Space Technology Applications to Monitor Effects of Climate Change in Pakistan

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SUPARCO

Sequence of Presentation

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- SUPARCO's Satellite Ground Stations
- Floods/ Rains 2010-2013
- Glaciers & GLOF Monitoring
- Landslides
- Drought
- Marine & Coastal Studies
- Assistance to Ministries & Stake Holders
- International Cooperation
- Conclusion & Recommendations

Introduction

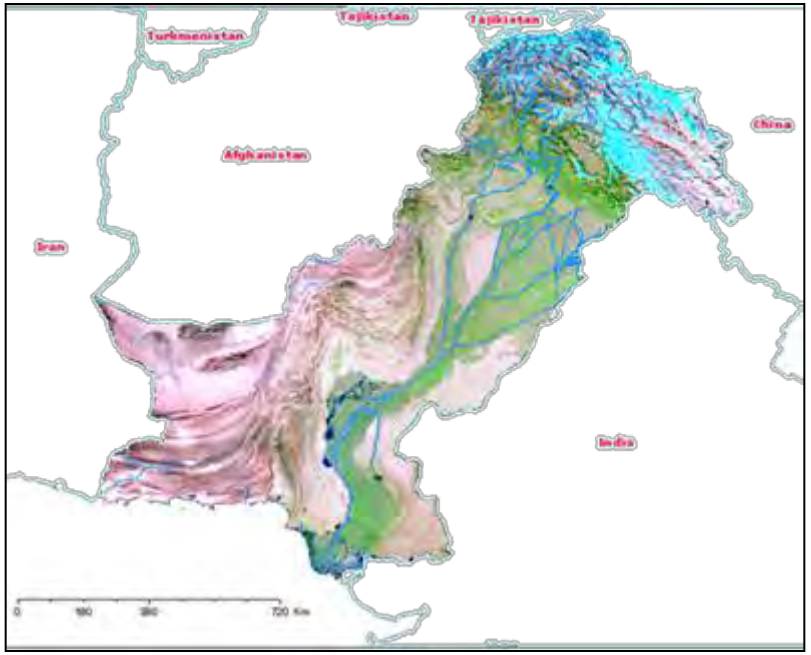
- Climate Change has occurred globally due to unprecedented concentration of GHGs in the atmosphere
- Although Pakistan's contribution to the total GHG emissions is among the lowest in the world, but it is still among the countries most vulnerable to climate change
- As per IPCC, global averaged surface temperature on Earth will increase by 1 to 3.5 °C by the year 2100
- Harmful impacts of climate change & global warming include frequent & intense occurrence of extreme weather events, glaciers retreat rainfall variability, negative effects on marine ecosystem
- In Pakistan, extreme events such as the unprecedented floods, droughts, storms, glacial lake outbursts, etc are frequent
- Economic & social losses for each of these has been enormous

Cont. . . .

- In the recent floods alone, 20 million people were affected
- This outbalances the three major securities of the country namely water, food & energy
- Huge downpour in short time, also shift in the monsoon pattern caused problems in water management & flood control
- Catchment areas of existing & the planned dams are receiving less rains
- Climatic shift posed serious threat to agriculture, livelihood & economies of the semi-arid regions
- SUPARCO has been utilizing space technology to mitigate the effects of various disasters through provision of timely satellite data & situation update reports to the stake holders
- The space based information were useful for rescue / relief activities, early recovery and rehabilitation efforts

Major Disasters in Pakistan

- Pakistan is susceptible to various hazards depending on its geography & climatic conditions. Catastrophic events, both natural & manmade, bring about heavy loss & damage of life, property, livelihoods, & infrastructure
- Catastrophic events include floods, cyclones, severe storms, torrential rains droughts, excessive snowfalls, landslides, avalanches, etc



