UTILIZATION OF SPACE BASED INFORMATION FOR DISASTER MONITORING IN PAKISTAN

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SUPARCO, PAKISTAN

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Sequence of Presentation

1. Introduction
2. Disaster Monitoring & Mapping
   - Earthquake 2013
   - Floods 2013
   - Monsoon Contingency Planning
3. International Collaborative Work
4. Space education & Awareness
5. Conclusion
6. Recommendation

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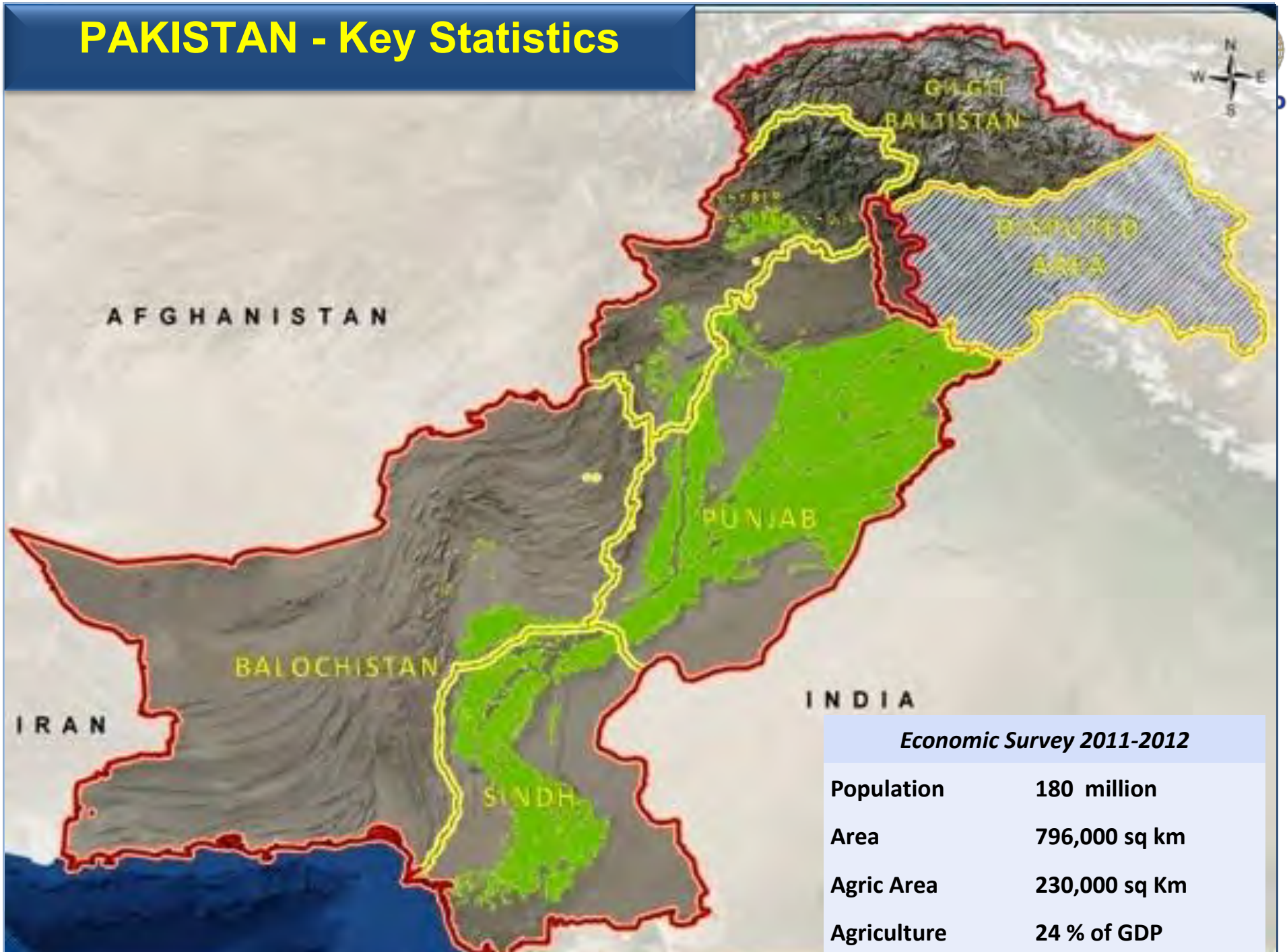
Introduction

PAKISTAN - Key Statistics



Economic Survey 2011-2012	
Population	**180 million**
Area	**796,000 sq km**
Agric Area	**230,000 sq Km**
Agriculture	**24 % of GDP**

Pakistan Space & Upper Atmosphere Research Commission (SUPARCO)

SUPARCO

- Pursue R&D activities in space science, space technology and allied fields for achieving the objective of self-reliance
- Advise the government in all space related matters
- Liaise with national & international agencies

Satellite Ground Station

SUPARCO

Atmosphere Data Processing & Receiving Centre (ADPRC) Karachi

Satellite Ground Station (SGS) Islamabad

Acquisition Zone

Satellite Aided Search and Rescue Program (COSPAS-SARSAT)

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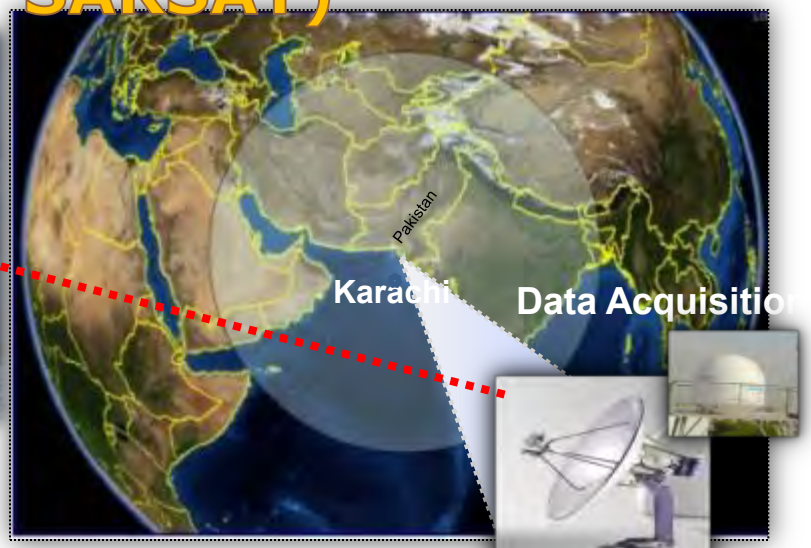
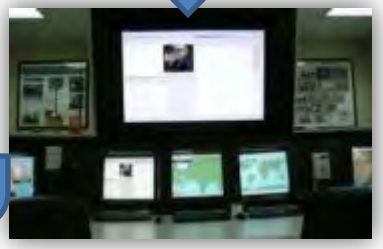


Data Reception

Ground Receiving Station



Data Processing

Data Product

Rescue Coordinate Centers

Data Distribution

Search & Rescue

- Constellation of Russian, US, French and Canadian Geo-stationary & LEO Satellites
- Receives Distress Signals from Aircrafts, Vessels, Personnel
- 121.5 MHz, 243 MHz and 406 MHz Beacons

1st October 2010 ELT Alert of UN Helicopter Crashed Near Dadu Sindh

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Location of incident

UN Helicopter (26° 32' N 067° 36' E)

Date: 1st October 2010

Location: Dadu, Sindh

No. of persons rescued: 12

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Disaster Monitoring and Mitigation

Natural Disasters

The Rising Costs For Mankind

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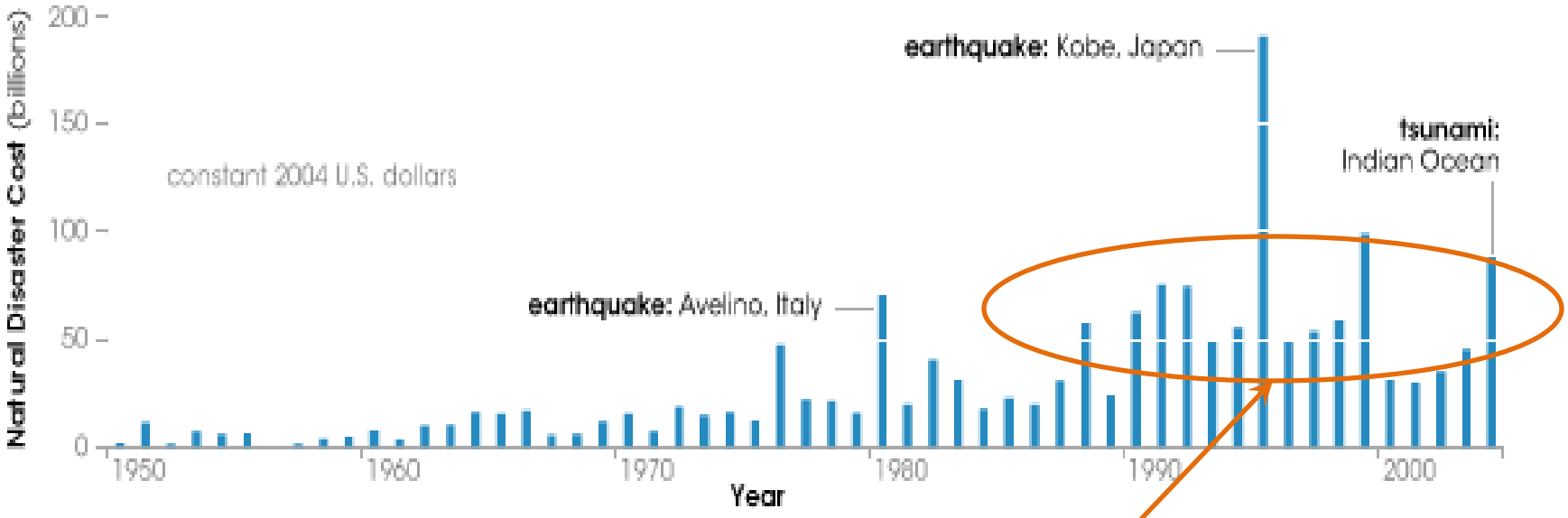

Graph by **Robert Simmon**, based on data (Upto **2005**) courtesy EM-DAT: The OFDA/CRED International Disaster Database (www.em-dat.net) Université Catholique de Louvain—Brussels, Belgium

Average Cost is beyond 50 Billion USD

Advanced Technologies like Remote Sensing could help in lowering these costs

Natural Disasters

events In Pakistan

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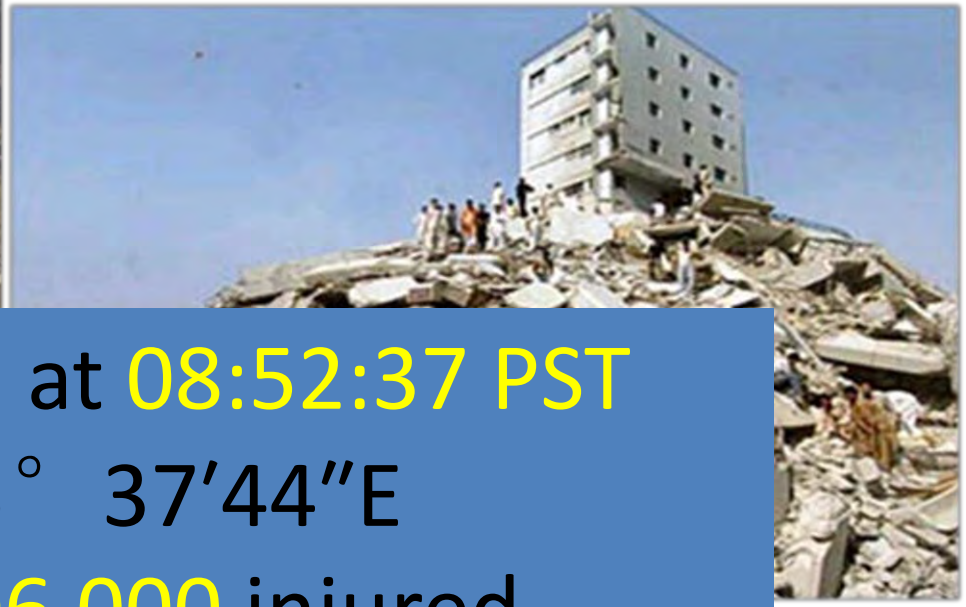
- Earthquake 2005
- Hunza Landslide - 2010
- Floods/Rains 2010,2011,2012 & 2013
- Avalanche 2012
- Earthquake 2013

Natural Disasters

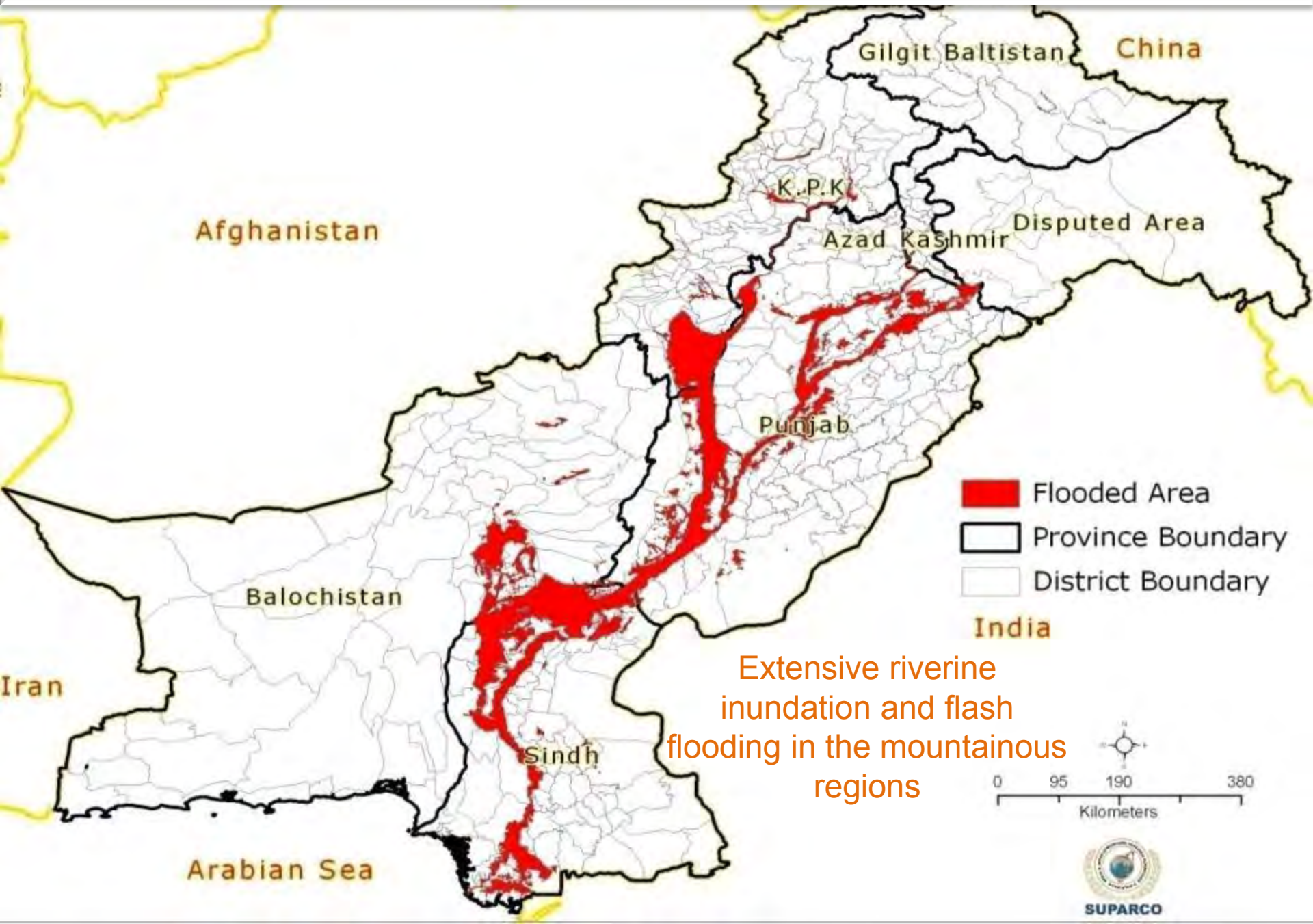
EARTHQUAKE/LANDSLIDES (2005)

SUPARCO



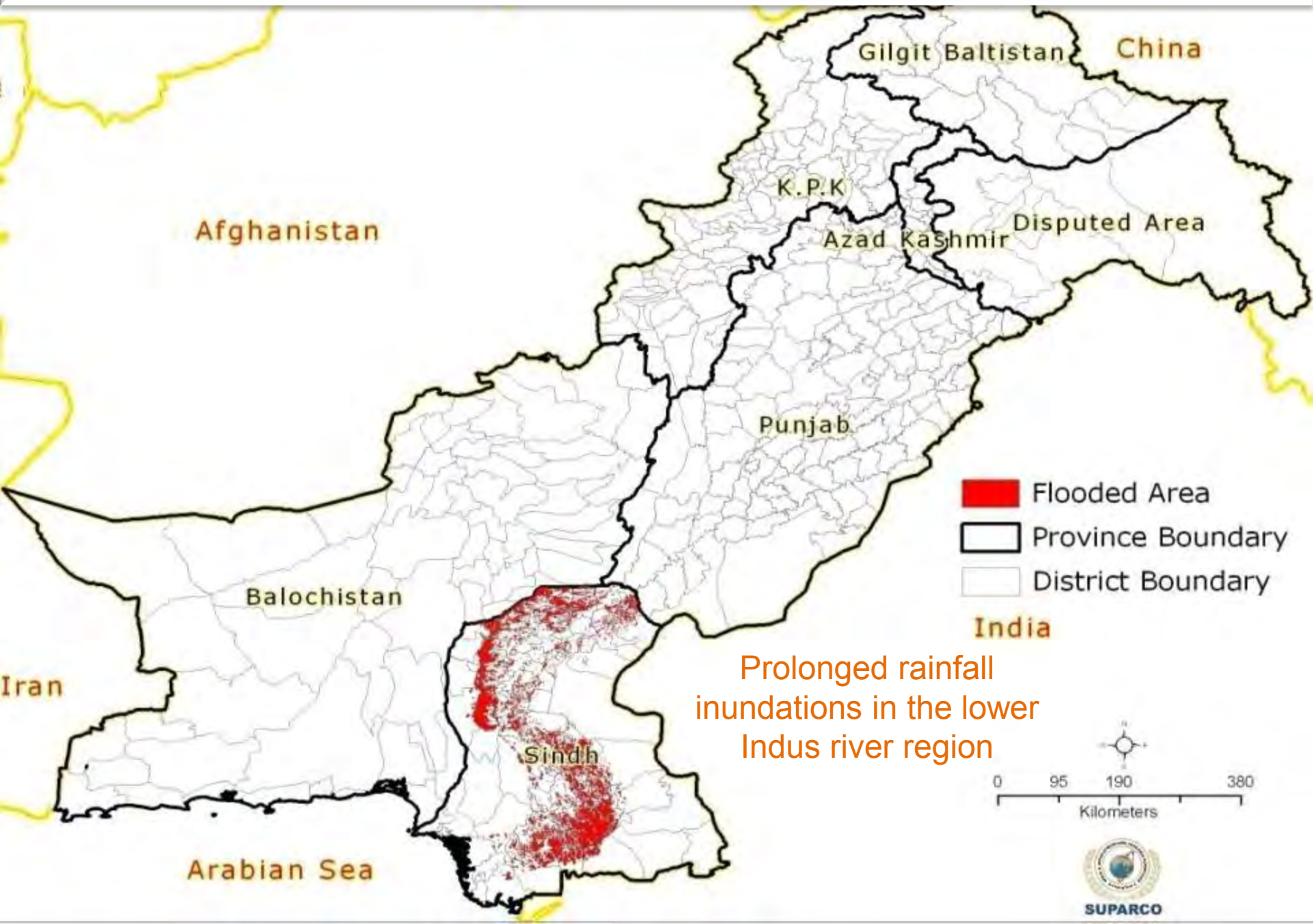
- October 8, 2005 at 08:52:37 PST
- 34° 29′35″N 73° 37′44″E
- 79,000 dead, 106,000 injured
- 17th deadliest earthquake of all time

