tank and D.I.Khan districts were still under flood water for a longer period and standing water drained out by mid September 2010. A further period of four weeks till mid October will bring the soil moisture contents in these areas to field capacity. Short of a few pockets of low-lying areas, most of these flooded areas are expected to come under sowing of rabi Crops 2010-11. The province is not likely to suffer from any short fall in production of rabi crops on account of floods/rains.

b. Punjab

The rain affected areas, mostly on northern and eastern parts of the province were generally cleared of standing water within a week. However the areas affected by floods from breaches of Indus river upstream Taunsa Barrage were under water for a

INUNDATION DURATION STATISTICS

Sr. No.	Province		District	Total District Area (Sq. km)	Total Affected Area (sq. km)	31-jul	5-Aug	10-Aug	15-Aug	20-Aug	25-Aug	30-Aug	5-Sep	10-Sep	15-Sep	20-Sep	25-Sep	30-SSep	Inundation Duration	Status as on 30 September
1	AJK	1	MIRPUR	765	167		↑ 100%	↑ 100%											05 Days	100 % Receded
2		2	BHIMBER	1652	105		↑ 100%	↑ 51%	↑ 100%										10 Days	100 % Receded
3	BALOCHISTAN	1	BOLAN	8546	3034			↑ 100%	↓ 19%		↓ 60%	↓ 4%	↓ 13%	↓ 2%					40 Days	2 % Still Inundated
4		2	JAFARABAD	2487	1926			↑ 73%	↓ 58%	↑ 42%	↑ 12%	↑ 3%	↓ 4%	↓ 7%		↓ 4%	↑ 12%	↓ 12%	45 Days	45 % Still Inundated
5		3	NASIRABAD	3222	1264			↑ 85%	↑ 58%	↑ 15%	↑ 15%	↓ 3%	↓ 3%	↓ 4%		→ 7%	↓ 2%	↓ 2%	45 Days	8 % Still Inundated
6		4	JHAL MAGSI	3859	929			↑ 60%	↑ 14%	↑ 6%	↓ 32%	↑ 20%		↓ 19%		↓ 10%	↓ 11%	↓ 11%	45 Days	28 % Still Inundated
7		5	LORALAI	9955	286			↑ 100%	↑ 100%										05 Days	100 % Receded
8		6	SIBI	4963	250			↑ 100%	↑ 100%										05 Days	100 % Receded
9		7	DERA BUGTI	10286	229			↑ 99%		↑ 1%		↑ 100%							20 Days	100 % Receded
10		8	QILLA SAIFULLAH	12446	229			↑ 100%	↑ 100%										05 Days	100 % Receded
11	FATA	1	SOUTH WAZIRISTAN AGENCY	5034	84			↑ 100%	↑ 100%										05 Days	100 % Receded
12		2	MOHAMAD AGENCY	2280	47		↑ 100%	↑ 100%											05 Days	100 % Receded
13		3	BAJAUR AGENCY	1502	31		↑ 100%	↑ 100%											05 Days	100 % Receded
14		4	KURRAM AGENCY	3469	20		↑ 100%	↑ 100%											05 Days	100 % Receded
15	KHYBER PAKHTOON KHWA	1	D. I. KHAN	9466	6014	↑ 66%	↓ 43%	↑ 100%	↓ 44%	↑ 2%	↓ 6%	↓ 25%	↓ 8%	↓ 1%					50 Days	9 % Still Inundated
16		2	TANK	3167	1108	↑ 58%	↓ 15%	↑ 100%	↑ 20%	↓ 5%	↓ 21%	↓ 28%	↓ 7%	↓ 2%					50 Days	2 % Still Inundated
17		3	LAKKI MARWAT	3126	316		↑ 100%	↑ 100%											05 Days	100 % Receded
18		4	NOWSHERA	1806	287	↑ 78%	↑ 22%			↑ 82%	↓ 3%	↑ 100%							30 Days	100 % Receded
19		5	SWABI	1474	241	↑ 75%	↑ 25%		↓ 37%		↓ 16%	↑ 100%							30 Days	100 % Receded
20		6	HARIPUR	2113	220		↑ 100%		↑ 100%										10 Days	100 % Receded
21		7	CHARSADDA	1091	215	↑ 57%	↑ 43%	↑ 100%											10 Days	100 % Receded
22		8	LOWER DIR	1697	149		↑ 100%	↑ 100%											05 Days	100 % Receded
23		9	KOHAT	3495	147	↑ 78%			↓ 47%	↑ 22%	↓ 9%	↑ 100%							30 Days	100 % Receded
24		10	BANNU	2299	138		↑ 100%	↑ 100%											05 Days	100 % Receded
25		11	SWAT	5087	130		↑ 100%	↑ 100%											05 Days	100 % Receded
26		12	MANSEHRA	4310	62		↑ 100%	↑ 100%											05 Days	100 % Receded
27		13	MARDAN	1617	59		↑ 100%	↑ 100%											05 Days	100 % Receded
28		14	KOHISTAN	7628	43		↑ 100%	↑ 100%											05 Days	100 % Receded
29		15	PESHAWAR	1410	29	↑ 55%	↑ 44%	↑ 100%											10 Days	100 % Receded
30		16	SHANGLA	1278	11		↑ 100%	↑ 100%											05 Days	100 % Receded
31	PUNJAB	1	MUZAFFARGARH	8412	4783	↑ 16%	↑ 11%	↑ 64%	↓ 31%	↓ 9%		↓ 15%	↓ 11%	↓ 5%		↓ 8%	↑ 14%	↓ 14%	55 Days	16 % Still Inundated
32		2	RAJANPUR	12372	3772	↑ 10%	↓ 3%	↑ 83%	↓ 32%	↑ 9%	↓ 7%	↓ 1%	↓ 1%	↓ 10%	↑ 4%	↓ 18%	↓ 16%	↓ 16%	55 Days	28 % Still Inundated
33		3	JHANG	6189	3003	↑ 20%	↑ 31%	↑ 49%	↓ 54%	↓ 5%		↓ 5%	↓ 21%	↓ 1%			↓ 3%	↓ 3%	55 Days	11 % Still Inundated
34		4	DERA GHAZI KHAN	11763	2840	↑ 49%	↑ 26%	↑ 25%	↓ 38%	↓ 5%	↓ 3%	↓ 16%	↓ 20%	↓ 1%	↑ 1%		↓ 6%	↓ 6%	55 Days	12 % Still Inundated
35		5	KHUSHAB	6634	1460	↑ 100%	↓ 55%	↓ 10%	↓ 35%	↑ 5%	↓ 5%	↑ 11%	↓ 6%						50 Days	5 % Still Inundated
36		6	MIANWALI	5875	1443	↑ 77%	↑ 19%	↓ 27%	↓ 7%	↓ 6%	↑ 4%	↓ 21%	↓ 5%	↓ 3%		↓ 1%	↑ 4%	↓ 4%	55 Days	28 % Still Inundated
37		7	MANDI BAHUDDIN	2832	1374		↑ 36%	↑ 64%	↑ 74%	↓ 3%			↓ 17%	↓ 1%					45 Days	5 % Still Inundated
38		8	SARGODHA	6082	1255	↑ 9%	↑ 17%	↑ 69%	↑ 89%	↑ 5%	↓ 2%	↓ 4%							50 Days	5 % Still Inundated