SUPARCO's Satellite Ground Stations

Atmosphere Data Receiving & Processing Centre (ADRPC) Karachi

Satellite Ground Station (SGS) Islamabad

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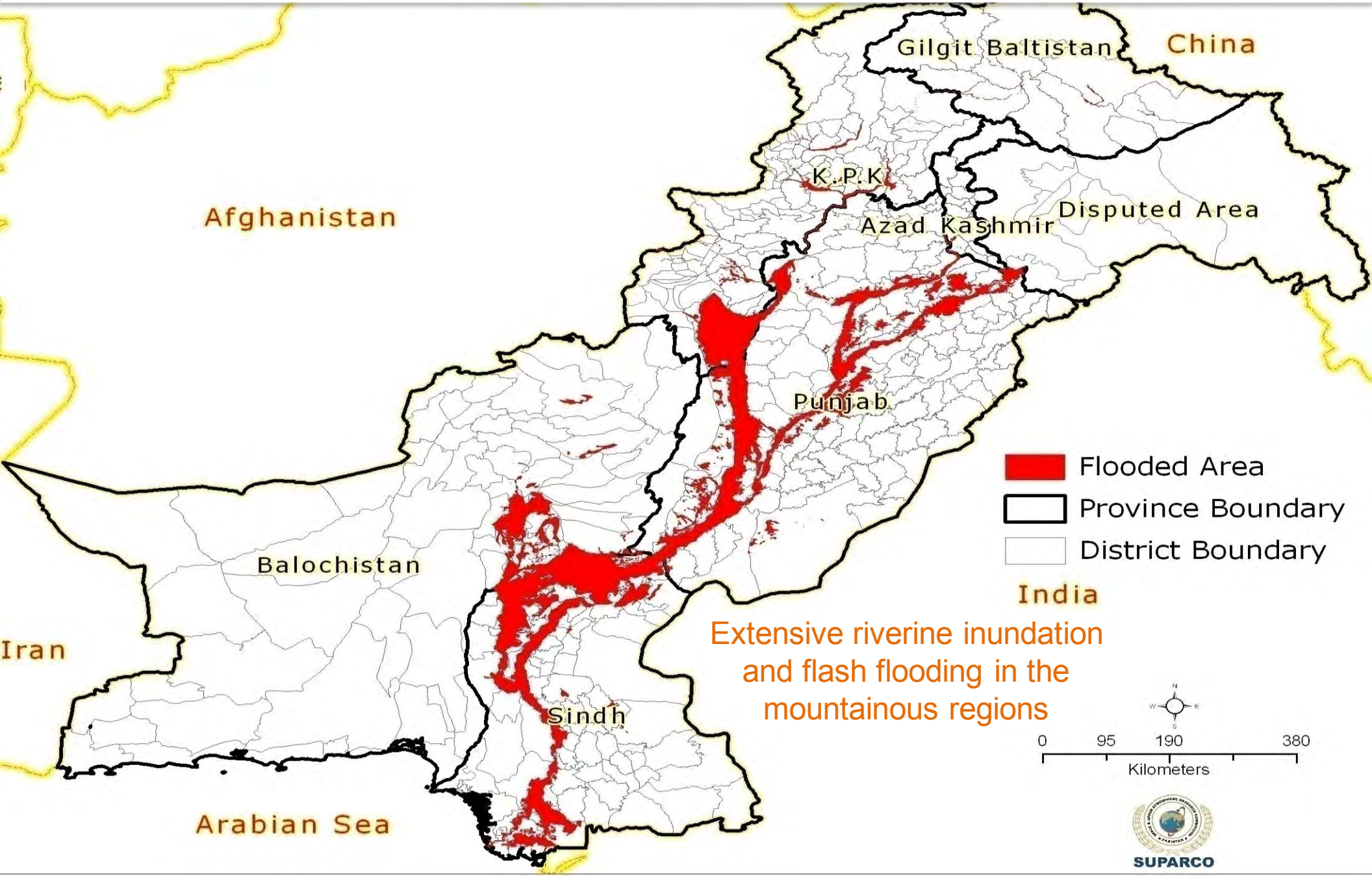
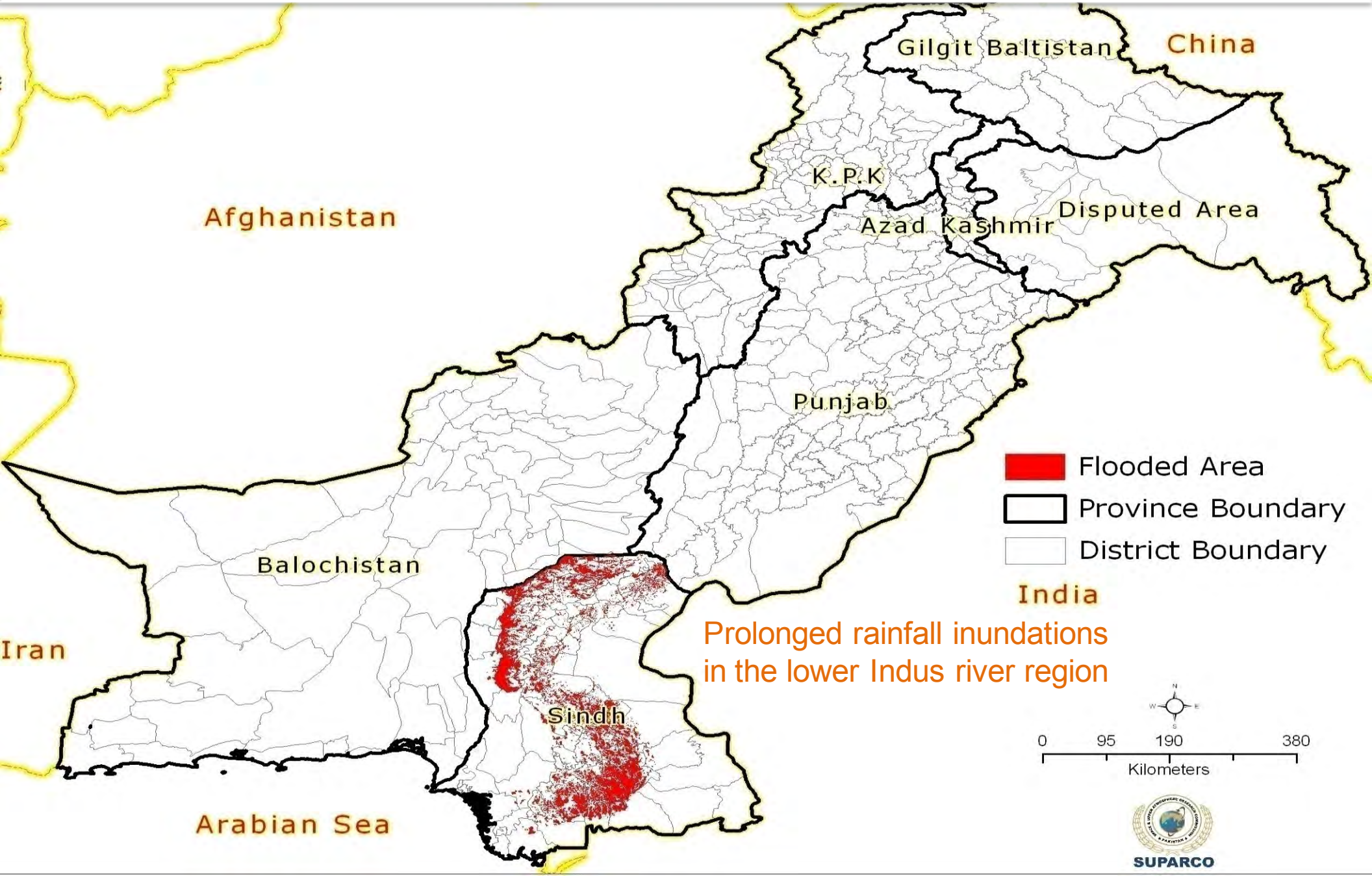
FLOODS