Maximum Flood Extent – 2010

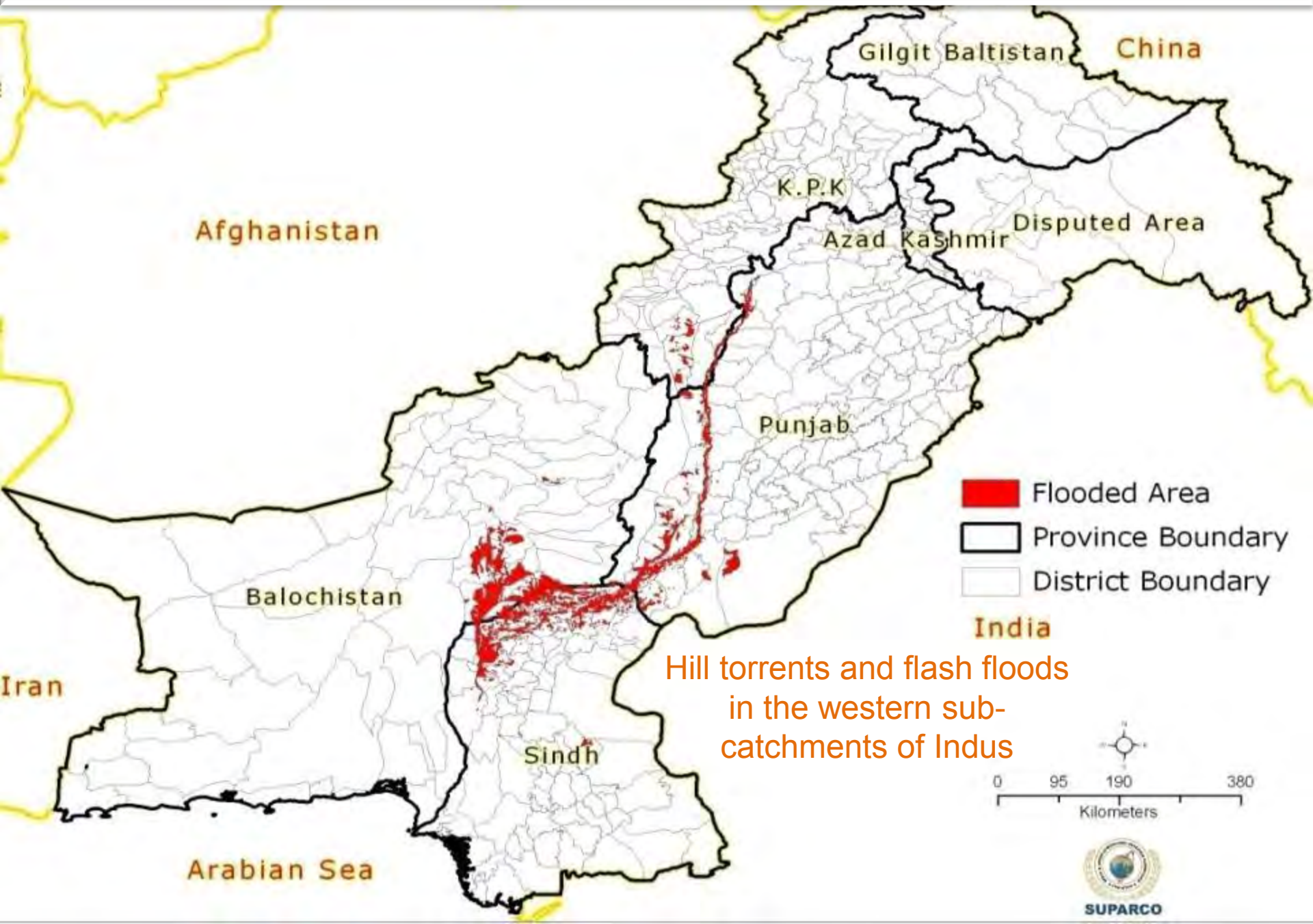


Extensive riverine inundation and flash flooding in the mountainous regions

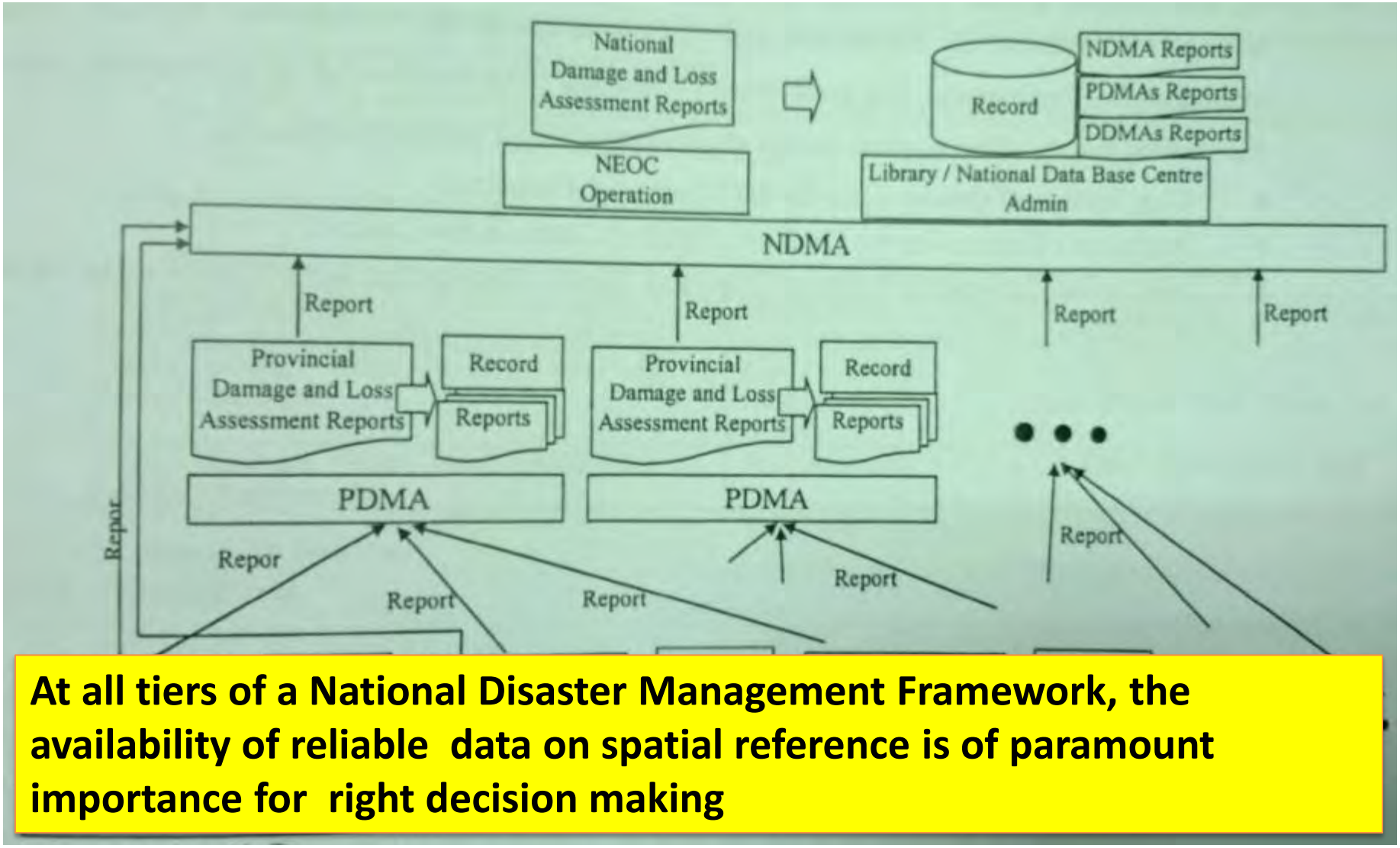
Maximum Flood Extent – 2011



Maximum Flood Extent – 2012



Disaster Management Frame work



At all tiers of a National Disaster Management Framework, the availability of reliable data on spatial reference is of paramount importance for right decision making

SUPARCO Role in Disaster Management

SUPARCO ‘s assistance includes:

- Rapid Regional coverage of disaster events
- Extent of disaster + imminent damages
- Estimation of losses to crops and infrastructure
- Suggest floods water flow directions/mapping
- Monitoring of breaches in embankments/bunds
- Monitoring recession of water
- Monitoring rehabilitation process
- Flythrough/3D model etc to ascertain level of damage
- Emergency Communication service through PAKSAT-1R
- Climate change impact assessment-Monitoring depletion of glaciers/snow melt

Work in Two Phases

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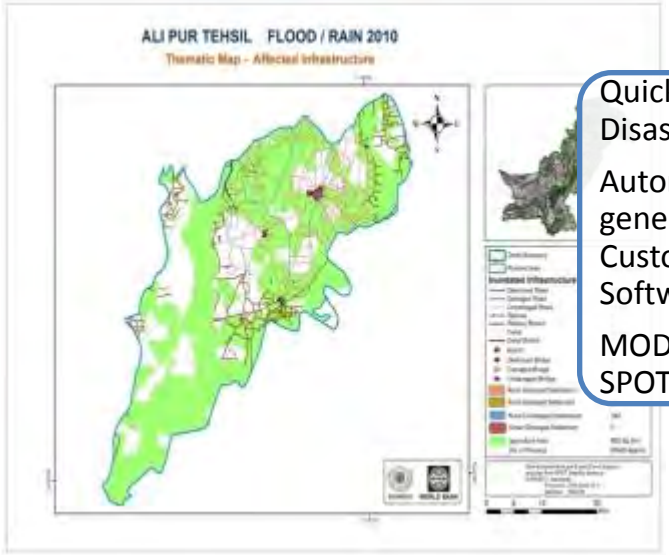
Work Process At SUPARCO

Rapid Mapping



Quick Response to Disaster

Automatic map generation through Custom Developed Software

MODIS, SPOT 4, SPOT 5, Vector data

Detailed Assessment

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
BOLAN	8646	3034			↑ 100%	↓ 19%		↓ 60%	
JAFARABAD	2487	1926			↑ 73%	↓ 58%	↑ 42%	↑	
NASIRABAD	3222	1264			↑ 85%	↑ 58%	↓ 15%	↑	
JHAL MAGSI	3859	929			↑ 60%	↑ 14%	↑ 8%	↓	
LORALAI	9955	186			↑ 100%	↓ 100%			
SIBI	4969	250			↑ 100%	↓ 100%			
DERA BUGTI	10286	229			↑ 99%		↑ 1%		
QILLA SAIFULLAH	13446	229			↑ 100%	↓ 100%			
D. I. KHAN	9468	8014	↑ 66%	↓ 43%	↑ 69%	↓ 44%	↑ 2%	↓	
TANK	3167	1108	↑ 58%	↓ 15%	↑ 42%	↓ 28%	↓ 5%	↓	
LAKKI MARWAT	3126	916		↑ 100%	↓ 100%				
NOWSHERA	1806	287	↑ 78%	↑ 22%			↓ 82%	↓	
SWABI	1474	241	↑ 75%	↑ 25%		↓ 97%		↓	
HARIPUR	2113	220		↑ 100%		↓ 100%			
CHARSADDA	1091	215	↑ 57%	↑ 43%	↓ 100%				
LOWER DIR	1697	149		↑ 100%	↓ 100%				
KOHAT	3495	147	↑ 78%			↓ 47%	↑ 22%	↓ 9%	↓ 100%
MUZAFFARGARH	8412	4783	↑ 16%	↑ 11%	↑ 64%	↓ 31%	↑ 9%		↓ 15%
RAJANPUR	12372	3772	↑ 10%	↓ 3%	↑ 83%	↓ 32%	↑ 9%	↓ 7%	↓ 1%
JHANG	6189	3003	↑ 25%	↑ 31%	↑ 49%	↓ 54%	↓ 5%		↓ 5%

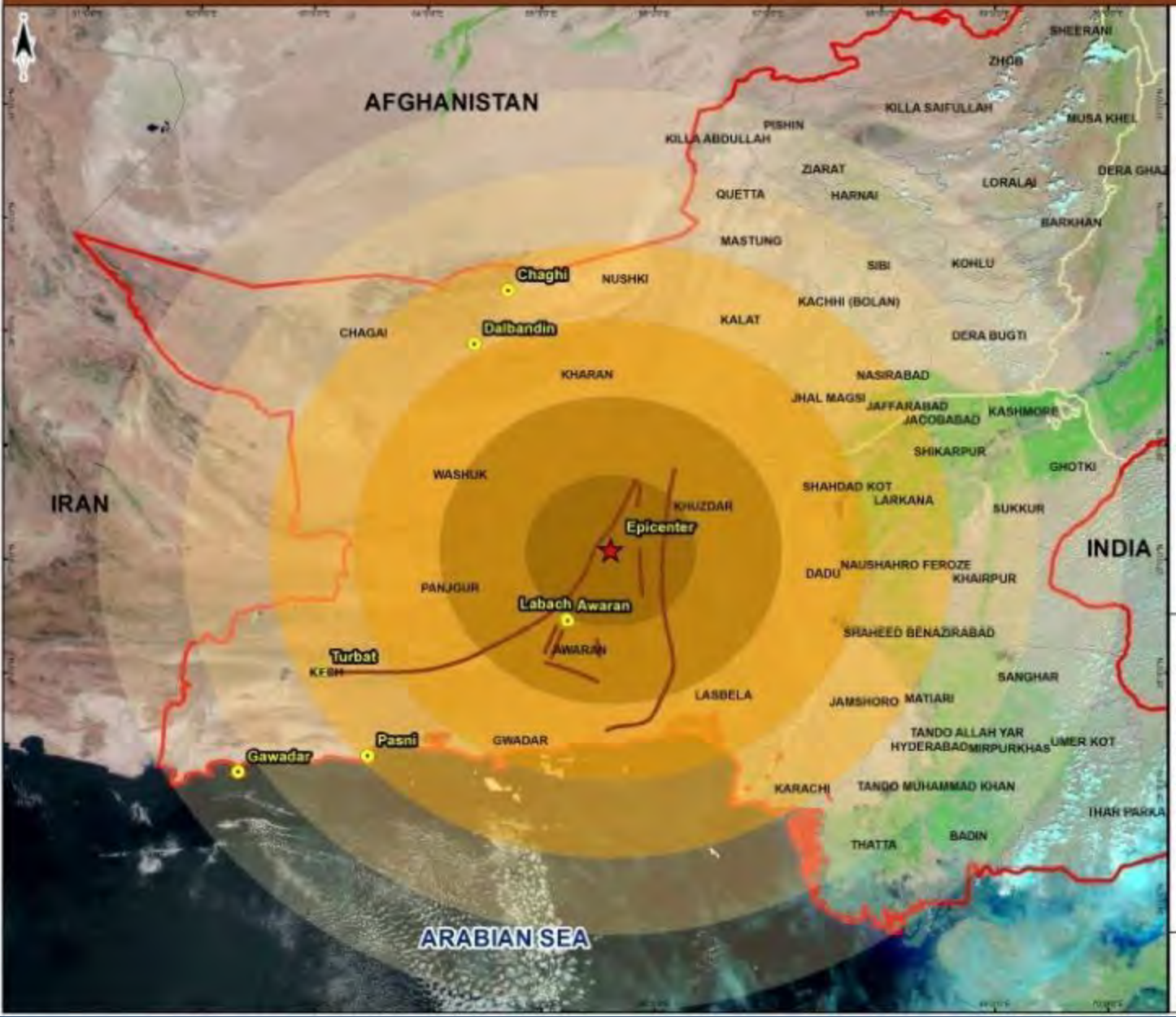
Ground surveys

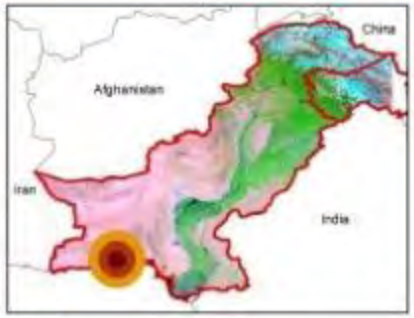
Damage Analysis for Infrastructure, Agriculture, Household etc.

Detailed Reports

Earthquake 2013

PAKISTAN EARTHQUAKE, SEPTEMBER 24, 2013





Legend

- Epicentre
- Major City
- Active Fault Line
- International Boundary
- District Boundary

Distance from Epicenter (in km)

- 0-75
- 76-150
- 151-225
- 226-300
- 301-375
- 376-450

This is a rapid map based on pre-earthquake MODIS imagery of Sept 23, 2013. There are several active fault lines near the epicenter located in District Awaran (Balochistan). Magnitude of the earthquake was 7.7 while the depth was 10 Km. This map is created on September 24, 2013 at SUPARCO.