39		9	JHELUM	3751	1194	↑ 63%	↓ 3%	↑ 8%	↓ 46%	↓ 1%	↑ 26%	↓ 33%	↓ 4%						50 Days	16 % Still Inundated
40		10	RAHIM YAR KHAN	12510	1111	↑ 22%		↑ 53%	↓ 7%	↑ 18%	↑ 7%	↓ 14%	↓ 4%		↑ 6%				55 Days	33 % Still Inundated
41		11	GUJRAT	2925	1057		↑ 21%	↑ 73%	↑ 82%	↑ 6%	↓ 3%	↑ 100%							25 Days	100 % Receded
42		12	LEIAH	6238	959	↑ 54%	↑ 24%	↑ 22%	↑ 18%	↓ 6%		↓ 32%	↓ 18%	↓ 4%	↑ 2%				55 Days	23 % Still Inundated
43		13	CHINIOT	2801	672	↑ 70%		↑ 22%	↓ 39%	↑ 8%	↓ 5%	↓ 12%	↓ 10%	↓ 5%					88 Days	30 % Still Inundated
44		14	MULTAN	3767	554			↑ 100%	↓ 41%		↓ 14%	↓ 21%		↓ 6%					45 Days	6 % Still Inundated
45		15	BAHAWALPUR	25692	538		↑ 4%	↑ 89%	↓ 75%	↑ 3%	↑ 1%	↓ 13%	↑ 3%	↓ 3%					50 Days	5 % Still Inundated
46		16	KHANEWAL	4418	517		↑ 4%	↑ 96%	↓ 93%	↓ 2%	↓ 2%		↓ 1%	↓ 2%					35 Days	100 % Receded
47		17	HAFIZABAD	2455	492		↑ 9%	↑ 91%			↓ 2%	↑ 100%							25 Days	100 % Receded
48		18	TOBA TEK SINGH	3027	476			↑ 100%	↑ 100%										05 Days	100 % Receded
49		19	SHEIKHUPURA	3348	373			↑ 100%	↑ 100%										05 Days	100 % Receded
50		20	SIALKOT	2593	326		↑ 5%	↑ 95%	↓ 91%		↓ 4%	↑ 100%							25 Days	100 % Receded
51		21	CHAKWAL	6819	208			↑ 99%	↑ 19%	↑ 100%									10 Days	100 % Receded
52		22	BHAKKAR	8046	194	↑ 72%	↑ 8%	↑ 8%	↓ 17%	↓ 25%	↑ 12%	↓ 22%	↓ 2%			↓ 2%	↑ 6%		88 Days	30 % Still Inundated
53		23	GUJRANWALA	3455	179			↑ 8%	↑ 100%										05 Days	100 % Receded
54		24	NANKANA SAHIB	2755	172			↑ 100%	↑ 100%										05 Days	100 % Receded
55		25	OKARA	4225	129			↑ 100%	↑ 100%										05 Days	100 % Receded
56		26	KASUR	3937	101			↑ 100%	↑ 100%										05 Days	100 % Receded
57		27	FAISALABAD	5876	88			↑ 100%	↑ 100%										05 Days	100 % Receded
58		28	NAROWAL	1995	67			↑ 100%	↑ 100%										05 Days	100 % Receded
59		29	ATTOCK	6976	52	↑ 26%	↑ 6%		↑ 61%	↓ 69%		↑ 100%							30 Days	100 % Receded
60		30	RAWALPINDI	5527	45		↑ 81%		↑ 19%	↑ 100%									15 Days	100 % Receded
61		31	BAHWALNAGAR	9331	17			↑ 100%	↑ 100%										05 Days	100 % Receded
62		32	SAHIWAL	3167	12			↑ 100%	↑ 100%										05 Days	100 % Receded
63	SINDH	1	THATTA	17390	5332				↑ 3%		↑ 12%	↓ 11%	↑ 85%	↑ 14%	↓ 4%	↓ 33%	↓ 27%	↓ 27%	40 Days	19 % Still Inundated
64		2	QAMBAR SHAHDADKOT	5607	3401			↑ 69%		↓ 61%	↑ 17%	↑ 38%	↑ 3%	↓ 1%		↓ 5%	↓ 4%	↓ 4%	45 Days	56 % Still Inundated
65		3	JACOBABAD	2751	2678			↑ 79%	↓ 47%	↑ 31%		↑ 15%	↓ 12%	↓ 1%		↓ 3%	↓ 7%	↓ 7%	45 Days	55 % Still Inundated
66		4	KASH MORE	2850	2496			↑ 98%	↓ 32%			↑ 6%	↓ 4%			↓ 1%	↑ 38%	↓ 38%	45 Days	29 % Still Inundated
67		5	DADU	8016	2288			↑ 40%	↓ 24%			↑ 18%	↑ 36%	↑ 22%	↓ 5%	↓ 3%	↑ 18%	↓ 18%	45 Days	72 % Still Inundated
68		6	GHOTKI	6440	2165			↑ 100%	↓ 74%					↓ 1%		↓ 1%	↑ 18%	↓ 18%	45 Days	8 % Still Inundated
69		7	SHIKARPUR	2563	2124			↑ 64%	↓ 50%	↑ 16%	↑ 7%	↑ 8%	↓ 7%	↓ 2%			↑ 19%	↓ 19%	45 Days	37 % Still Inundated
70		8	SUKKUR	5203	1236			↑ 100%	↓ 25%	↓ 2%				↓ 5%			↑ 49%	↓ 49%	45 Days	19 % Still Inundated
71		9	LAR KANA	1907	1217			↑ 100%	↓ 35%					↓ 4%		↓ 1%	↑ 30%	↓ 30%	45 Days	32 % Still Inundated
72		10	JAMSHORO	11245	1206			↑ 40%	↑ 14%	↑ 22%	↑ 24%		↓ 10%	↑ 1%		↓ 9%	↑ 28%	↓ 28%	45 Days	72 % Still Inundated
73		11	KHAIRPUR	15804	901			↑ 53%	↑ 10%			↑ 7%	↓ 5%	↓ 2%			↑ 63%	↓ 63%	45 Days	30 % Still Inundated
74		12	NAWABSHAH	4493	849			↑ 51%	↑ 13%	↑ 36%			↓ 2%			↓ 4%	↑ 44%	↓ 44%	45 Days	54 % Still Inundated
75		13	NAUSHAHRO FEROZE	3037	843			↑ 59%	↓ 24%	↑ 7%	↓ 4%			↑ 2%			↑ 57%	↓ 57%	45 Days	42 % Still Inundated
76		14	MATIARI	1453	492			↑ 15%	↑ 40%	↑ 39%		↓ 3%	↓ 6%			↓ 2%	↑ 39%	↓ 39%	45 Days	56 % Still Inundated
77		15	TANDO MUHAMMAD KHAN	1545	353				↑ 40%		↑ 40%	↓ 13%	↑ 27%		↓ 13%	↓ 12%	↑ 23%	↓ 23%	40 Days	70 % Still Inundated
78		16	SANGHAR	10676	217						↑ 100%	↑ 100%							05 Days	100 % Receded
79		17	HYDERABAD	1018	165				↑ 33%	↑ 10%	↑ 43%	↑ 14%	↓ 7%		↓ 14%	↓ 8%	↑ 35%	↓ 35%	40 Days	52 % Still Inundated
80		18	BADIN	6690	73						↑ 100%	↑ 100%							05 Days	100 % Receded
81	GILGIT BALTISTAN	1	DIAMIR	7548	109		↑ 100%	↑ 100%											05 Days	100 % Receded
82		2	SKARDU	19004	102		↑ 100%	↑ 100%											05 Days	100 % Receded
83		3	GILGIT	18296	84		↑ 100%	↑ 100%											05 Days	100 % Receded
84		4	GHANCHE	8266	30		↑ 100%	↑ 100%											05 Days	100 % Receded
85		5	GHIZER	12002	29		↑ 100%	↑ 100%											05 Days	100 % Receded
86		6	ASTOR	5226	10		↑ 100%	↑ 100%											05 Days	100 % Receded

Receding Water ↓ Flood Extension ↑

longer time and cleared by mid September. These districts include Muzaffargarh, D.G. Khan and Rajanpur. Similar is the position of southern parts of Rahim Yar Khan district. Short of some localized, low lying pockets, most of these areas are expected to be available for sowing in rabi season.

c. Baluchistan

The water from the mountainous region of the province cleared off within a week or so. However around 80,000 ha were under 1.5 - 2.0 meter deep flood water in Jhal Magsi (6 thousand ha - 8 %), Naseerabad (7 thousand ha - 9 %) and Jaffarabad (67 thousand ha - 83 %) at the end of September. These districts were almost under 0.8 million acre feet of standing water on this date. These areas need to be monitored on continuous basis. All areas in Jhal Magsi and Nasir Abad and 60 % of the agricultural-flooded areas in Jaffarabad are most likely to be available for sowing of rabi crops.

d. Sindh

The Indus River system developed a peak flow of around one million cusecs by the time it reached river intersection between Gaddu and Sukkur Barrages. It breached the embankments at right bank of river Indus setting in motion a spiral action of inundation followed by continuously moving draining water from upstream districts of Kashmore, Jacobabad, Shikarpur, Qambar Shahdad Kot to the coastal district of Dadu. About 0.6 million hectares were under 1.5 to 2 meter deep water at the end of September. It is estimated that this area had almost 6 million acre feet of standing water at the end of September. These affected areas have already missed Kharif crops and will further pass through the predicament of failing to grow the current rabi crops. There is a need to continuously monitor these areas on temporal basis.