SUPARCO is host to the UN-SPIDER Regional Support Office (RSO) in Pakistan

Data Sources: PMD, GSP
Projection & Datum: WGS 84

1:3,750,000

0 25 50 100 150 200

Kilometers

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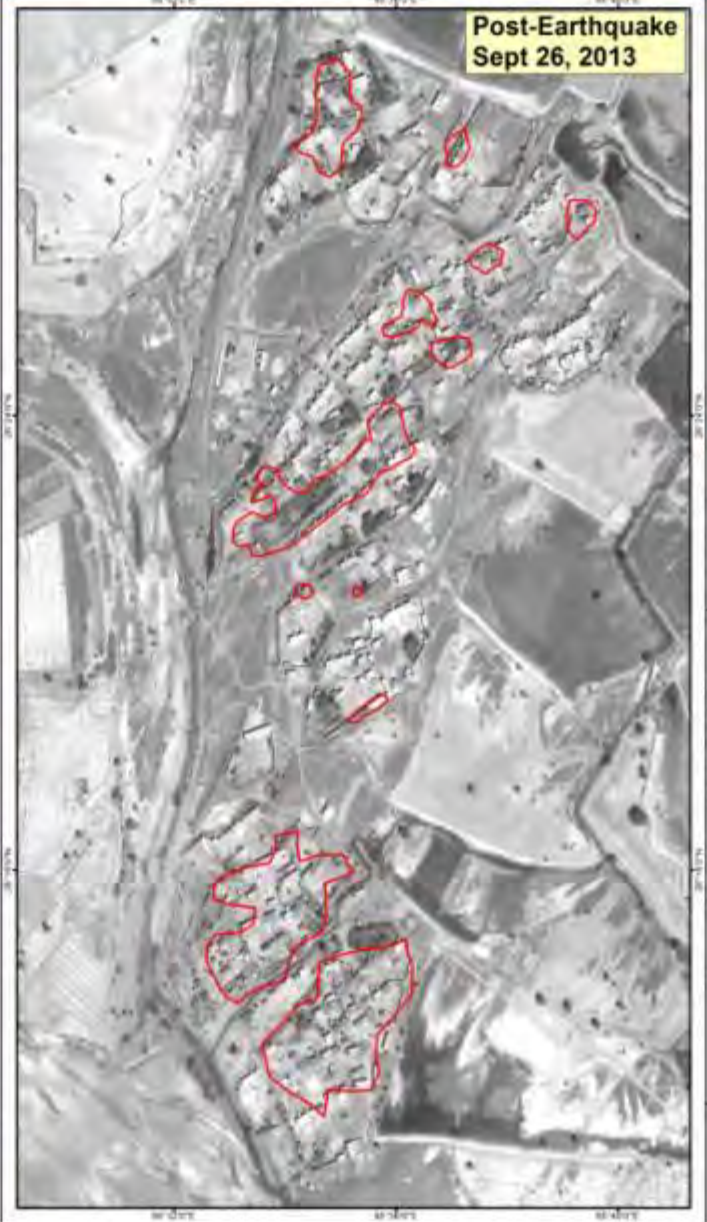
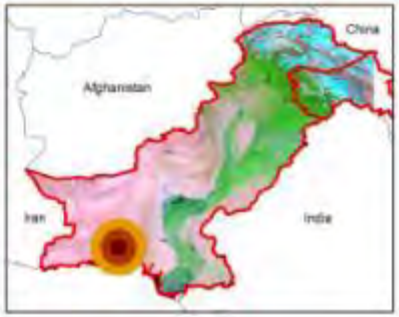
PAKISTAN EARTHQUAKE, SEPTEMBER 24, 2013

LABACH CITY, BALOCHISTAN - AFFECTED INFRASTRUCTURE





Legend

Damaged Structures

Total building structures: 1500 (approx.)

Damaged building structures: 80 (approx.)

This map presents the preliminary analysis of earthquake affected area of Labach City, District Awaran (Balochistan). This analysis is based on 0.5 m resolution imagery collected by PLEIADES satellite on September 26, 2013. This analysis has yet to be validated in the field.

This map has been produced at SUPARCO on September 26, 2013.

Projection & Datum: WGS 84

0 1 2 4 6 8 10

Kilometers

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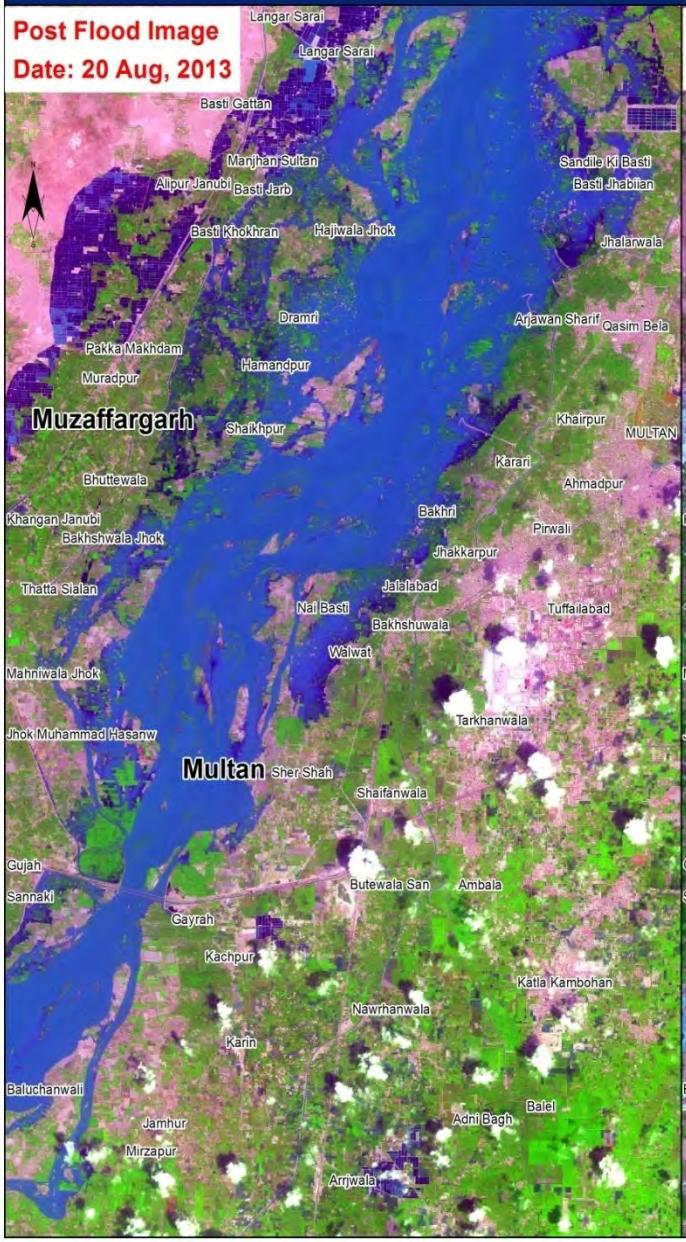
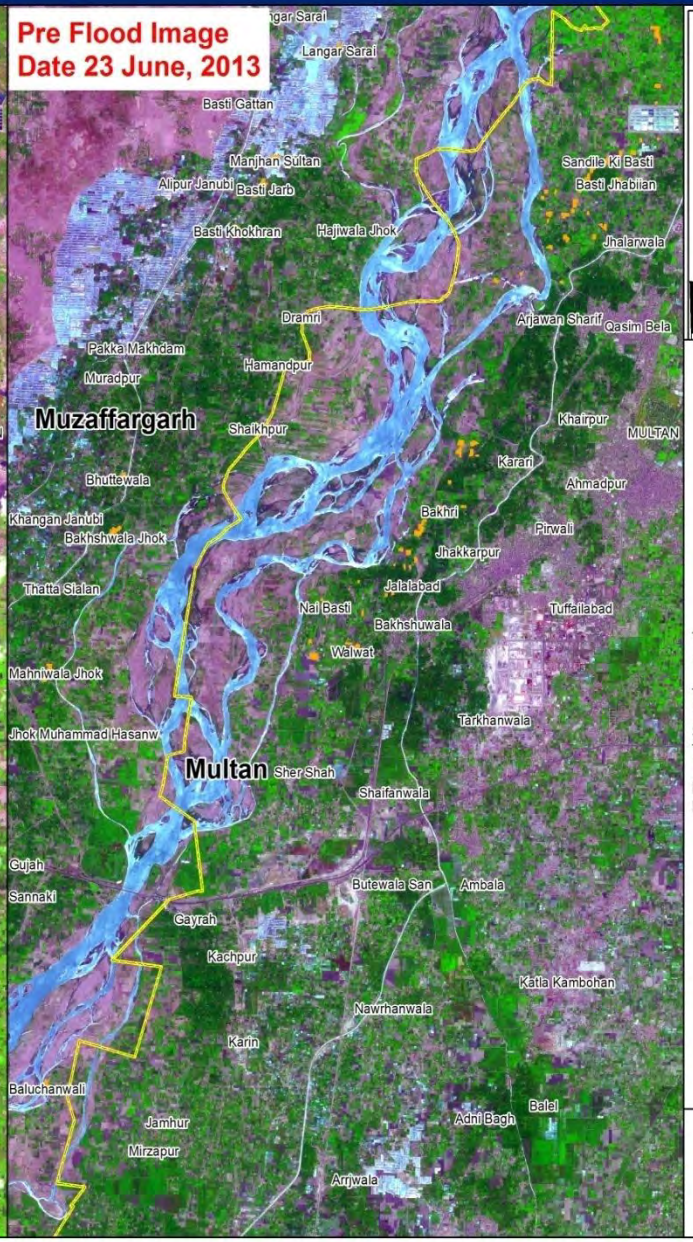
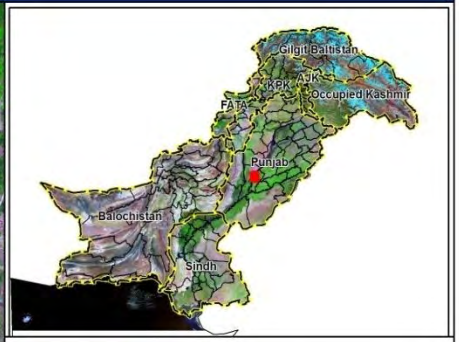
Floods 2013

EXTENT OF RIVER CHENAB AS ON AUGUST 20,2013







District Boundary

Affected Settlement 89

Rice Fields in Pre Flood Images

Inundated Area

This map shows extent of River Chenab on August 20, 2013 as compared to June 23, 2013

This analysis is based on pre & post disaster satellite imagery collected by SPOT sensors at Satellite Ground Station,SUPARCO Islamabad. This analysis has yet to be validated in the field.

Projection: UTM Zone 42 N
Datum: WGS84

SUPARCO is host to UN-SPIDER Regional Support Office in Pakistan

0 1.5 3 6
Km

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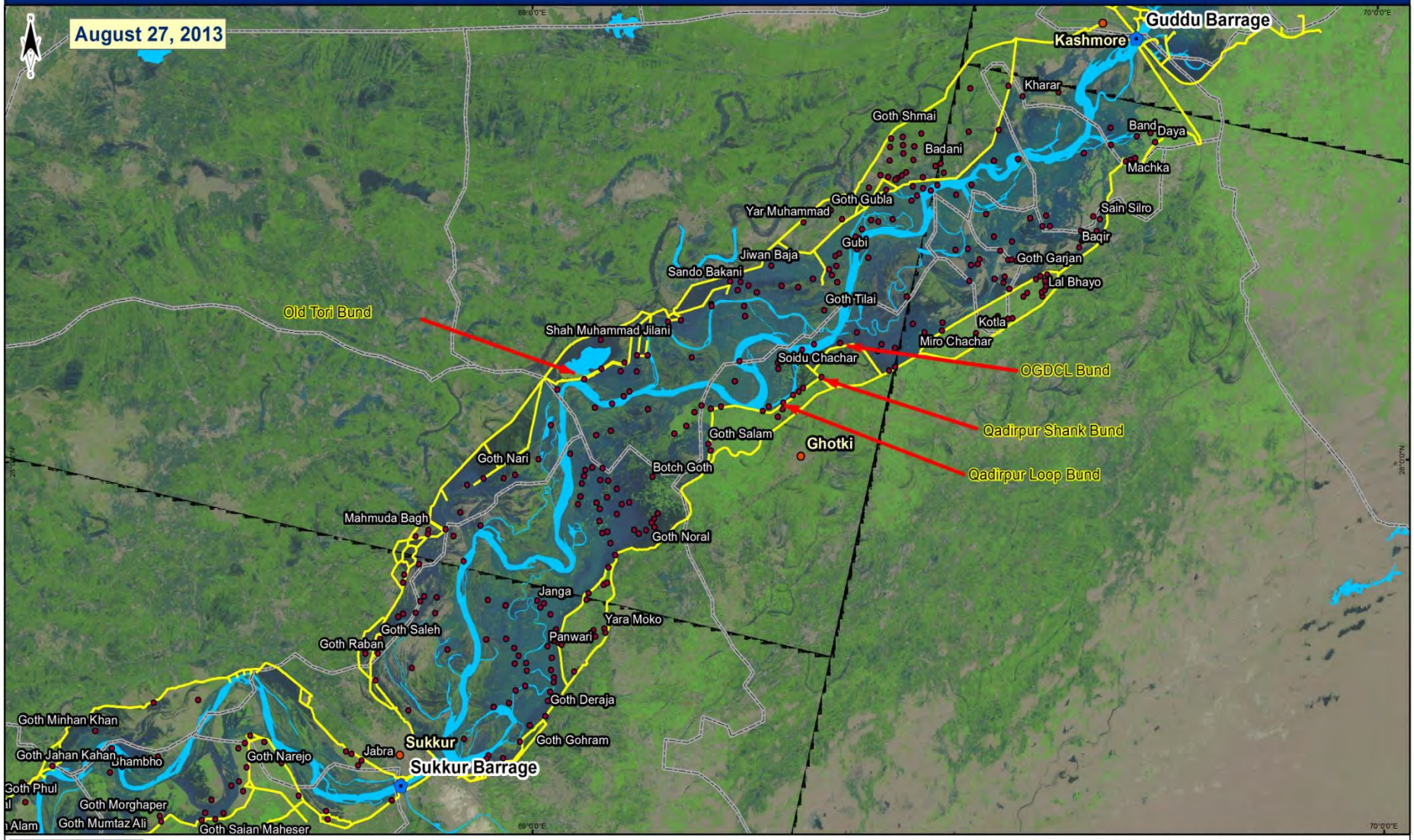
GUDDU BARRAGE - SINDH: PRE AND POST MONSOON COMPARISON



Legend

- Major Cities
- Setts. in Indus plain
- Barrage
- R. Indus (norm. course)
- Bunds
- International Boundary
- District Boundary

1:400,000

0 5 10 15 20

Kilometers

This map shows the pre and post monsoon behaviour of River Indus between Guddu and Sukkur Barrages. The settlements in the Indus plain which are highly prone to flooding are indicated. Widening past the normal course of River Indus could be seen. Important bunds are highlighted with red arrows. This analysis is based on Landsat 8 data of 20th and 27th August, 2013. The map is produced on August 28, 2013.

Projection: UTM Zone 42 N Datum: WGS 84

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OVERVIEW OF FLOOD WATERS IN SHIKARPUR & SUKKUR DISTRICT, SINDH PROVINCE, PAKISTAN

Analysis with Radarsat-2 Data Acquired 26 August 2013 & TerraSAR-X Data Acquired 27 March 2010

This map illustrates satellite-detected areas of standing flood waters over Shikarpur, Sukkur and Khaipur Districts in Sindh Province, Pakistan using Radarsat-2 data acquired 26 August 2013. It is likely that flood waters have been systematically underestimated along highly vegetated areas along main river banks, and within built-up urban areas because of the special characteristics of the satellite data used. This analysis has not yet been validated in the field. Please send ground feedback to UNITAR/UNOSAT.

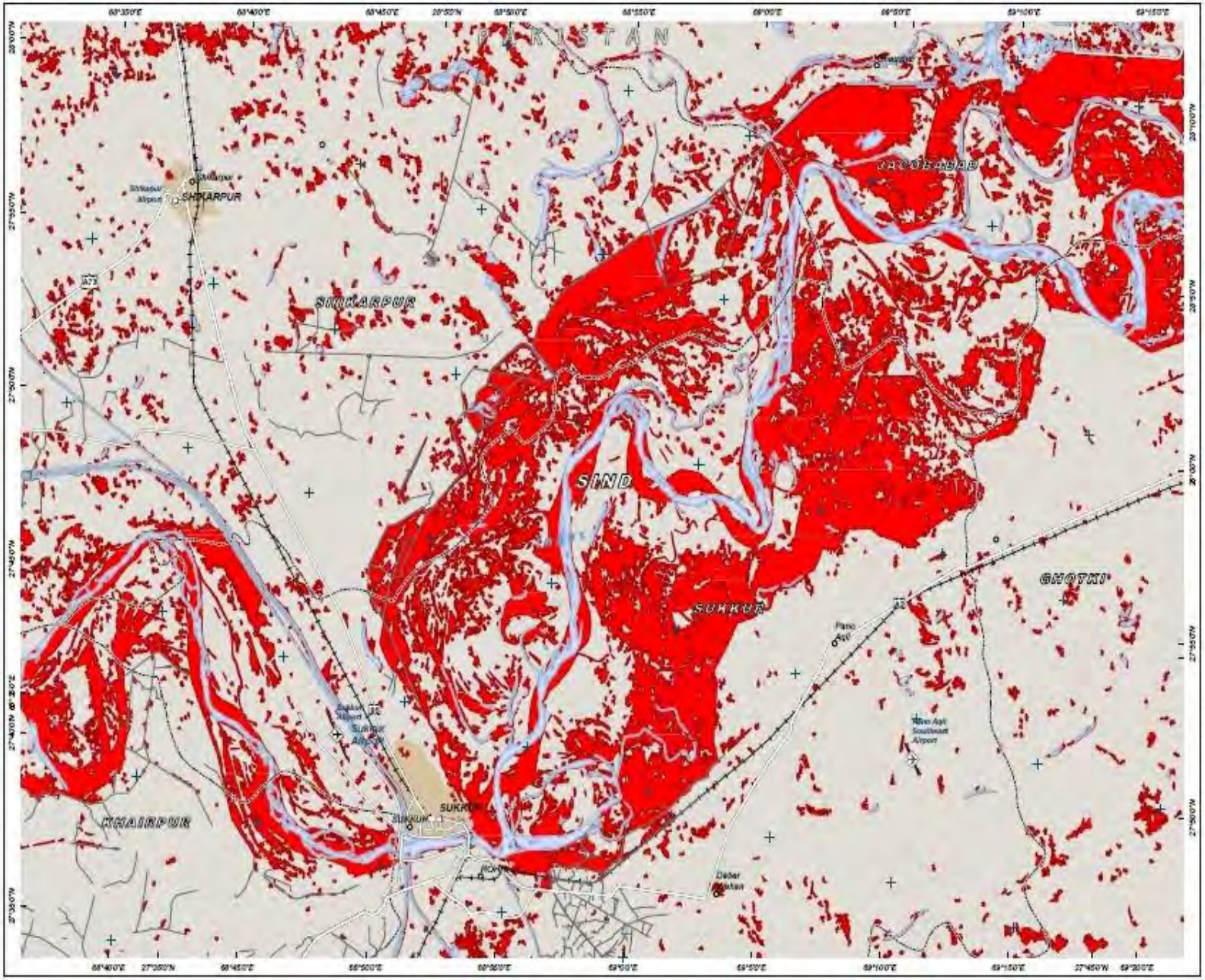
Disaster coverage by the International Charter 'Space and Major Disasters'. For more information on the Charter, which is about assisting the disaster relief organizations with multi-satellite data and information, visit: www.disastercharter.org

Flood

Production Date: 27/08/2013

Version 1.0

Activation Number: FL20130820PAK



LEGEND

- City
- Town
- Dam Site
- Main Airport
- Runway / Airfield
- Urban Area
- Primary Rd
- Secondary Rd
- Railroad
- International Border
- District Border

FLOOD WATER EXTENT ANALYSIS

(Satellite-Based Classification)

- Probable Standing Flood Waters: Radarsat-2: 26 August 2013
- Pre-Crisis Water Extent: TerraSAR-X: 27 March 2010

Map Scale for A3: 1:208,300

0 3.75 7.5 15 22.5 30 37.5 Km

Satellite Data (Post-Crisis): Radarsat-2
Imagery Dates: 26 August 2013
Resolution 12 m
Copyright: MDA
Source: Canadian Space Agency
Satellite Data (Pre-Crisis): TerraSAR-X
Copyright : TerraSAR-X Aerospace Center (DLR), 2013
Astrium Services/Infoterra GmbH
Source: DLR
Road Data : OSM / ESRI
Other Data: USGS, UMCS, NASA, NGA
Analysis : UNITAR / UNOSAT
Production: UNITAR / UNOSAT
Analysis conducted with ArcGIS v10.1

Coordinate System: World Robinson
Projection: Robinson
Datum: WGS 1984
Units: Meter

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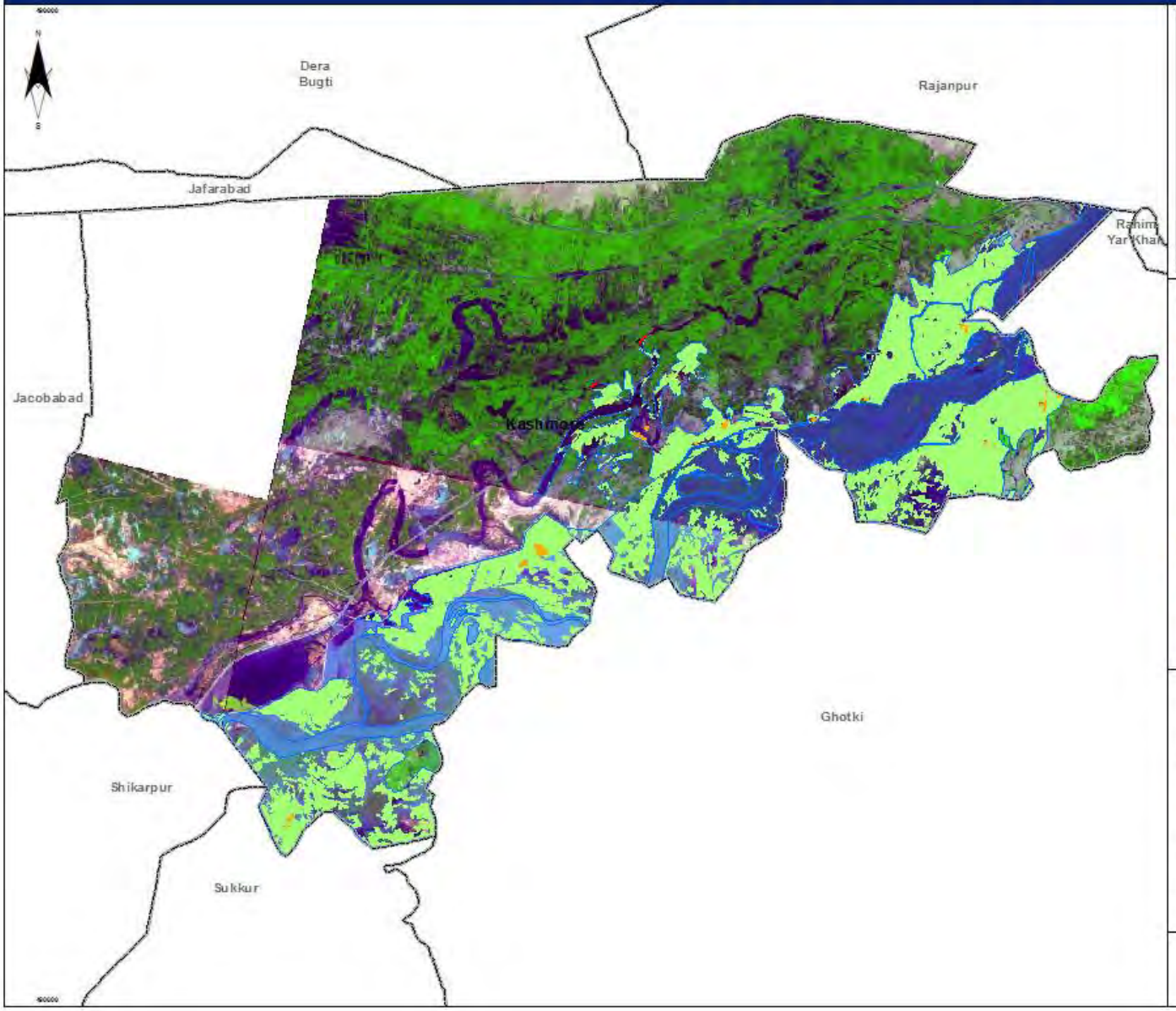
www.unitar.org/unosat

KASHMORE DISTRICT FLOOD/RAIN 2013

Thematic Map - Affected Infrastructure



District Boundary

Flooded Area 623 Sq Km

Inundated Infrastructure

National Highway	1	Km
Provincial/District Road	5.4	Km
Kacha/Paka Road	234.6	Km
Railway	1.5	Km
Bridge	0	
Settlement	48	
Agriculture Area	362	Sq Km

This map presents preliminary analysis of flood affected areas.
This analysis is based on post-disaster satellite imagery collected by SPOT sensors on 20-08-13 at Satellite Ground Station, SUPARCO Islamabad.
This analysis has yet to be validated in the field.

SUPARCO is host to UN-SPIDER Regional Support Office in Pakistan

Projection: UTM Zone 42 N
Datum: WGS84

0 5 10 20
Km

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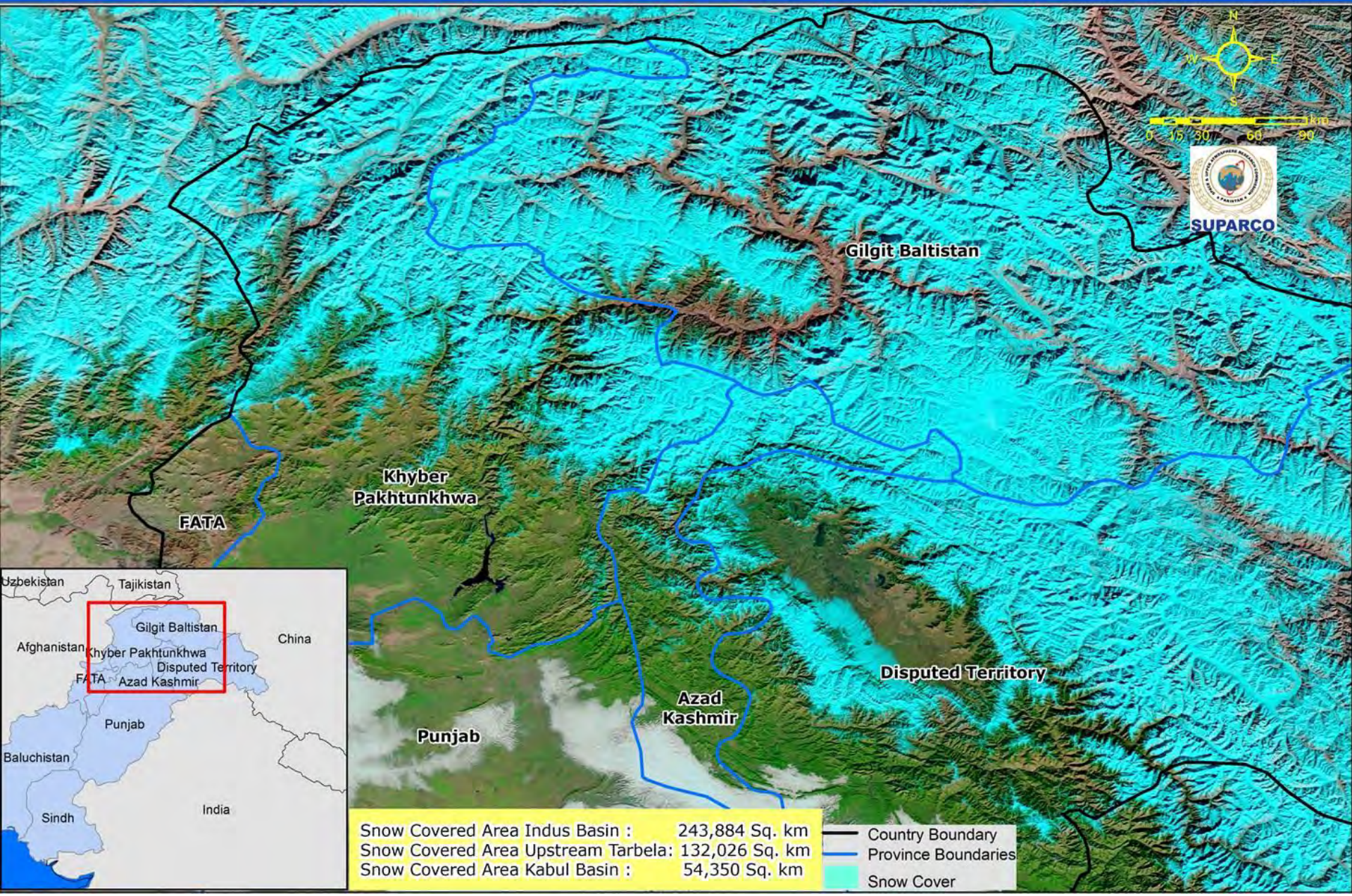
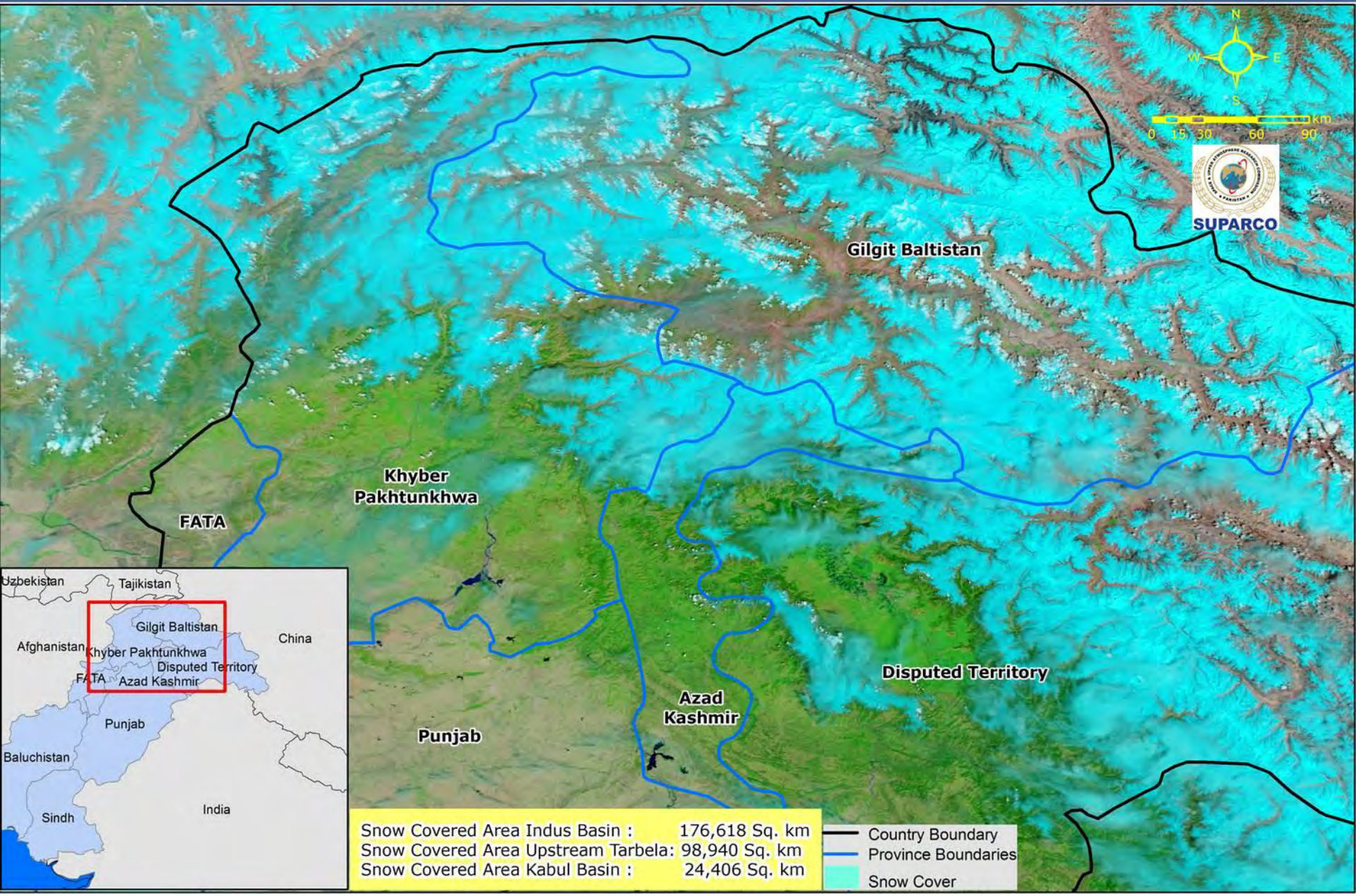
Contingency planning


Estimation of Snow Cover
During 2008-2013
(Entire Indus Basin)
(http://www.suparco.gov.pk/pages/pak-scms.asp)
3D-FLYTHROUGH

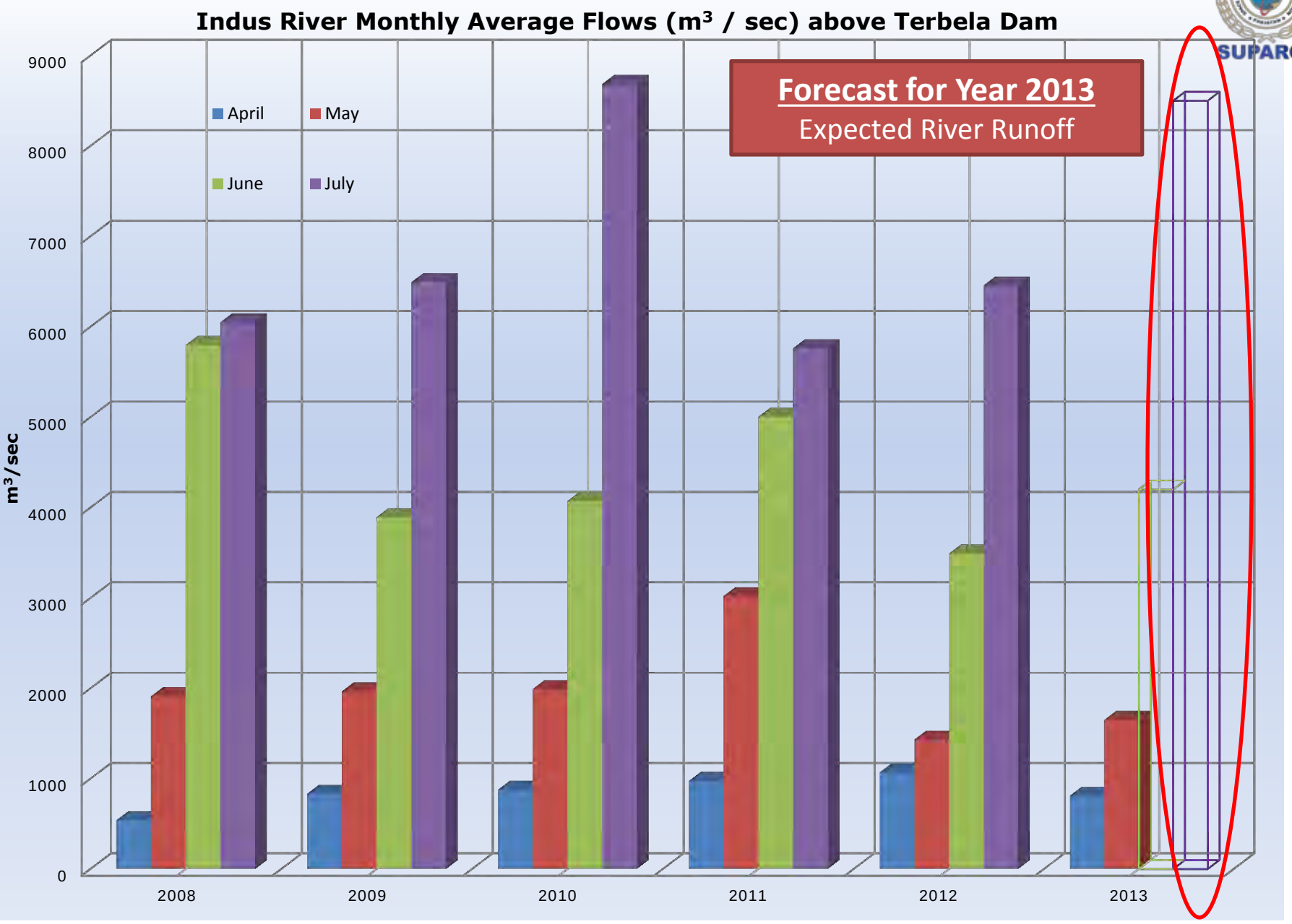
Snow Cover Extent - 02 January 2013



Snow Cover Extent - 10 May 2013



River FLow


Indus River Monthly Average Flows (m³ / sec) above Terbela Dam
Forecast for Year 2013
Expected River Runoff
April
May
June
July
m³/sec
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
2008
2009
2010
2011
2012
2013

Conclusion of Study

- ✓ Snow Cover in 2013 is higher as compared to rest of the years and it is expected that snowmelt will be higher as compared to previous years (2008-2012).
- ✓ Results show increasing trend in snow cover from 2008 to 2013
- ✓ Higher temperatures will result higher flows in rivers as compared to previous years.