10. Damage to Kharif Crops

The damage to various Kharif crops as cotton, sugarcane, rice and others was as under.

a. Cotton

Cotton is the most important cash crop of the country. It runs the wheel of Pakistan's largest industry of textile and generates 70% of foreign exchange earnings. Cotton is mainly produced in Punjab and Sindh provinces. There is a changing trend in the production of cotton crop with share of Sindh increasing significantly on account of (a) attractive prices of the commodity (b) high productivity efficiency with yields of 1144 kg per ha in Sindh against 597 kg per ha in Punjab – a margin of 90 percent (c) and early crop harvests getting attractive prices to make a debut in the ginning season. This wide margin of yield in Sindh over Punjab is due to lesser insect pressure as high applications of agro-chemicals in Punjab have almost eliminated friendly predators feeding on cotton insects. In addition, Punjab is in the grip of severe attack of Cotton Leaf Curl Virus (CLCV) whereas Sindh is almost free of this menace.The disease has assumed the dimension of almost an epidemic in Sahiwal, Vehari, Khanewal, Lodhran and Multan districts of Punjab and is present to a moderate level in other cotton growing areas of the province. On account of these factors, it is becoming increasingly difficult to grow cotton in Punjab. However textile quality of cotton in Punjab is better than Sindh, mostly in terms of fiber strength, micronaire (fineness), and fiber length as these are generally temperature sensitive phenomena and Punjab crop is picked during relatively cooler months of the year.

The cotton crop during 2009-10 was sown on an area of 3.110 million ha and production[4] was 12.913 million bales[5]. Of this, area in Punjab was 2.436 million ha and Sindh was 0.635 million ha. Cotton production was 8.6 million bales in Punjab and 4.3 million bales in Sindh. The crop statistics are as follows :

Province	Achievements 2009-10			Targets 2010-11		
	Area (million ha)	Production (million bales)	Yield (kg/ha)	Area (million ha)	Production (million bales)	Yield (kg/ha)
Punjab	2.436	8.552	597	2.50	9.70	660
Sindh	0.635	4.270	1144	0.65	4.20	1099
KP	0.004	0.001	43	0.01	0.01	170
Baluchistan	0.035	0.090	437	0.04	0.10	425
Pakistan	**3.110**	**12.913**	**706**	**3.20**	**14.010**	**745**

For the year 2010-11, the targets were fixed by the Federal Committee on Agriculture (FCA) at area 3.20 million ha and production at 14.010 million bales

The core areas of cotton production are in southern Punjab and areas on left bank of Indus in Sindh. However it is also being grown in central Punjab and Pat Feeder areas of Baluchistan. Major damage to cotton occurred along river Indus in Punjab and in the Katcho areas in Sindh province. Cotton requires well drained soils. The plant cannot survive prolonged wet condition resulting in depletion of oxygen from the root zone. The plant dies of suffocation, under anaerobic conditions. Cotton crop was mainly lost in the inundated areas along river Indus. The major damage to cotton was caused by floods in the districts of Muzaffargarh 124 thousand ha, Rajanpur 107 thousand ha, D.G.Khan 29 thousand ha and Rahim Yar Khan 23 thousand ha. However in the areas affected by rains alone, the water did not stand for long periods of time. The damages in these areas were marginal and the crop was mostly safe. These areas include Multan, Khanewal, Jhang and T.T.Singh. In Sindh, the major affected areas are mainly on the right bank of Indus which are not generally important for cotton production.

The district wise damages have been worked out, basing on flood information extracted from SPOT VGT. The term floods include the affect by rains and river over flows. The basic parameters used in the assessment include:

i) In Punjab, cotton in all areas hit by water outflows from rivers has been completely washed out. A factor of 1 was used in the assessment denoting a complete damage in the affected area. Cotton in areas that were hit by rains alone, some marginal damage is expected, mainly in low lying areas. Cotton areas do generally receive monsoon of variable intensity each year and in well drained soils /or on soils with high infiltration rate, cotton escapes damage. The SPOT VGT NDVI data indicate that in areas outside the

[4] The figures in this document were rounded off and this may lead to some discrepancy of reporting

[5] A cotton bale is of 375 lbs in Pakistan compared to international standard of 480 lbs

inundation command, the crop growth is better than last year. A negative crop growth factor in rain affected areas was assumed to be balanced by marginal gains else where.

ii) In Sindh, in districts of Ghotki, Sukkur, Khairpur, Naushero Feroze and Shaeed Benazir Abad, cotton is mainly grown on the main land. However some of the cotton is also grown in the river bed of these districts. All cotton in the river bed was damaged. Cotton under water in inundated areas was damaged. However it is assumed that on peripheries water drained out and crop was safe. The factor of damage therefore has been taken as a mix of two i.e. 75 percent of the crop damaged and 0.25 percent for the crop at peripheries.

Based on above assumptions, the district wise categorization of cotton areas in rain/ river water flooded areas was carried out. The summary of these data is as follows:

Province	Area Damaged (000 ha)	Extent of damage in the flash flooded areas (%)	Projected Production Loss (million bales)
Punjab	405.3	100	1.08
Sindh	190.6	60	0.67
Baluchistan	2.5	100	0.01
Total	**598.4**	**74**	**1.76**

The cotton area affected is about 0.6 million ha. The crop may be down by approximately two million of bales from last year's production of 12.7 million bales[6], owing to damage by floods/rains.

b Sugarcane

Sugar[7] industry is the second largest industry in Pakistan. The industry is fraught with problems of cyclic production of bumper / short crops, owing to cash flows generated by the crop in the preceding year. The area under sugarcane crop is around 1 million ha and production is about 50 million tons ± 2 to 3 million tons. In Sindh, sugarcane is sown in September as an intercrop with other short duration crops. Sugarcane in Punjab and KP is sown in February /March. The crop is not generally grown in Baluchistan. The crop growth season is 14 months in Sindh and 9 months in Punjab and KP. Because of the prolonged growing season, sugarcane productivity is the highest in Sindh, followed by Punjab and KP in the order. The target for the current year is fixed at area little more than one million ha and production at 53.7 million tons. The data are as follows:

[6] Ministry of Food and Agriculture

[7] Sugar is mainly extracted from sugarcane.
Some sugar is also manufactured from sugarbeet in Peshawar valley.