Improvements to the Climate change monitoring concept can be achieved through:

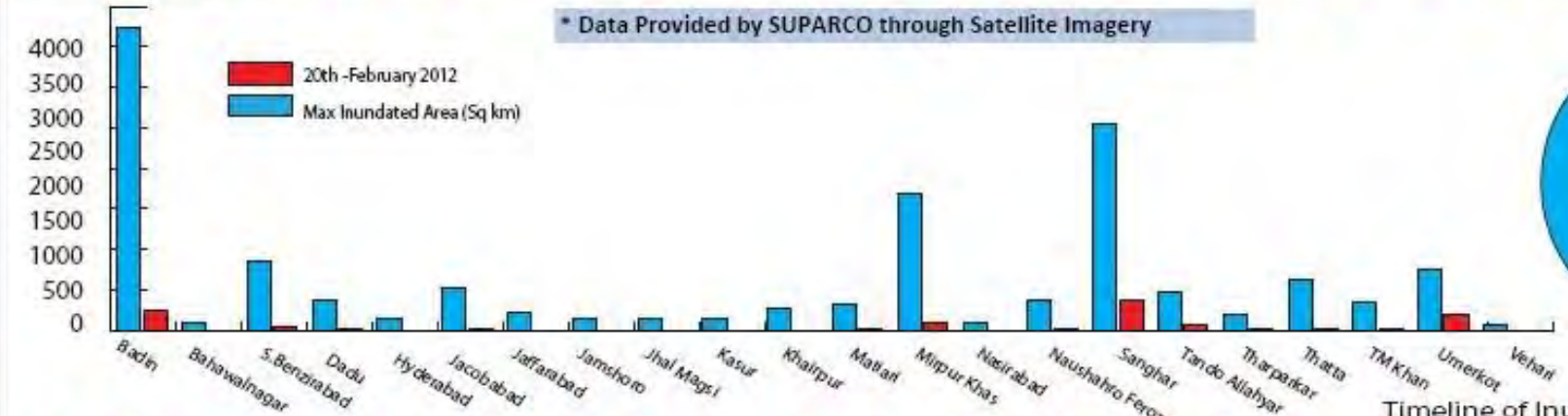
Inventorying glacial databases

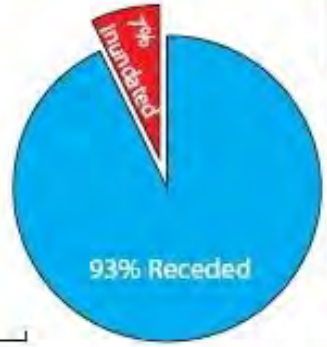
Temporal monitoring snow/glacial melt using Earth Observation satellites

Inundate Area (Sq Km)

District	Max Inundated	28-Sep-11	1-Oct-11	3-Oct-11	8-Oct-11	13-Oct-11	18-Oct-11	25-Oct-11	30-Oct-11	4-Nov-11	11-Nov-11	16-Nov-11	21-Nov-11	27-Nov-11	11-Dec-11	25-Dec-11	1-Jan-12	10-Jan-12	20-Jan-12	30-Jan-12	10-Feb-12	20-Feb-12
Badin	3751	3687	3644	3632	2645	2359	1930	1767	1592	1425	1401	1208	1145	968	783	573	483	393	332	302	265	235
Bahawalnager	81	81	70	62	38	23	14	11	5	1	1	1	1	1	0	0	0	0	0	0	0	0
Benazirabad	850	827	806	797	417	288	256	232	163	150	142	128	123	118	97	82	81	73	67	62	40	35
Dadu	360	360	289	279	186	175	140	107	98	87	86	75	71	55	60	55	53	31	28	28	15	12
Hyderabad	151	151	137	137	34	22	22	22	20	19	18	14	13	13	12	8	7	7	6	5	4	2
Jacobabad	517	517	492	490	235	169	114	103	95	77	74	63	55	55	39	30	28	23	21	18	16	14
Jafarabad	211	211	190	185	124	80	64	41	19	13	11	8	6	5	1	0	0	0	0	0	0	0
Jamshoro	154	154	110	101	68	54	33	29	21	20	20	18	17	16	15	10	8	5	4	3	0	0
Jhal Magsi	146	146	135	130	88	59	47	31	13	9	7	4	3	3	2	0	0	0	0	0	0	0
Kasur	138	138	133	122	55	42	29	17	6	4	1	1	1	1	0	0	0	0	0	0	0	0
Khairpur	268	268	260	258	29	18	17	16	14	13	12	9	8	7	6	4	3	0	0	0	0	0
Matiari	325	325	315	314	116	79	75	71	57	45	44	40	35	32	30	22	20	17	14	12	10	7
Mirpurkhas	1694	1685	1674	1668	1288	1079	867	785	670	641	602	520	460	397	278	209	200	172	139	123	101	95
Nasirabad	79	79	75	68	41	28	21	15	8	5	4	2	1	1	0	0	0	0	0	0	0	0
Naushahro Ferzoe	376	376	365	362	110	69	50	47	37	31	30	27	26	25	24	20	19	16	15	13	11	7
Sanghar	2554	2550	2450	2442	2081	1726	1543	1458	1254	1223	1170	1076	987	925	771	672	648	534	465	456	401	360
Tando Allahyar	462	450	448	446	264	234	223	219	201	198	196	178	167	165	141	112	108	96	85	82	57	57
Tharparkar	197	197	202	201	126	178	157	145	120	109	105	97	85	79	60	23	19	14	10	7	5	3
Thatta	621	650	606	606	393	275	214	206	136	120	115	102	84	78	65	45	43	38	35	32	27	24
TM Khan	346	340	336	333	179	131	96	84	81	75	68	61	58	57	55	34	27	23	20	16	14	12
Umerkot	754	790	784	784	674	637	566	561	491	468	455	430	421	415	347	297	294	274	245	233	209	198
Vehari	56	56	49	44	23	14	8	4	3	1	1	0	0	0	0	0	0	0	0	0	0	0
Total	14091	14008	13570	13461	9214	7739	6486	5971	5106	4734	4565	4062	3771	3426	2786	2196	2041	1716	1486	1398	1185	1062

* Data Provided by SUPARCO through Satellite Imagery





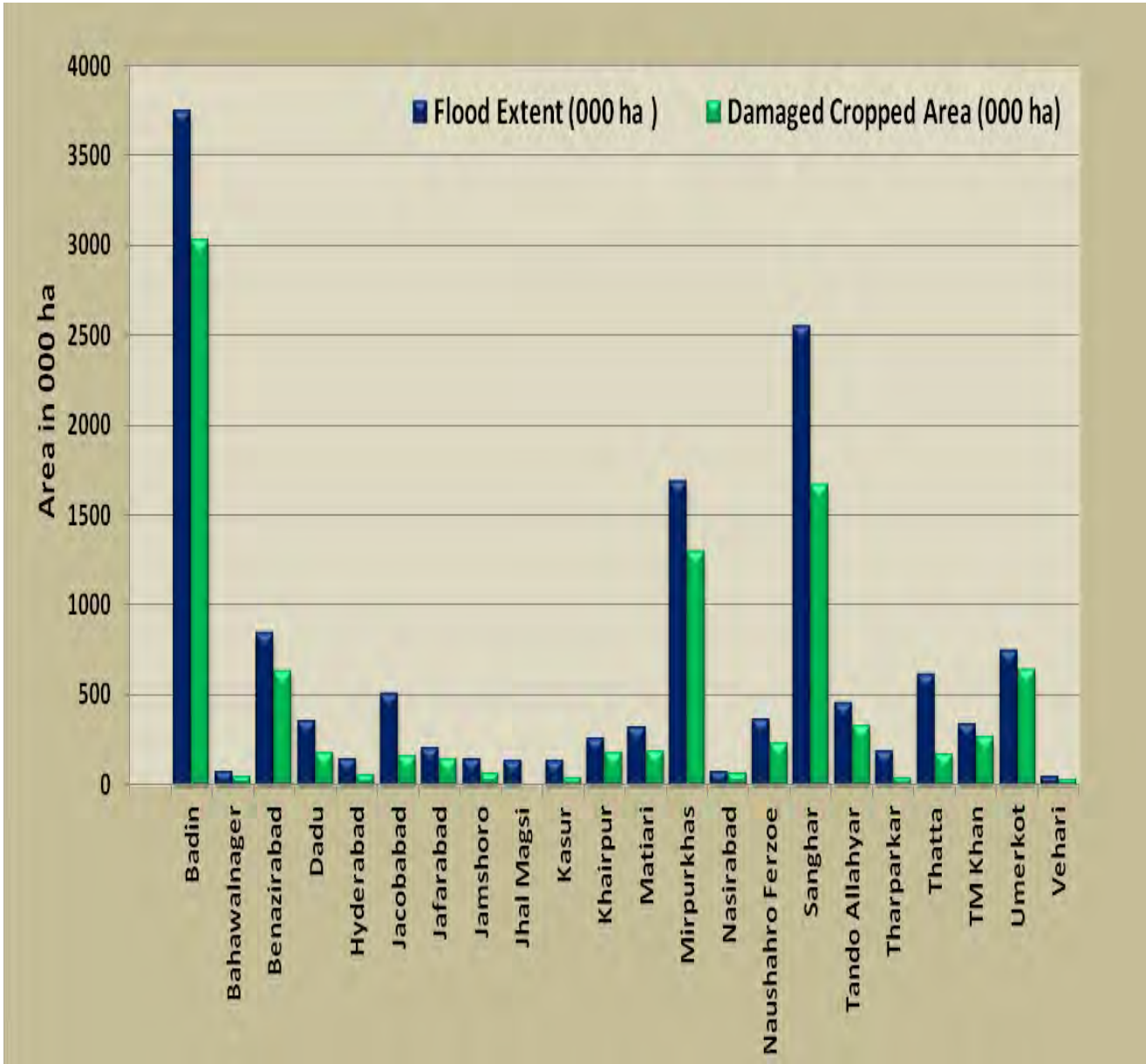
Timeline of Inundated area in sq.km

Max 28-Sep 1-Oct 3-Oct 8-Oct 13-Oct 18-Oct 25-Oct 30-Oct 4-Nov 11-Nov 16-Nov 21-Nov 27-Nov 11-Dec 25-Dec 1-Jan 10-Jan 20-Jan 30-Jan 10-Feb 20-Feb

Prepared by Information Management Unit - FAO-ERCU - Pakistan @ 2011

Damage to Agriculture

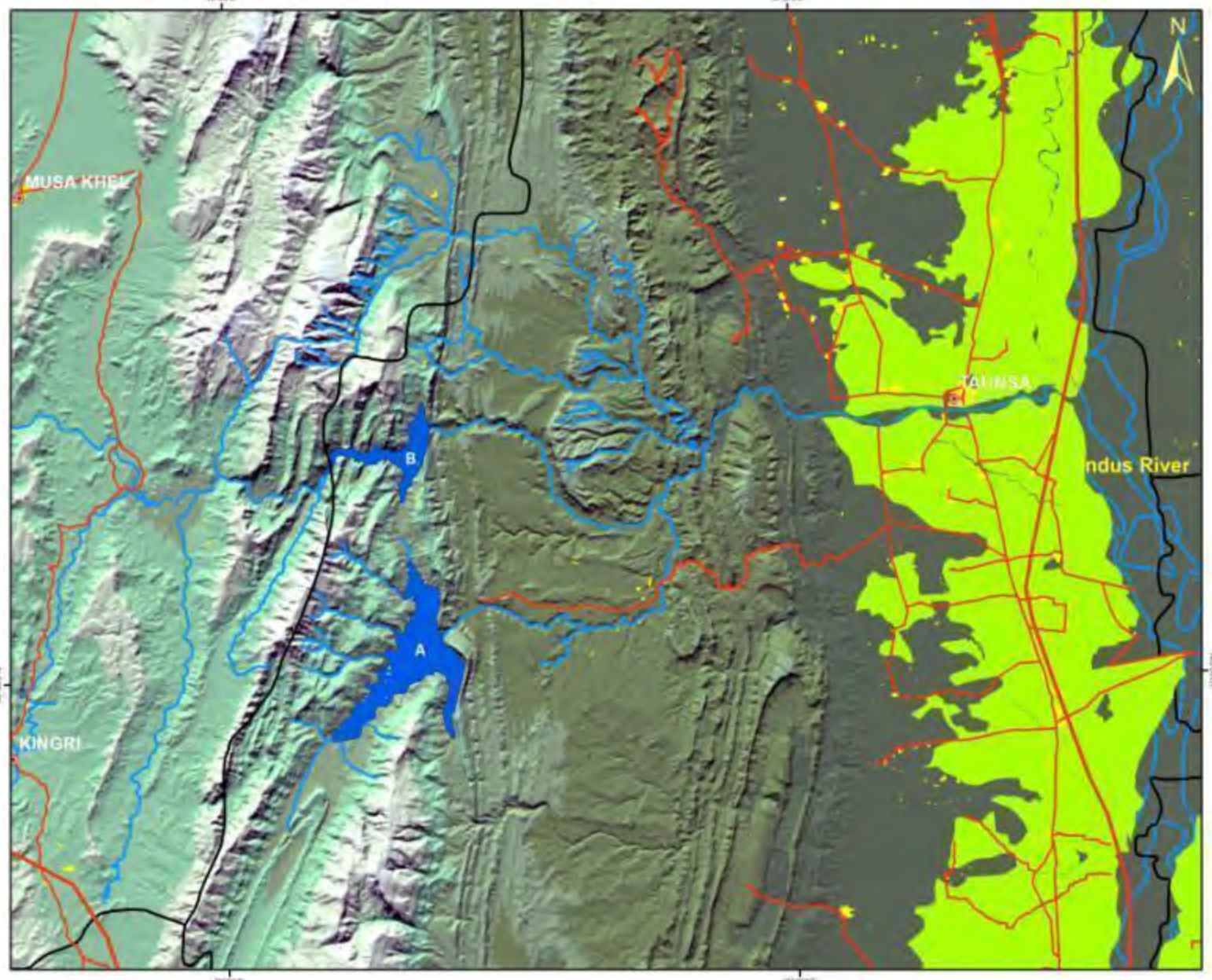
SUPARCO

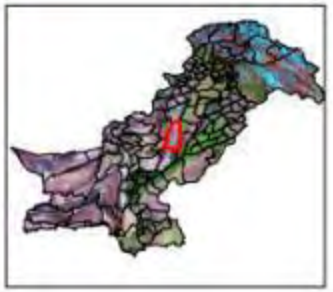


Damage Assessment Reports

Storage of Torrential Rain water (case study)

PROPOSED DAM SITE - TAUNSA, DERA GHAZI KHAN





Legend

- Cities
- Roads
- National High Ways
- Drainage
- District
- Settlements
- Agri land
- Proposed Dam

Propose Dam

Site-A

Height	900m (Sea Level)
Area	48.68 Sq km
Capacity	4.15 Cu km

Site-B

Height	900m (Sea Level)
Area	16.34 Sq km
Capacity	1.49 Cu km

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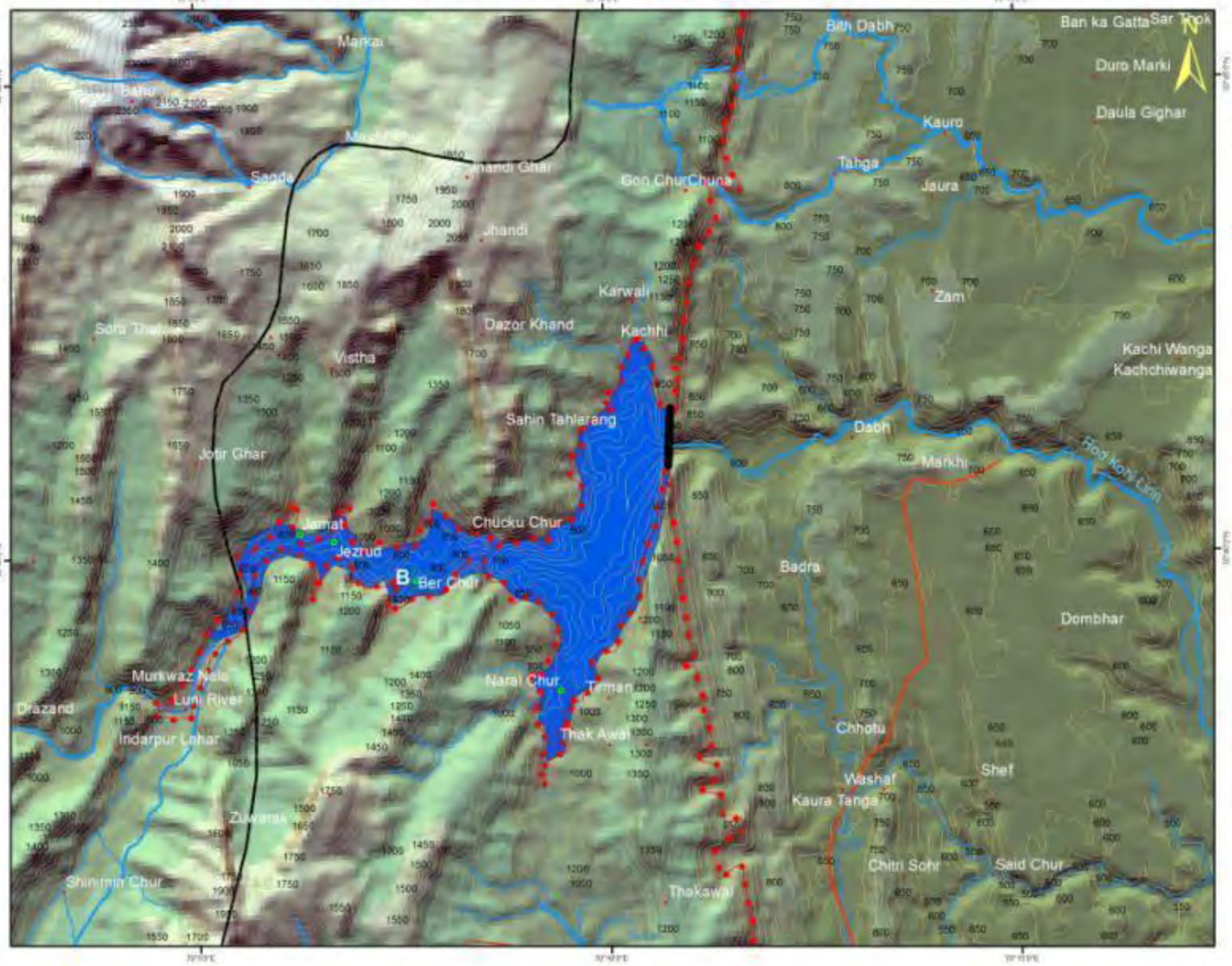
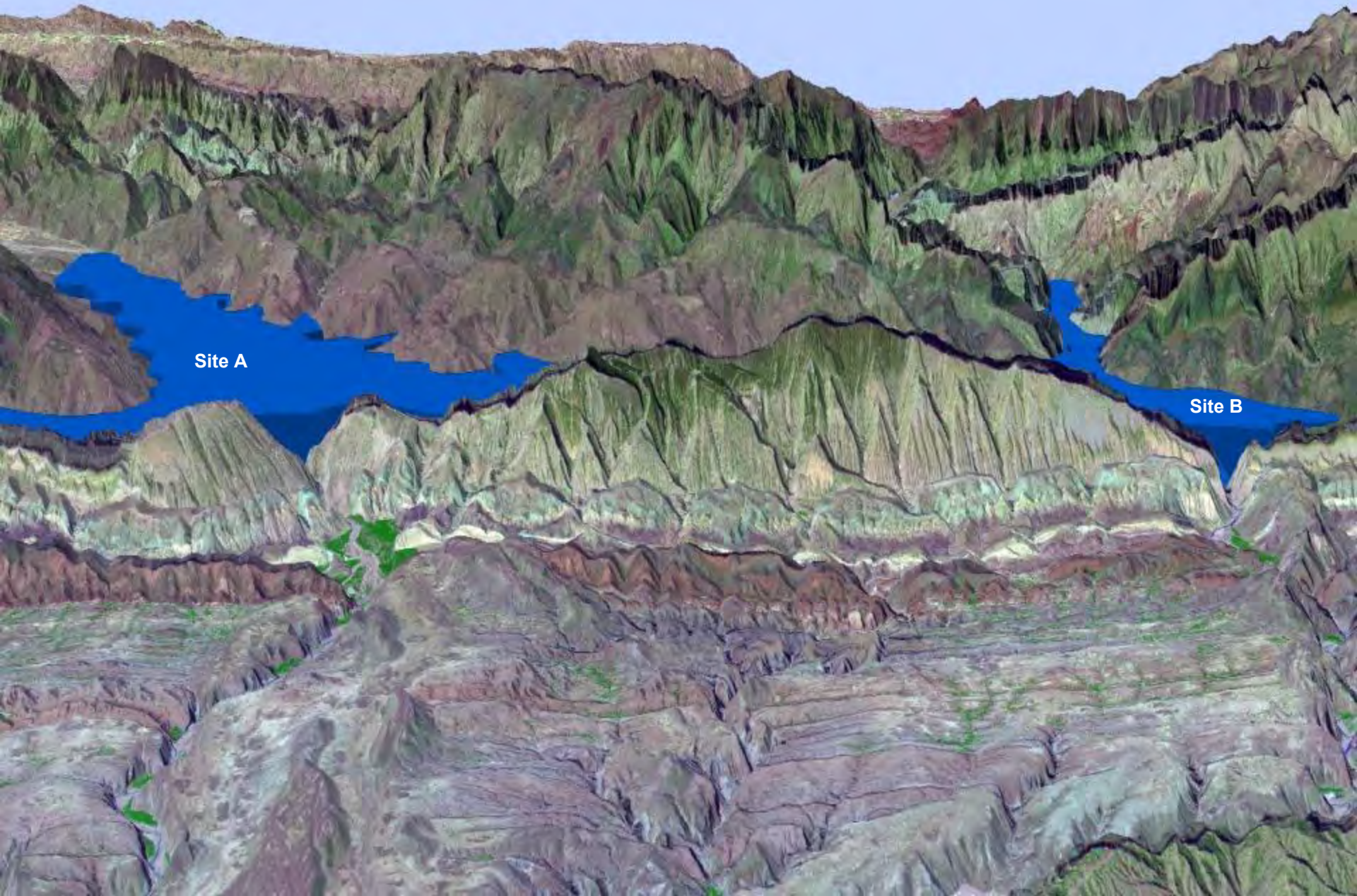
6 3 0 6 Kilometers