Province	Achievements 2009-10			Targets 2010-11		
	Area (000 ha)	Prod uction (000 tons)	Yield (tons/ha)	Area (000 ha)	Production (000 tons)	Yield (tons/ha)
Punjab	607.42	31.324	51.56	698.00	33.846	49.00
Sindh	233.95	13.505	57.73	269.00	15.170	57.00
KP	100.8	4.508	44.71	102.00	4.641	45.50
Baluchistan	0.7	0.036	50.86	0.70	0.033	47.57
Pakistan	**942.87**	**49.373**	**52.36**	**1069.70**	**53.690**	**50.19**

Sugarcane is a water hydrophilic crop but it requires a well drained soil with moderate rate of soil infiltration. In case it is subjected to a long flooding, the growth is impeded drastically. The adventitious roots appear on the plants and the process of sucrose formation is distorted by hydrolysis from 12-carbon sugars into 6-carbon sugars. The basic assumptions made in the assessment of sugarcane crop were as follows.

i) Rains have no or negligible impact on sugarcane crop except low lying areas. Any marginal damage in such areas is assumed to be offset by gains in crop productivity in other areas.

ii) In areas under river floods, it was assumed that 80 percent of crop under deep water is damaged. However 20 percent of the crop on the peripheries with shallow water that drained quickly, was safe.

Based on these assumptions, each district was assigned a damage factor. The yields for the current year were assumed at the level of last year. The area of sugarcane under flood water is about 18 percent of total. The summary of the damages is as follows:

Province	Area Damaged (000 ha)	Damage (%)	Projected Production Loss (million tons)
Punjab	102.8	43	2.1
Sindh	76.4	64	2.3
KP	15.4	64	0.4
Total	**177.7**	**52**	**4.8**

At a rate of 9 percent of sugar recovery, the loss in sugar production is estimated at about half a million tons. This will further add up to the deficit of sugar which Pakistan already has to meet through imports. The overall imports required may be a little above one million tons.

c. Rice

Rice is grown in all provinces. basmati, the aromatic long grain rice is mainly concentrated in the heartland of Kallar tract in Punjab. This area comprises of districts in North East Punjab:

Gujranwala, Sheikhupura, Hafiz Abad, Narowal, Sialkot and Nankana Sahib. In Punjab, basmati rice covers 75 percent of rice area and coarse rice covers 25 percent of the area. Swat grows cold water tolerant Japanica rice which is photosensitive. All other rice including basmati and coarse rice grown in Pakistan is of Indica origin and is day-neutral. All areas in Sindh and Baluchistan are covered under coarse grain bold sized non-aromatic rice popularly called IRRI. Chinese based hybrid rice with high productivity is finding an inlet into IRRI rice growing areas on account of high margins in output.

Rice is grown on about 2.9 million ha with a production of about 7 million tons. About half of this area is under basmati rice. The production of basmati rice is 2.5 million tons and production of IRRI rice is about 4.5 million tons. The statistics of achievements and targets of rice are as follows:

Province	Achievements-2009-10			Targets 2010-11		
	Area (000 ha)	Prod uction (000 tons)	Yield (kg/ha)	Area (000 ha)	Prod uction (000 tons)	Yield (kg/ha)
Punjab						
Basmati	1413.95	2475.43	1751	1465	2526.00	1726
IRRI/Others	517.58	1237.57	2396	353	841.00	2374
Total	**1931.53**	**3713.00**	**1922**	**1818.00**	**3367.00**	**1852**
Sindh	707.75	2422.30	3423	642	2039.00	3176
KP	53.78	102.40	1904	60	126.00	2100
Baluchistan	190.10	645.00	3393	190.00	644.10	3390
Pakistan	**2883.16**	**6882.70**	**2387**	**2710.00**	**6176.10**	**2279**

Major rice growing areas of Punjab were outside the flood reach. In Punjab, the rice was affected in the flooded areas of D.G.Khan, Rajanpur, Muzaffargarh, and Jhang. Other areas reported were affected by rains. In view of oxygen supply mechanism to rice roots through leaves, plant has a system to survive in water, rather perform better In view of nitrogen conservation phenomenon in flooded soils. However deep water that leads to submergence of plants, is likely to cause mortality of plants. The damage assumptions made are similar to sugarcane.

In Sindh, major devastation in rice occurred in most of the right bank districts. Water from river Indus initially inundated these districts. Later on the receding water from the upper districts caused major devastation particularly in Dadu district. On left bank, Thatta was the only rice growing district affected by floods.
The summary of these data are as follows:

Province	Area Damaged (000 ha)	Damage (%)	Projected Production Loss (million tons)
Punjab	235.8	24	0.12
Sindh	507.3	100	1.83
KP	5.5	47	0.02
Baluchistan	124.3	80	0.42
Total	**872.9**	**73**	**2.39**

The rice production loss may be well over two million tons on account of flooding. The sowing of rice in Sindh continued up to mid September. Given the climatic condition of the province such short duration rice, may not mature for grain harvests. The loss of rice may be exclusively from coarse IRRI cultivars, mainly in Sindh province. The right Bank of Indus that suffered a catastrophe, is home to IRRI rice as a main cash crop.

d. Maize

Maize is an important industrial crop, known for its use for production of glucose, starches, beverages and animal feed both for ruminants and poultry. The development of livestock and poultry sectors is dependent on promotion of this crop. The crop, therefore, occupies high priority in agricultural development planning. Punjab farmers have shifted to use of hybrid seed for its vigor in crop productivity. Elsewhere synthetic varieties are sown, mainly because of prohibiting /high initial cost of hybrid seeds. The crop is grown in Punjab. KP, AJK and GB. The major maize growing districts are Okara, Pakpattan, Jhang, Sahiwal, Sargodha, Rawalpindi, Attock and Chakwal in the Punjab. The areas in KP include Swat, Mansehra, Bunir, Haripur and Shangla. This crop is not generally grown in Sindh and Baluchistan provinces mainly because of comparative advantage of these provinces in other crops, particularly autumn vegetables and spices.

About 1 million ha area is under maize crop. The production is around 3.5 million tons. The targets for the year are: area 1.11 million ha and production target is 3.59 million tons. The data are as follows:

Province	Achievements 2009-11			Targets 2010-11		
	Area (000 ha)	Production (000 tons)	Yield (kg/ha)	Area (000 ha)	Prod uction (000 tons)	Yield (kg/ha)
Punjab	519.60	2717.04	5229	525.60	2603.60	4954
Sindh	3.13	1.89	606	2.80	1.80	655
KP	421.90	752.15	1783	530.00	925.00	1745
Baluchistan	5.20	5.90	1134	60.00	60.00	1000
Pakistan	**949.83**	**3476.98**	**3661**	**1118.40**	**3590.40**	**3210**

The major maize growing areas were out of the reach of catastrophe. At other places where floods inundated the crops, maize was at sowing stage. These areas are mainly in Jhang, Muzaffargarh, Sargodha and Jehlum in Punjab and Swat, Nowshera and Laki Marwat in KP. The damage to maize area was as follows.

Province	Area Damaged (000 ha)
Punjab	44.2
KP	16.7
Total	**60.9**

The area affected had to be replanted.

e. Millet

Millet is a crop of barani areas. Total area under this crop is a little more than half a million ha and production is around 0.3 million tons. It used to be a Kharif supply of food grains in old times. With the advent of HYVs of wheat, rice and maize crops, millet is not important as a human food. In recent years, it is picking up as an avian feed. The crop statistics are as follows:

Province	Area (000 ha)	Production Loss (000 tons)	Yield (kg/ha)
Punjab	394.8	244.9	620
Sindh	74.8	44.6	596
KP	4.0	2.2	550
Baluchistan	2.1	1.3	619
Total	**475.7**	**293.0**	**616**

An area of 0.108 million ha was affected by rains and floods. The crop is mainly affected in Punjab. The major districts are Jhelum, Jhang, and Mianwali. The assumptions made are similar to sugarcane crop. The summary of damage assessment is as follows:

Province	Area Damaged (000 ha)	Damage (%)	Projected Production Loss (000 tons)
Punjab	105.8	50	32.6
Sindh	1.4	80	0.02
KP	0.9	80	0.3
Total	**108**	**44**	**33.1**

f. Sorghum

Sorghum is sown more widely in all provinces than millet which is mainly confined to Punjab. Like millet, sorghum used to be a Kharif supply of food grains in olden times. With plenty of food supply, it is no more being used as a human food. Sorghum is basically a fodder crop. The grain crop is mainly a source of seed and to some extent, may be used as feed. The chances of use as a human food are remote. However such a possibility cannot be ruled out.

Province	Area (000 ha)	Production Loss (000 tons)	Yield (kg/ha)
Punjab	184.4	103.6	562
Sindh	31 7	24 8	782
KP	7.4	4.1	554
Baluchistan	24.9	21 6	867
Total	**248.4**	**154.1**	**620**

Sorghum is also a crop of barani areas. Total area under crop is around a quarter of a million. The production is around 0.15 million tons. The assumptions for damage assessment for sorghum are the same as for other crops.

An area of 72 thousand ha was affected by rains and floods. The crop is mainly affected in Punjab and Sindh. The major districts are Jhelum, Jhang, and Mianwali. The summary of damage assessment is as follows:

Province	Area Damaged (000 ha)	Damage (%)	Projected Production Loss (000 tons)
Punjab	41.0	41	13.0
Sindh	22.5	60	7.3
KP	0.9	80	0.3
Baluchistan	8.23	80	1.6
Total	**72.4**	**46**	**22.2**

g. Kharif Fodders

The Kharif fodders include a number of crops as sorghum, millets and a variety of others. About an area of 1.1 million hectares is under fodders. The cultivated area under fodders may be a little more than one half of this, as most of the fodders are harvested and re-sown.

Province	Area (000 ha)	Production Loss (million tons)	Yield (tons/ha)
Punjab	914.9	11.7	12.8
Sindh	140.2	1.6	11.4
KP	40.6	0.6	14.8
Baluchistan	16.5	0.54	32.7
Total	**1112.2**	**14.5**	**13.0**

The damage of fodders caused very high discomfort to farmers, as fodders supply for livestock was restricted or cut in extreme cases.

Province	Area Damaged (000 ha)	Damage (%)	Projected Production Loss (million tons)
Punjab	283.2	63	1.7
Sin dh	97.5	68	1.7
KP	20.2	80	0.3
Baluchistan	7.8	80	0.2
Total	**408.7**	**72**	**3.9**

About 0.4 million ha area was damaged. The production loss is estimated at about 4 million tons.

Annexure 1

DAMAGE TO COTTON CROP

Punjab

Districts	Area Damaged ('000' ha)	Yield Loss (bales/ha)	Damage Factor	Projected Production Loss (million bales)
Bhakkar	3.7	2.9	1.0	0.01
Bahawalpur	1.0	3.9	0.0	0.00
D.G.Khan	28.8	3.6	1.0	0.10
Jhelum	0.6	1.0	0.0	0.00
Jhang	30.3	2.9	0.1	0.01
Khanewal	20.6	3.9	0.0	0.00
Layyah	17.7	3.0	1.0	0.05
M.B.Din	0.7	1.4	0.0	0.00
Mianwali	9.6	3.8	1.0	0.04
Multan	26.3	3.8	0.0	0.00
Muzaffargarh	124.0	2.8	1.0	0.35
Rahim Yar Khan	22.9	4.4	1.0	0.10
Rajanpur	107.1	3.9	1.0	0.42
Sargodha	2.1	2.3	0.0	0.00
T.T.Singh	9.8	3.2	0.0	0.00
Total	**405.3**	**3.4**	**0.8**	**1.08**