PROPOSED DAM SITE B - TAUNSA, DERA GHAZI KHAN



3D Prospective view



The satellite remote sensing and GIS technologies are very useful for the pre feasibility studies to select dam sites. A detailed study is recommended which may include the following parameters:

- Geological structural capability
- Behavior of regional mountain
- Affect of sedimentation

Tele-epidemiology

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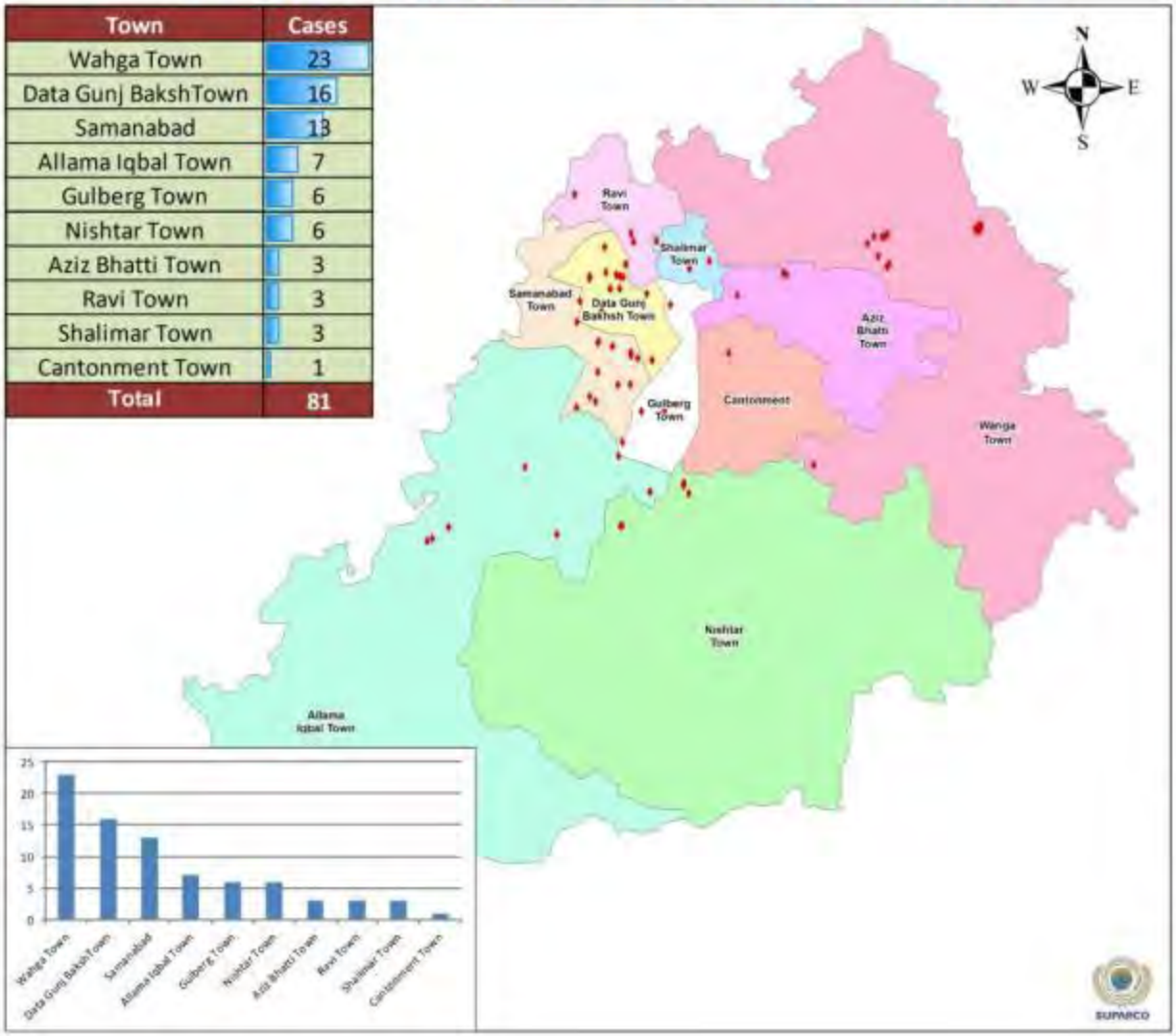
DENGUE FEVER

District Lahore : Spatial distribution of Dengue Case for 2009

Town	Cases
Wahga Town	23
Data Gunj BakshTown	16
Samanabad	13
Allama Iqbal Town	7
Gulberg Town	6
Nishtar Town	6
Aziz Bhatti Town	3
Ravi Town	3
Shalimar Town	3
Cantonment Town	1
Total	81



Legend

Cases

Town

- Allama Iqbal Town
- Aziz Bhatti Town
- Cantonment
- Data Gunj Bakhsh Town
- Gulberg Town
- Nishtar Town
- Ravi Town
- Ravi Town Punjab Map
- Samanabad Town
- Shalimar Town
- Wahga Town

This analysis was performed on the basis of dengue fever data provided by Health Department Govt. of Punjab, Lahore.

Projection: UTM Zone 42 N
Spheroid: WGS 84

0 5 10 20 Km

Factors analyzed for Correlations with Dengue Cases

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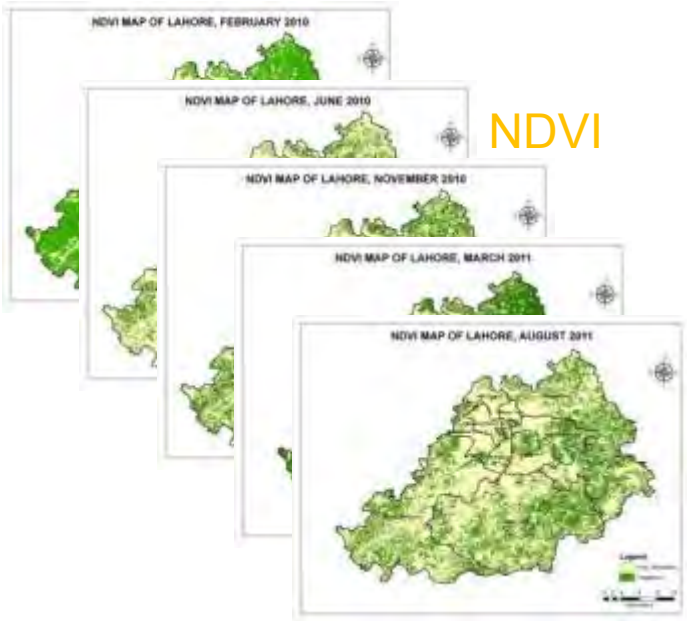
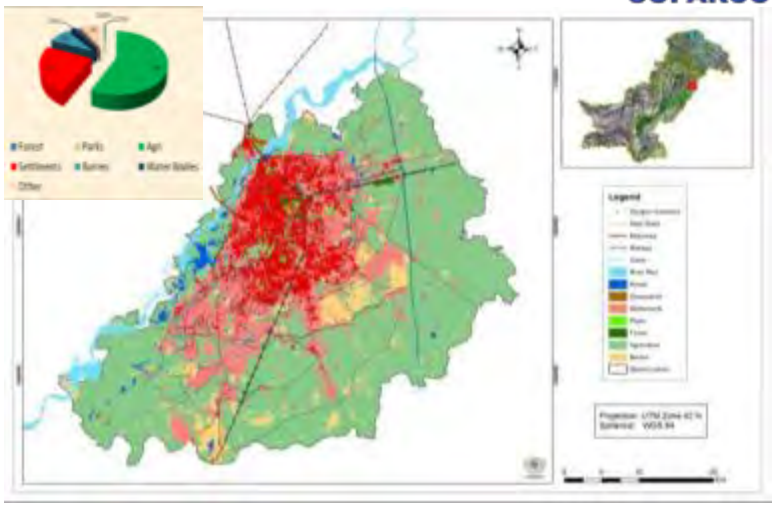
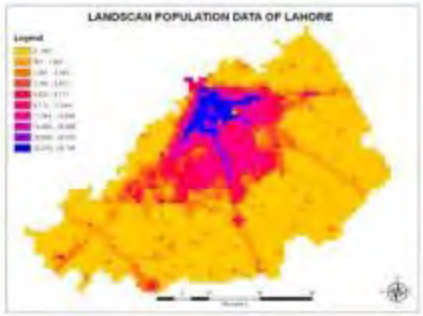


NDVI

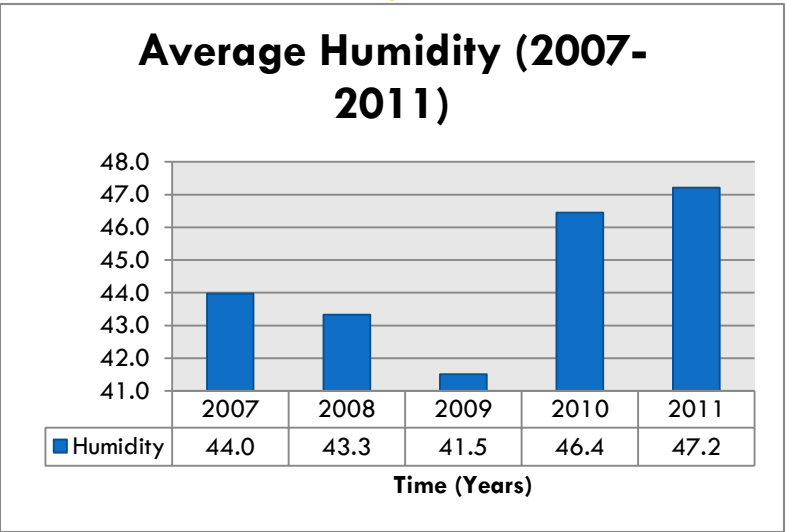


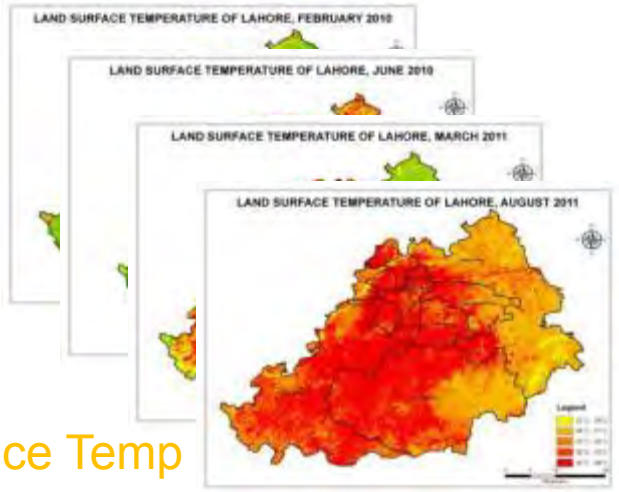
Landuse /Landcover

Population Density



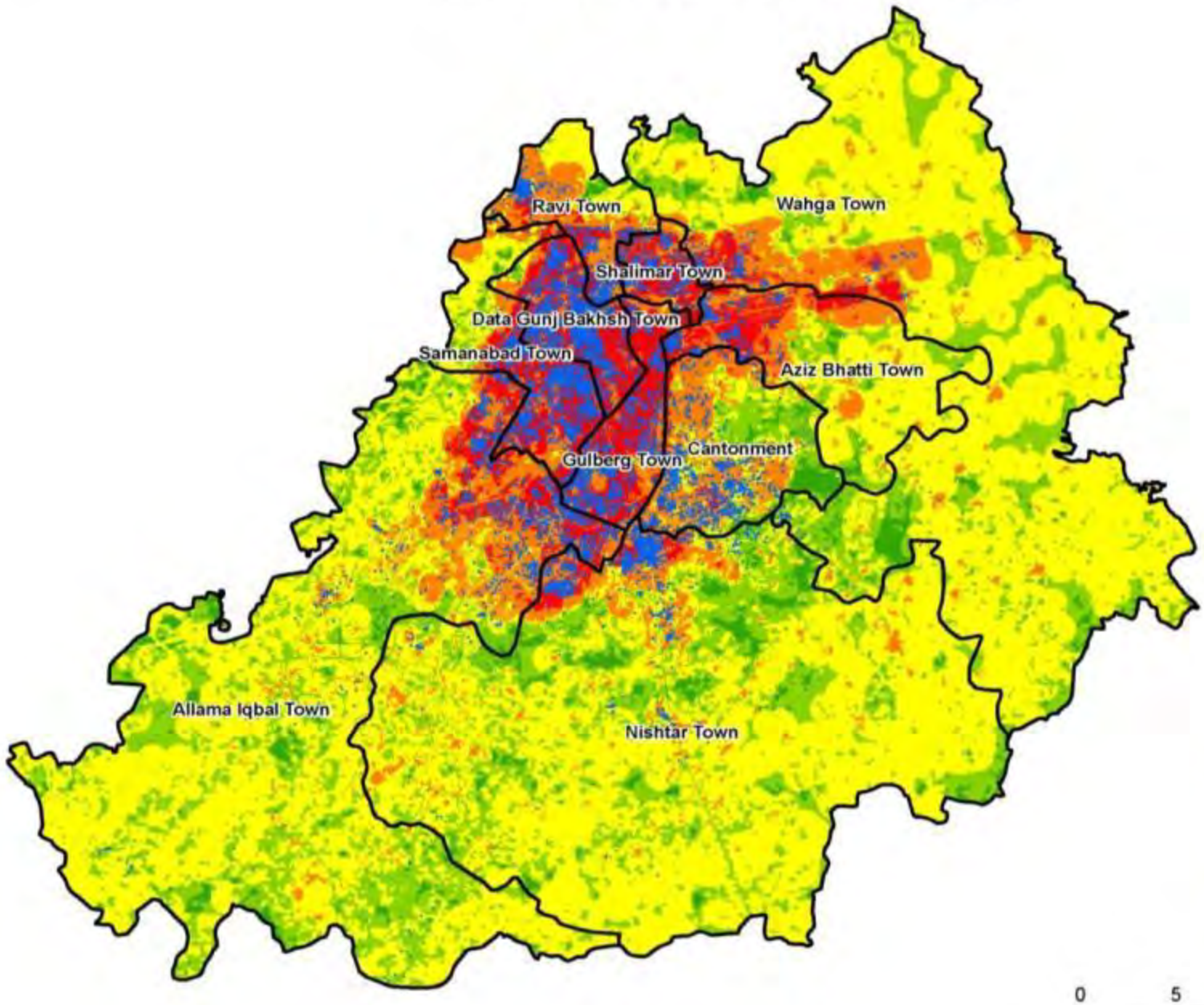
Relative Humidity





Land surface Temp

DENGUE RISK MAP (LAHORE)



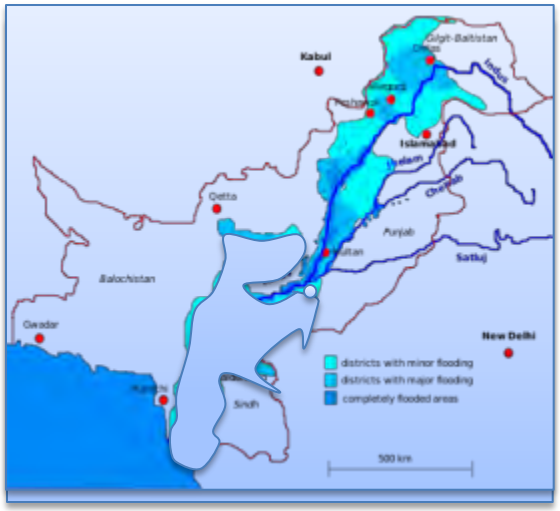
INTERNATIONAL COLLABORATIVE WORK

- SUPARCO is Regional Support Office of UN-SPIDER- It has participated in two TAM Missions (Bangla Desh & Sri Lanka)
- Being National Space Agency, it represents Pakistan at APSCO forum
- SUPARCO is a member of Regional Space Application Programme (RESAP) being undertaken by UNESCAP
- SUPARCO is also member of JPT-2, Sentinel Asia

Strategic Strengthening of Flood Warning and Management Capacity of Pakistan

- ✓ **Project Associates**
  - **SUPARCO/PMD/UNESCO/JAXA**
- ✓ **Objectives**
  - **Development of Indus-Integrated Flood Analysis System (IFAS)**
  - **Update flood hazard maps by using satellite data including newly flood affected areas**
  - **Test operation in Feb 2014**

Geographic area to be covered by Indus-IFAS (enclosed by dotted lines)



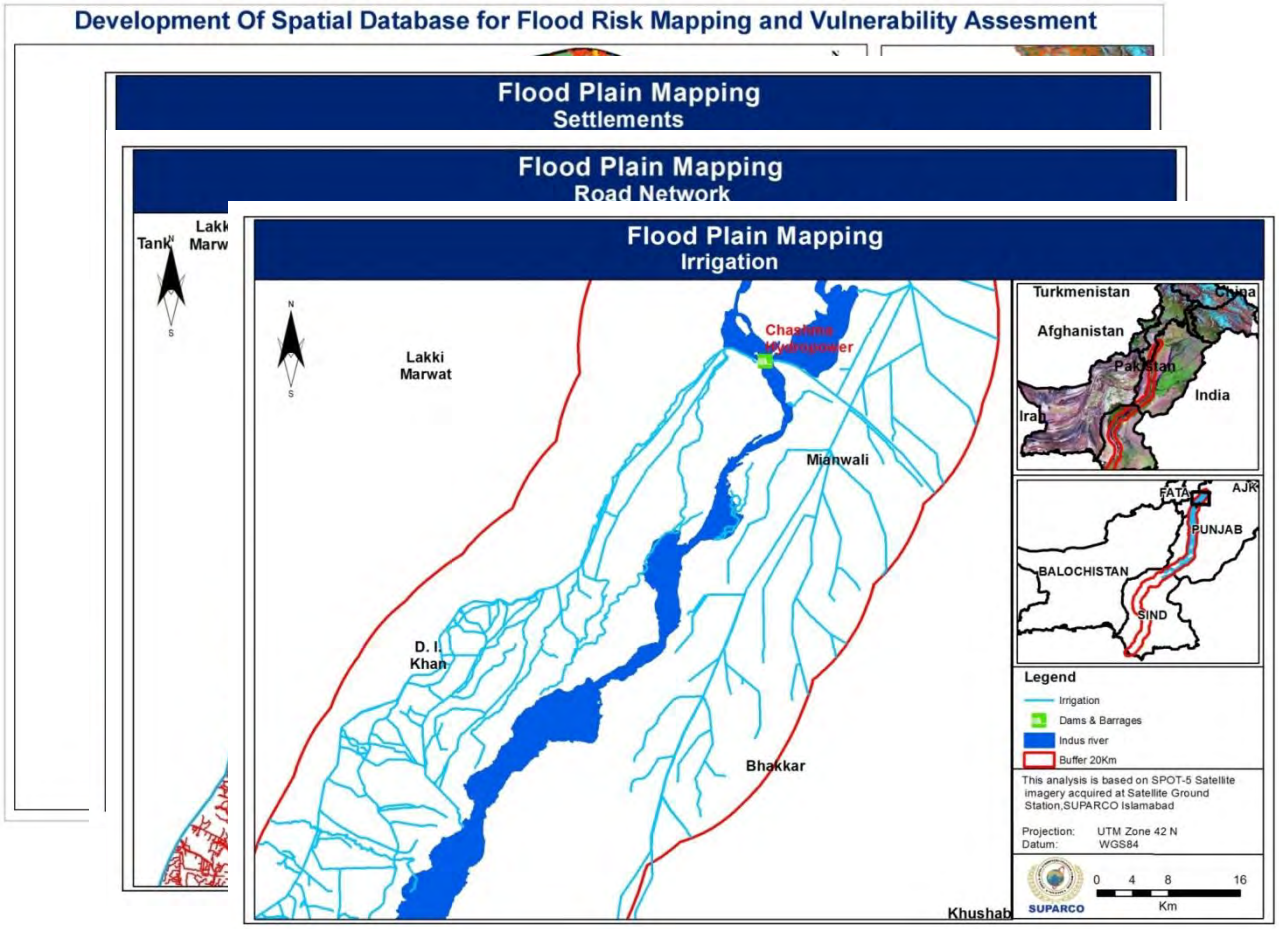
Proposed Flood Hazard Mapping Area (Lower Indus)

Vulnerability & Hazard Warning Mapping

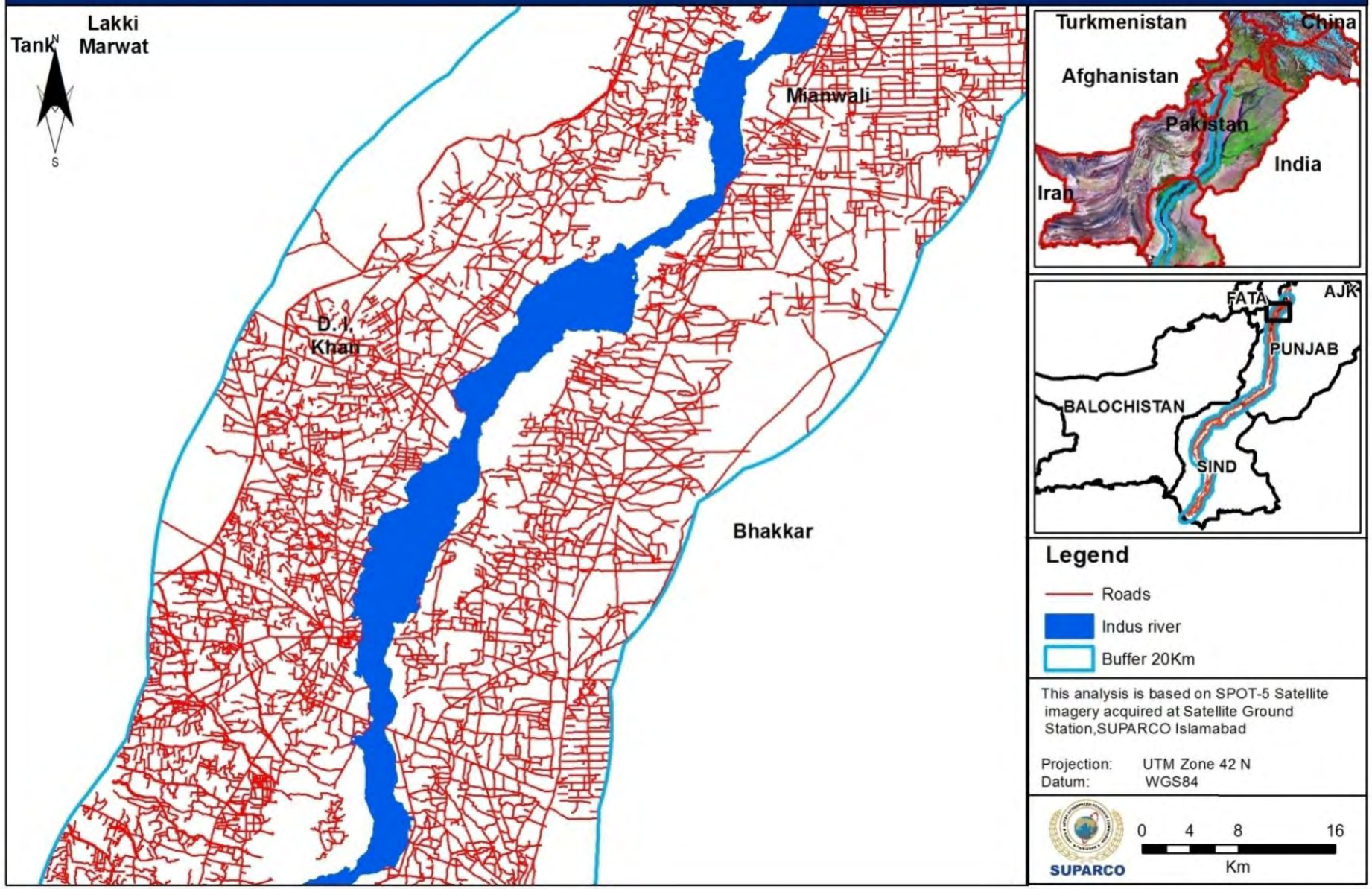
Several GIS layers have been prepared in a buffer of 20km across the Indus River from Chashma down to delta where it merges with sea.

GIS Layers:

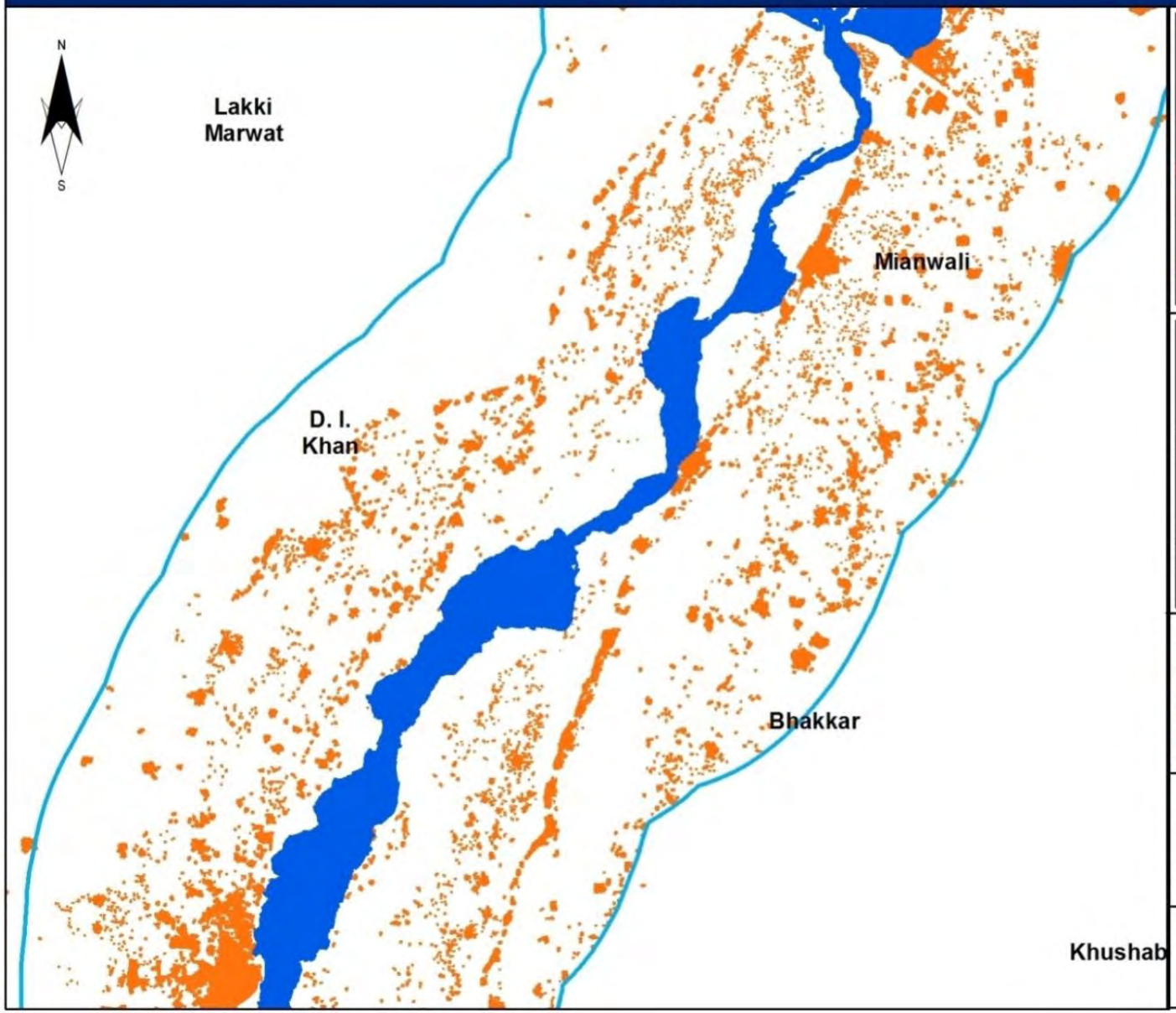
- ✓Settlements
- ✓Roads
- ✓Embankments
- ✓Railway line
- ✓Bridges
- ✓Agriculture land



Flood Plain Mapping
Road Network



Flood Plain Mapping
Settlements



Legend

- Settlements
- Indus river
- Buffer 20Km

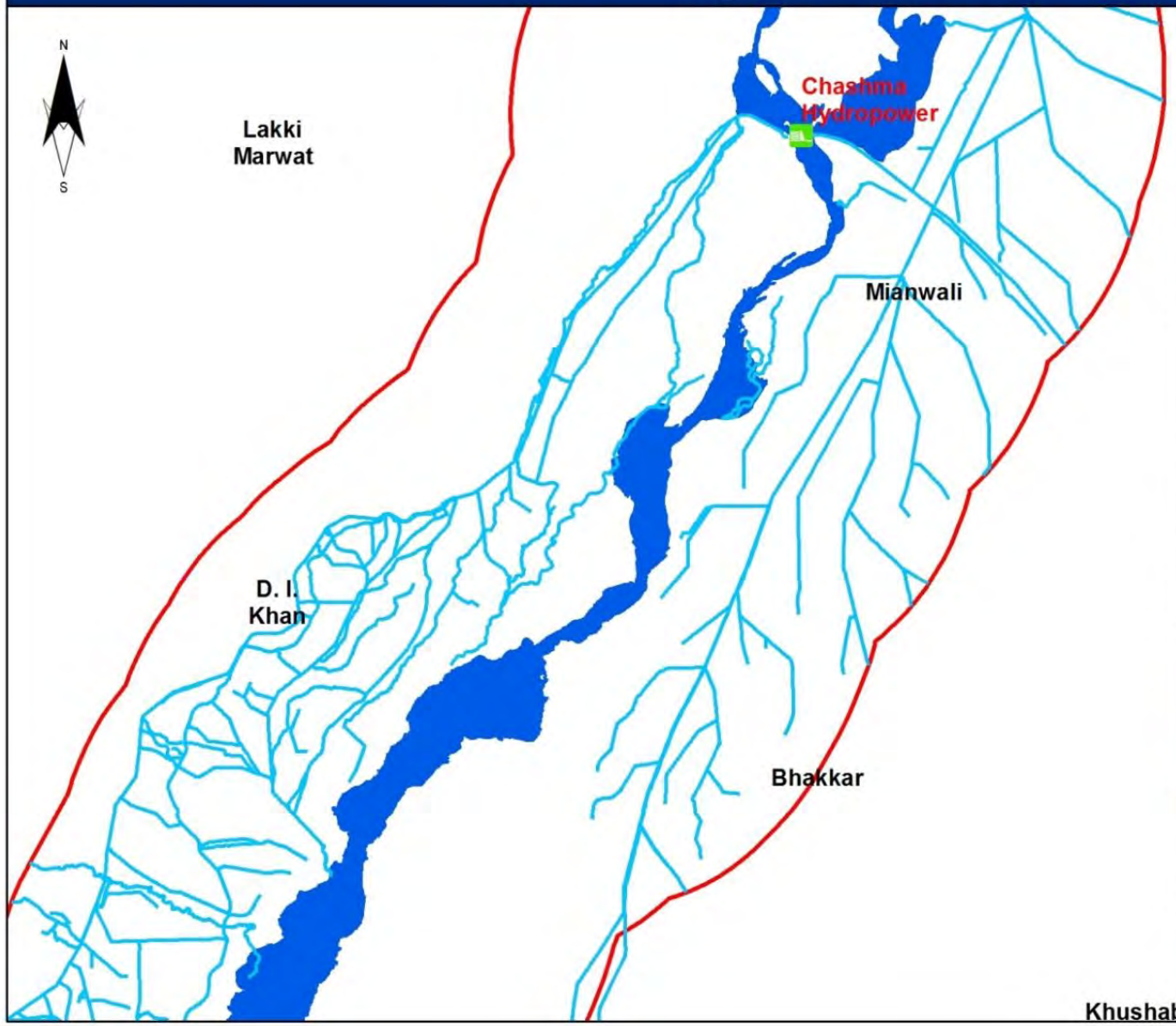
This analysis is based on SPOT-5 Satellite imagery acquired at Satellite Ground Station,SUPARCO Islamabad

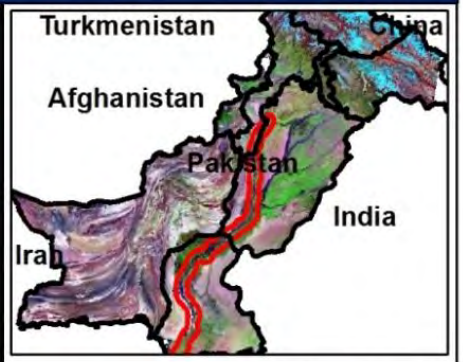
Projection: UTM Zone 42 N
Datum: WGS84

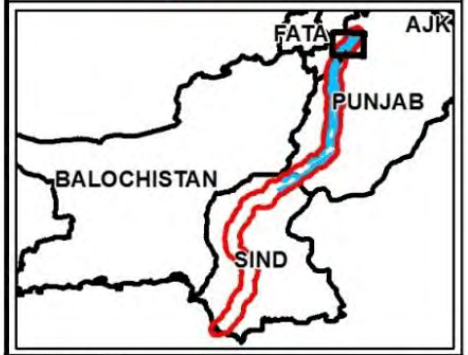
SUPARCO

0 4 8 16
Km

Flood Plain Mapping
Irrigation







Legend

- Irrigation
- Dams & Barrages
- Indus river
- Buffer 20Km

This analysis is based on SPOT-5 Satellite imagery acquired at Satellite Ground Station,SUPARCO Islamabad