Sindh

Districts	Area Damaged ('000' ha)	Yield Loss (bales/ha)	Damage Factor	Projected Production Loss (million bales)
Ghotki	79.8	5.5	0.75	0.3
Sukkur	29.6	5.0	0.75	0.1
Khairpur	14.7	5.0	0.75	0.1
Larkana	4.9	4.6	0.75	0.0
Thatta	1.9	6.4	0.00	0.0
Shaheed Benazir Abad	23.2	5.7	0.50	0.1
N.feroze	11.8	5.6	0.50	0.0
Sanghar	0.6	6.2	0.00	0.0
Dadu	20.1	4.5	0.50	0.0
Hyderabad	4.1	7.8	0.50	0.0
Total	**190.6**	**4.7**	**0.67**	**0.7**

Baluchistan

Districts	Area Damaged ('000' ha)	Yield Loss (bales/ha)	Damage Factor	Projected Production Loss (million bales)
Nasir Abad	2.5	2.5	1	0.01
Total	**2.5**	**2.5**	**1**	**0.01**

Annexure 2

DAMAGE TO SUGARCANE CROP				
Punjab				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (tons/ha)**	**Damage Factor**	**Projected Production Loss (million tons)**
Bhakkar	2.6	42.1	0.8	0.1
D.G.Khan	1.1	51.7	0.8	0.0
Gujranwala	0.2	37.8	0.0	0.0
Gujrat	0.7	39.0	0.0	0.0
Hafizabad	0.7	37.8	0.0	0.0
Jhang	17.3	48.4	0.2	0.2
Khanewal	0.9	50.8	0.0	0.0
Khushab	3.3	43.4	0.0	0.0
Layyah	4.4	51.5	0.8	0.2
M.B.Din	9.8	41.9	0.0	0.0
Mianwali	1.4	46.4	0.8	0.1
Multan	0.5	41.5	0.0	0.0
Muzaffargarh	22.5	50.9	0.8	0.9
Rahim Yar Khan	7.5	30.0	0.8	0.2
Rajanpur	9.8	63.1	0.8	0.5
Sargodha	13.7	45.9	0.0	0.0
Sialkot	0.2	29.9	0.0	0.0
T.T.Singh	6.4	50.7	0.0	0.0
Total	**102.8**	**47.9**	**0.4**	**2.2**

Sindh				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (tons/ha)**	**Damage Factor**	**Projected Production Loss (million tons)**
Ghotki	4.0	56.9	0.8	0.183
Sukkur	1.6	53.4	0.8	0.070
Khairpur	4.0	57.2	0.8	0.185
Shikarpur	13.3	25.7	0.8	0.273
Thatta	29.4	51.3	0.8	1.205
Shaheed Benazir Abad	9.7	46.4	0.0	0.000
N.feroze	5.2	57.2	0.5	0.149
Sanghar	0.1	48.6	0.0	0.000
Dadu	4.8	46.6	0.5	0.112
Hyderabad	4.3	56.2	0.5	0.121
Total	**76.4**	**46.7**	**0.6**	**2.298**

Khyber Pakhtoonkhawah				
Districts	Area Damaged ('000' ha)	Yield Loss (tons/ha)	Damage Factor	Projected Production Loss (million tons)
Charsada	3.7	45.0	0.8	0.1
D.I.Khan	9.7	32.3	0.6	0.2
Nowshera	2.0	50.4	0.5	0.1
Total	**15.4**	**38.0**	**0.6**	**0.4**

Annexure 3

DAMAGE TO RICE CROP				
Punjab				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
Bhakkar	0.5	1599	0.0	0.0
D.G.Khan	12.1	2301	1.0	27.8
Gujranwala	27.2	2099	0.0	0.0
Gujra t	15.0	1772	0.0	0.0
Hafizabad	14.9	1983	0.0	0.0
Jhelum	1.1	1686	0.0	0.0
Jhang	28.6	1723	0.2	9.9
Khanewal	2.9	1764	0.0	0.0
Khushab	13.9	1530	0.0	0.0
Layyah	3.6	1827	1.0	6.6
M.B.Din	30.7	1767	0.0	0.0
Mianwali	1.8	1589	1.0	2.9
Multan	2.1	1568	0.0	0.0
Muzaffargarh	19.0	1902	1.0	36.1
Rah im Yar Khan	2.1	1807	1.0	3.9
Rajanpur	9.8	2031	1.0	20.0
Sargodha	11.6	1655	0.0	0.0
Sialkot	32.2	1929	0.0	0.0
T.T. Singh	6.4	1739	0.0	0.0
Total	**235.8**	**1892**	**0.2**	**107.1**

Sindh				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
Ghotki	16.1	1975	1	32
Sukkur	7.4	2221	1	16
Khairpur	1.7	3097	1	5
Shikarpur	109.7	3495	1	383
Larkana	160.3	3907	1	626
Jacobabad	66.3	4101	1	272
Thatta	68.2	2788	1	190
Shaheed Benazir Abad	1.3	3265	0	4
N.feroze	1.4	2967	0	4
Sanghar	0.1	3065	0	0
Dadu	73.7	3737	1	275
Hyderabad	1.3	2910	1	4
Total	**507.3**	**3609**	**1**	**1831**

Baluchistan				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
Jaffarabad	85.4	3397	1	290.2
Nasir Abad	38.9	3407	1	132.4
Total	**124.3**	**3400**	**1**	**422.6**

Khyber Pakhtoonkhawah				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
Swat	0.3	2350	1	0.8
D.I.Khan	5.3	2588	1	13.7
Total	**5.5**	**2626**	**1**	**14.5**

Annexure 4

DAMAGE TO MILLET CROP				
Punjab				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
Bhakkar	3.8	1164	0.8	3.5
D.G.Khan	2.6	453	0.8	0.9
Gujranwala	0.2	781	0.0	0.0
Gujrat	20.1	439	0.0	0.0
Hafizabad	1.5	662	0.0	0.0
Jhelum	14.7	308	0.0	0.0
Jhang	13.0	963	0.4	5.0
Khanewal	0.5	826	0.0	0.0
Khushab	5.3	697	0.0	0.0
Layyah	11.3	778	0.8	7.0
M.B.Din	4.9	851	0.0	0.0
Mianwali	8.8	604	0.8	4.3
Multan	0.1	625	0.0	0.0
Muzaffargarh	10.5	1169	0.8	9.8
Rahim Yar Khan	0.1	1679	0.8	0.1
Rajanpur	2.3	1020	0.8	1.9
Sargodha	4.9	635	0.0	0.0
Sialkot	0.6	486	0.0	0.0
T.T.Singh	0.6	1187	0.0	0.0
Total	**105.8**	**622**	**0.5**	**32.6**

Sindh				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
Shaheed Benazir Abad	1.243	675	0.0	0.00
Hyderabad	0.113	250	0.8	0.02
Total	**1.356**	**250**	**0.8**	**0.02**

Khyber Pakhtoonkhawah				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
D.I.Khan	**0.9**	**415**	**0.8**	**0.3**

Annexure 5

DAMAGE TO SORGHUM CROP				
Punjab				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
Bhakkar	0.2	1164	0.8	0.2
D.G.Khan	3.3	453	0.8	1.2
Gujranwala	0.3	781	0.0	0.0
Gujrat	2.7	439	0.0	0.0
Hafizabad	0.3	662	0.0	0.0
Jhelum	1.7	308	0.0	0.0
Jhang	1.7	963	0.4	0.7
Khanewal	0.1	826	0.0	0.0
Khushab	7.9	697	0.0	0.0
Layyah	0.7	778	0.8	0.4
M.B.Din	7 .0	851	0.0	0.0
Mianwali	4 .0	604	0.8	1.9
Multan	0.3	625	0.0	0.0
Muzaffargarh	5.7	1169	0.8	5.3
Rahim Yar Khan	0.1	1679	0.8	0.2
Rajanpur	3.7	1020	0.8	3.0
Sargodha	1 .0	635	0.0	0.0
Sialkot	0.2	486	0.0	0.0
Total	**41.0**	**773**	**0.4**	**13.0**

Sindh				
Districts	**Area Damaged ('000' ha)**	**Yield Loss (kg/ha)**	**Damage Factor**	**Projected Production Loss (000 tons)**
Sukkur	5.8	455	0.8	2.1
Khairpur	1.7	488	0.8	0.7
Larkana	1.6	666	0.8	0.9
Jacobabad	0.9	727	0.8	0.5
Shaheed Benazir Abad	3.4	675	0.0	0.0
N.feroze	0.6	696	0.0	0.0
Dadu	3.7	852	1.0	3.2
Total	**17.7**	**413**	**0.8**	**7.3**

Annexure 6

DAMAGE TO FODDER CROPS				
Punjab				
Districts	Area Damaged ('000' ha)	Yield Loss (tons /ha)	Damage Factor	Projected Production Loss (million tons)
Bhakkar	7.6	12.8	0.8	0.08
Bahawalpur	0.1	18.3	0.0	0.00
D.G.Khan	7.3	16.4	0.8	0.10
Gujranwala	5.2	19.2	0.0	0.00
Gujrat	5.0	20.2	0.0	0.00
Hafizabad	3.2	22.0	0.0	0.00
Jhelum	2.8	13.7	0.0	0.00
Jhang	61.1	18.2	0.4	0.44
Khanewal	8.7	19.0	0.0	0.00
Khushab	18.5	12.8	0.0	0.00
Layyah	12.1	14.8	0.8	0.14
M.B.Din	14.0	21.0	0.0	0.00
Mianwali	5.8	10.6	0.8	0.05
Multan	9.7	19.4	0.0	0.00
Muzaffargarh	45.8	16.0	0.8	0.59
Rahim Yar Khan	4.6	16.1	0.8	0.06
Rajanpur	18.9	15.4	0.8	0.23
Sargodha	35.0	18.9	0.0	0.00
Sialkot	6.2	16.7	0.0	0.00
T.T.Singh	11.6	18.5	0.0	0.00
Total	**283.2**	**17.0**	**0.6**	**1.69**

Sindh				
Districts	Area Damaged ('000' ha)	Yield Loss (tons /ha)	Damage Factor	Projected Production Loss (million tons)
Ghotki	8.9	28.8	0.5	0.13
Sukkur	10.7	32	0.5	0.17
Khairpur	7.5	21	0.5	0.08
Shikarpur	4.4	32	0.8	0.11
Larkana	22.9	27	0.8	0.49
Jacobabad	2.7	24	0.8	0.05
Thatta	9.5	24	0.8	0.18
Shaheed Benazir Abad	6.7	43	0.0	0.00
N.feroze	3.5	38	0.0	0.00
Sanghar	0.1	28	0.0	0.00
Dadu	18.4	25	1.0	0.46
Hyderabad	2.2	24	0.6	0.03
Total	**97.5**	**29**	**0.74**	**1.71**

Baluchistan				
Districts	Area Damaged ('000' ha)	Yield Loss (tons /ha)	Damage Factor	Projected Production Loss (million tons)
Jaffarabad	4.74	28.9	0.8	0.11
Nasirabad	3.08	26.9	0.8	0.07
Total	**7.83**	**28.1**	**0.8**	**0.18**

Khyber Pakhtoonkhawah				
Districts	Area Damaged ('000' ha)	Yield Loss (tons /ha)	Damage Factor	Projected Production Loss (million tons)
Swat	1.99	14.5	0.8	0.02
Charsada	0.46	29.1	0.0	0.00
D.I.Khan	11.43	25.3	0.8	0.23
Nowshera	1.64	24.9	0.0	0.00
Laki Marwat	4.65	29.4	0.0	0.00
Total	**20.17**	**25.3**	**0.8**	**0.25**