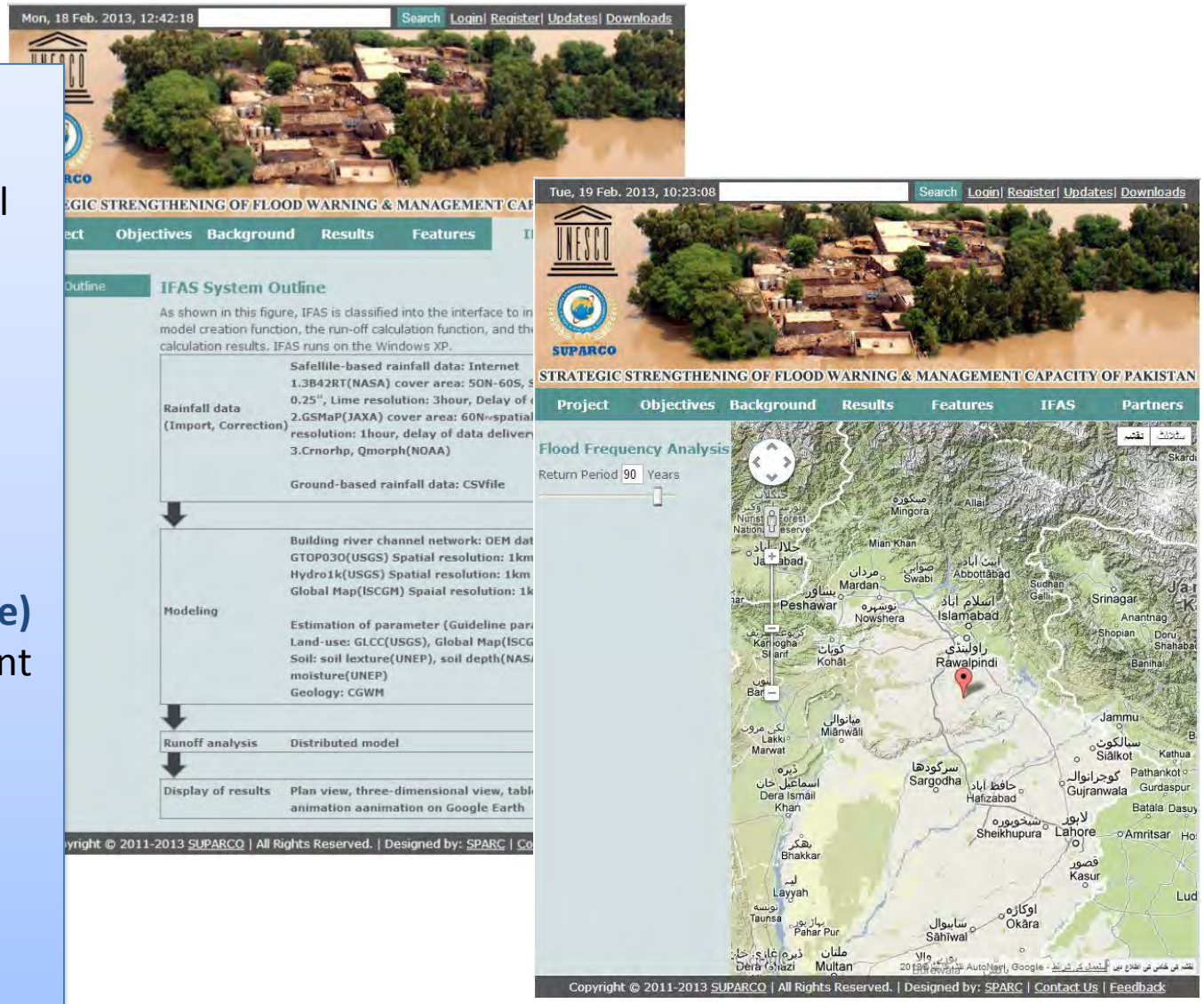
Projection: UTM Zone 42 N
Datum: WGS84

SUPARCO

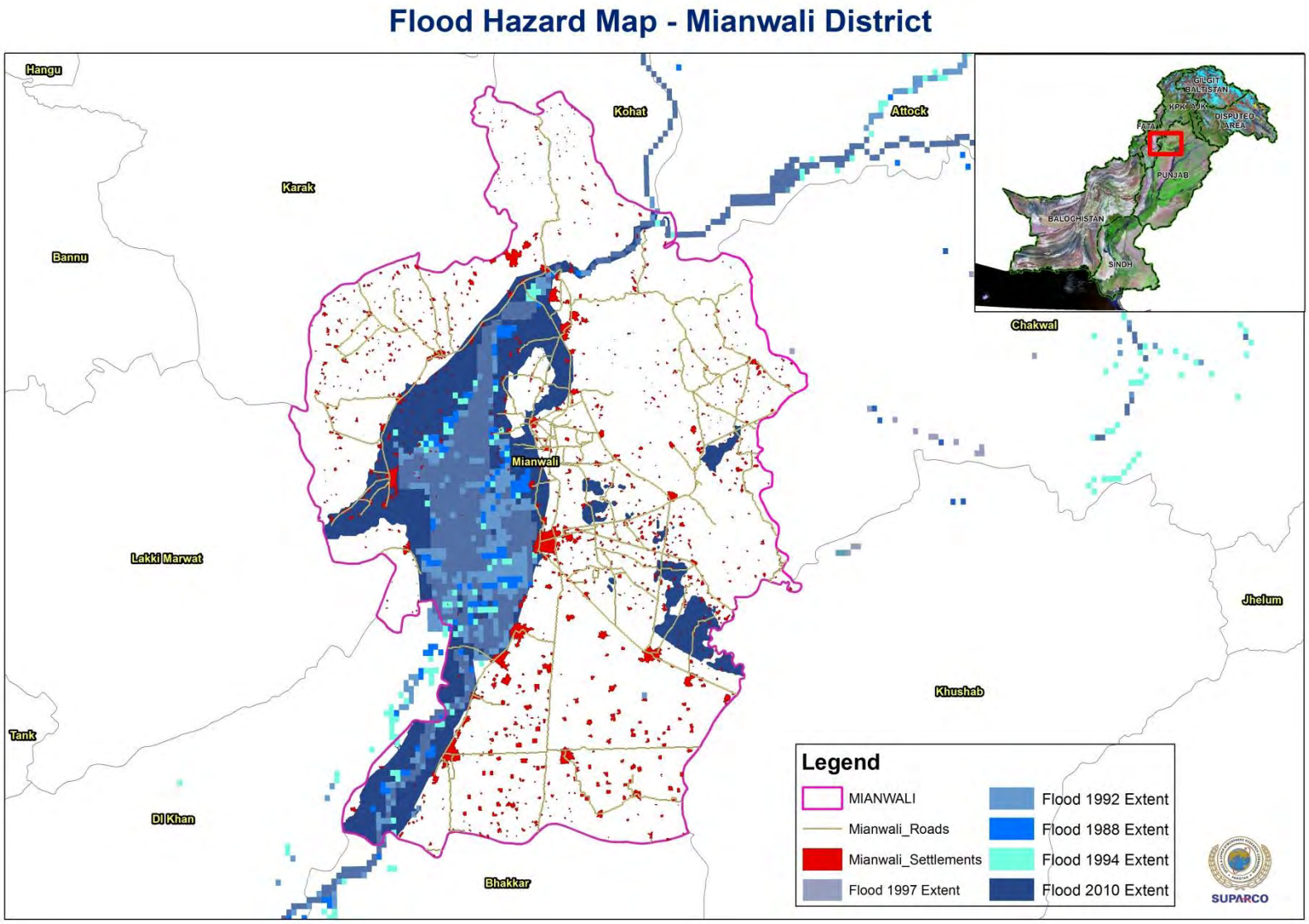
0 4 8 16
Km

Draft Web Portal

- **Pre-Disaster (Preparedness)**
  - Interactive GIS tool
  - Risk mapping at district level
  - Vulnerability assessment
  - Evacuation plans
  - Safest route identification
- **Post Disaster (Response)**
  - Damage assessment
  - Damage Need Analysis
  - Information dissemination



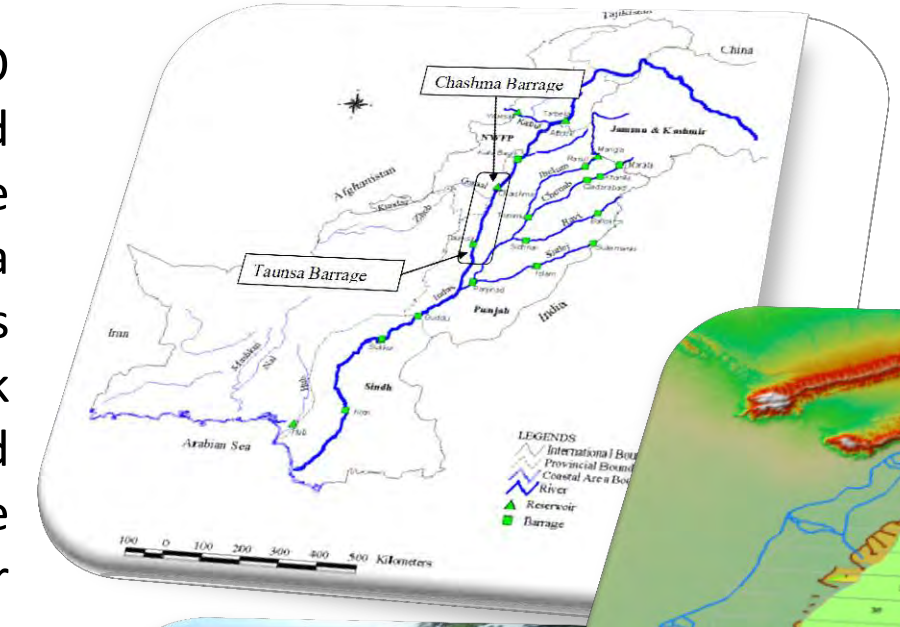
Draft Web Portal

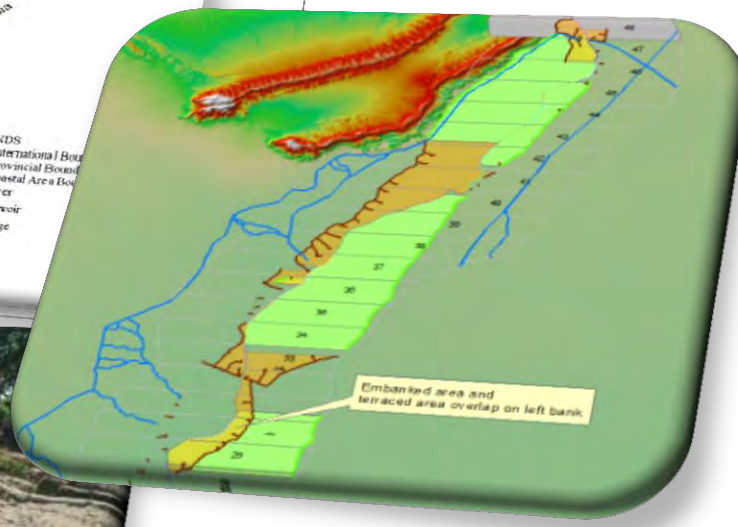


Flood Warning Modelling on the Indus River

(FAO/ University of Southampton (UoS) /FAO/SUPARCO)

As part of the FAO Pakistan Floods Relief and Early Recovery Response Plan, The GeoData Institute, UoS is coordinating a River Bank Erosion Modelling and Impacts on Agriculture Project on the Indus River from Chashma to Taunsa to provide early warning of hots spots of erosion, embankment breach and agricultural losses. It would also provide input to flood hazard maps





4 Key Activities

- Mapping of erosion based land loss and agricultural impact on the river Indus due to 2010 floods

- Statistical analysis of 20 years of satellite data for trend analysis of historical hot spots of erosion

- Conduct field tests of characteristic geotechnical properties of riverbanks to model likely impacts of given flood events on agricultural land and production as well as high potential for embankment breech

- Build capacity in country to conduct analysis and field work with joint production of erosion models based upon flood work and associated reporting/publications

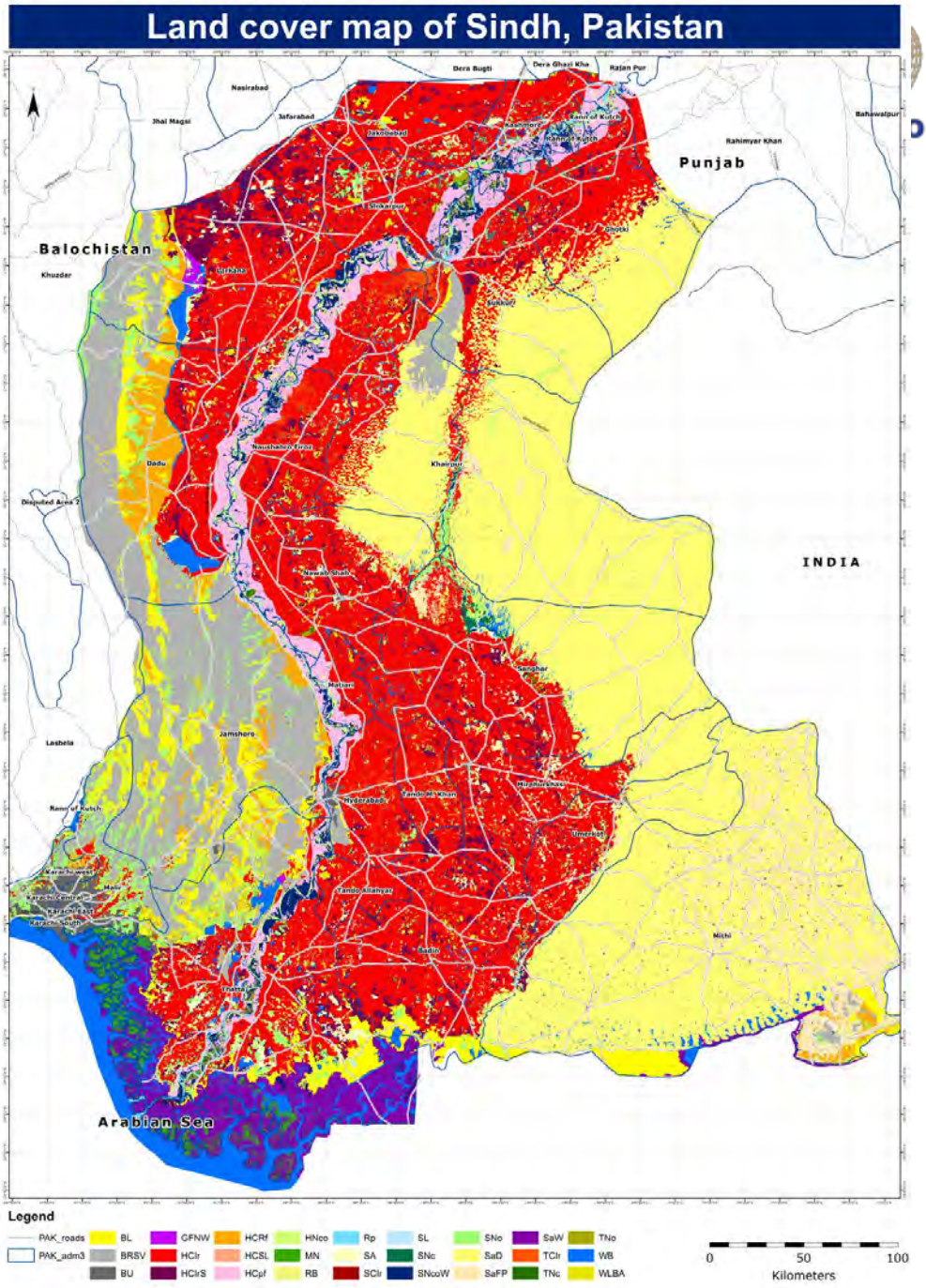
Huge losses of productive land and infra-structure

Defensive Structures Protect Land and Infra-structure but are costly and need to be optimally located

Land Cover Mapping

Land Cover Mapping is an going project in collaboration with FAO UN using the technique of Land Cover Classification System (LCCS) – an important component of FAO / GLCN approach to create a harmonized and extensive representation of land cover features

The possible areas of application would be Agriculture, Forestry, Environment, Irrigation, Disasters & Hazards Monitoring, Planning & Development, Oil & Gas Exploration, Mining, Wild Life and other emergent requirements.



Agg. Code	Original land cover class	Agg. Name
1	Tree Orchards - TCIr	Orchards
1	Shrubs Orchards - SCIr	
2	Herbaceous Crop Irrigated - HCIr	Crop irrigated
2	Herbaceous Crops surrounded by Tree Orchards– HTCIr	
3	Herbaceous Crop Rainfed in Desert area - HCRfD	Crop Marginal and Irrigated Saline
3	Herbaceous Crop Irrigated - Saline Fields - HCIrS	
4	Herbaceous Crop Irrigated in Flood Plain – HCIrFP	Crop in flood plain
4	Herbaceous Crop post-flooding – HCpf	
5	Herbaceous Crop Rainfed - HCRf	Crop Rainfed
5	Herbaceous Crop in Sloping Land - HCSL	
6	Trees Forest Plantation – TFP	Forest - (Natural trees & Mangroves)
6	Trees Closed - TNc	
6	Trees Open - TNo	
6	Mangroves - MN	
7	Shrub Closed (with Trees Sparse) – SNc	Range Lands - Natural shrubs and herbs
7	Shrubs Open (with Trees Sparse) - SNo	
7	Herbaceous Closed to Open (with Trees and/or Shrubs Sparse) – HNco	
8	Built-Up Area - BU	Built up
9	Sand Dunes (Desert) – SaD	Bare areas
9	Barren Land (with Sparse Vegetation) - BL	
10	Sand Dunes with Natural Vegetation - SaDNV	Bare areas with sparse natural vegetation
10	Bare Rocks (with Sparse Vegetation) - BRSV	
10	Desert Flat Plain - SaFP	
11	Mud Flat - SaW	Wet areas
11	River Perennial - Rp	
11	Salt Lake - SL	
11	Water Bodies - WB	
11	Saline Area (with Shrubs Sparse) – SA	
11	Water Logged Bare Area - WLBA	
12	Snow Permanent - SnP	Snow and Glaciers
12	Glacier - Gl	
13	River Bank - RB	Natural vegetation in wet areas
13	Shrubs Closed to Open in Wetland - SNcoW	
13	Trees Open in Wetland- TNoW	
13	Trees Closed in wetland- TNcW	
13	Wetlands (with Natural Vegetation) - GFNW	

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APSCO
ASIA-PACIFIC SPACE COOPERATION ORGANIZATION
Building 13& 14, Section 3, No. 188, South West Fourth Ring,
Fengtai District, Beijing, China, 100070
Tel: 86-10-6370 2677 Fax: 86-10-6370 2286
E-mail: secretariat@apsco.int

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Result Announcement o f the selection for candidate proposals of the Application Pilot Projects for APSCO Data Sharing Service Platform Project

By Department of Strategic Planning and Program Management of APSCO

18 September 2012, Headquarters of APSCO

On APSCO's invitation of its Member States for proposals on the Application Pilo Projects for APSCO Data Sharing Service Platform Project, 11 proposals were received fron Bangladesh, China, Peru, and Thailand. After evaluation by APSCO invited experts as th evaluation committee, the prioritize recommended list of proposals are shown as below;

Project	Rank	Country	Remark
Evaluation of Different Remote Sensing Techniques for Drought Study	1	Pakistan	Selected
Urban Lanuse Change Detection and Modeling Using Remote Sensing and GIS in Pakistan	2	Pakistan	
Strengthening of Satellite Based Crop Monitoring and Estimation System for Food Security Application in Bangladesh: Application of APSCO Data Sharing	3	Bangladesh	Selected
Training Program on the Nature Disaster Monitoring and Assessment with Remote Sensing Technology	4	China	
Remote Sensing Monitoring of Ecological Impact Resulting from Mineral Resource Developing and its Applicative Demonstration	5	China	
Estimation of Rice Field using Multiple Satellite Sensors	6	Thailand	Selected
limate Change Impacts on Glacial Lakes and Related Hazards	7	Pakistan	

TRAINING COURSES IN RS & GIS

SUPARCO

- **MS (RS & GISc) program** at NCRG, Karachi commenced on 07 Dec 2009
- 2 ½ years spread over 5 semesters (Two semesters per year)
- 30 credit hours including thesis

- **Short Term Training Courses** at NCRG for National and international user organizations on regular basis

Conclusion

It is imperative to utilize space based technologies into Disaster Management

Recommendation

Institutional linkages need to be strengthened for utilization of space resources and expertise among developing & developed countries