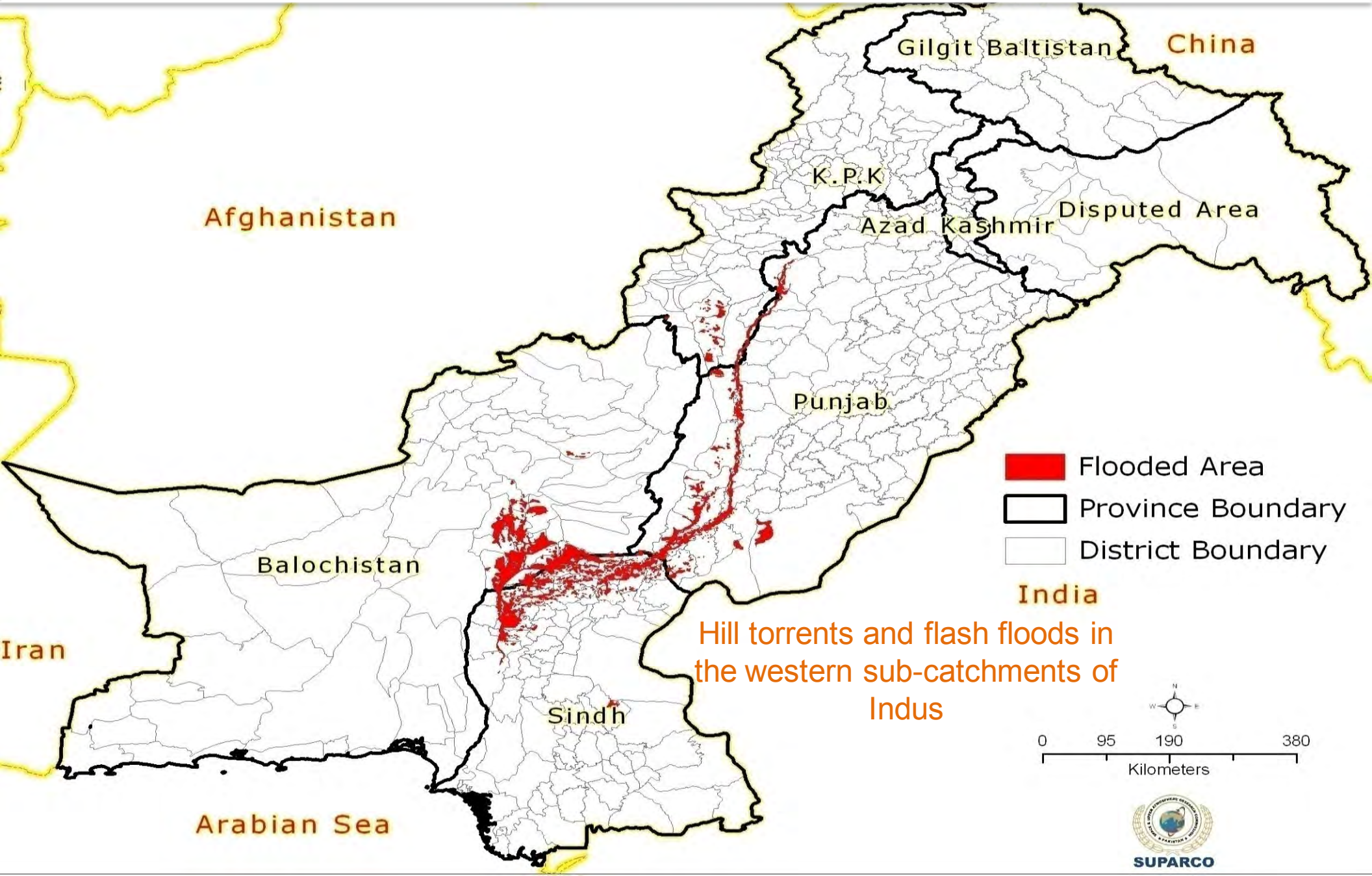
Maximum Flood Extent – 2010



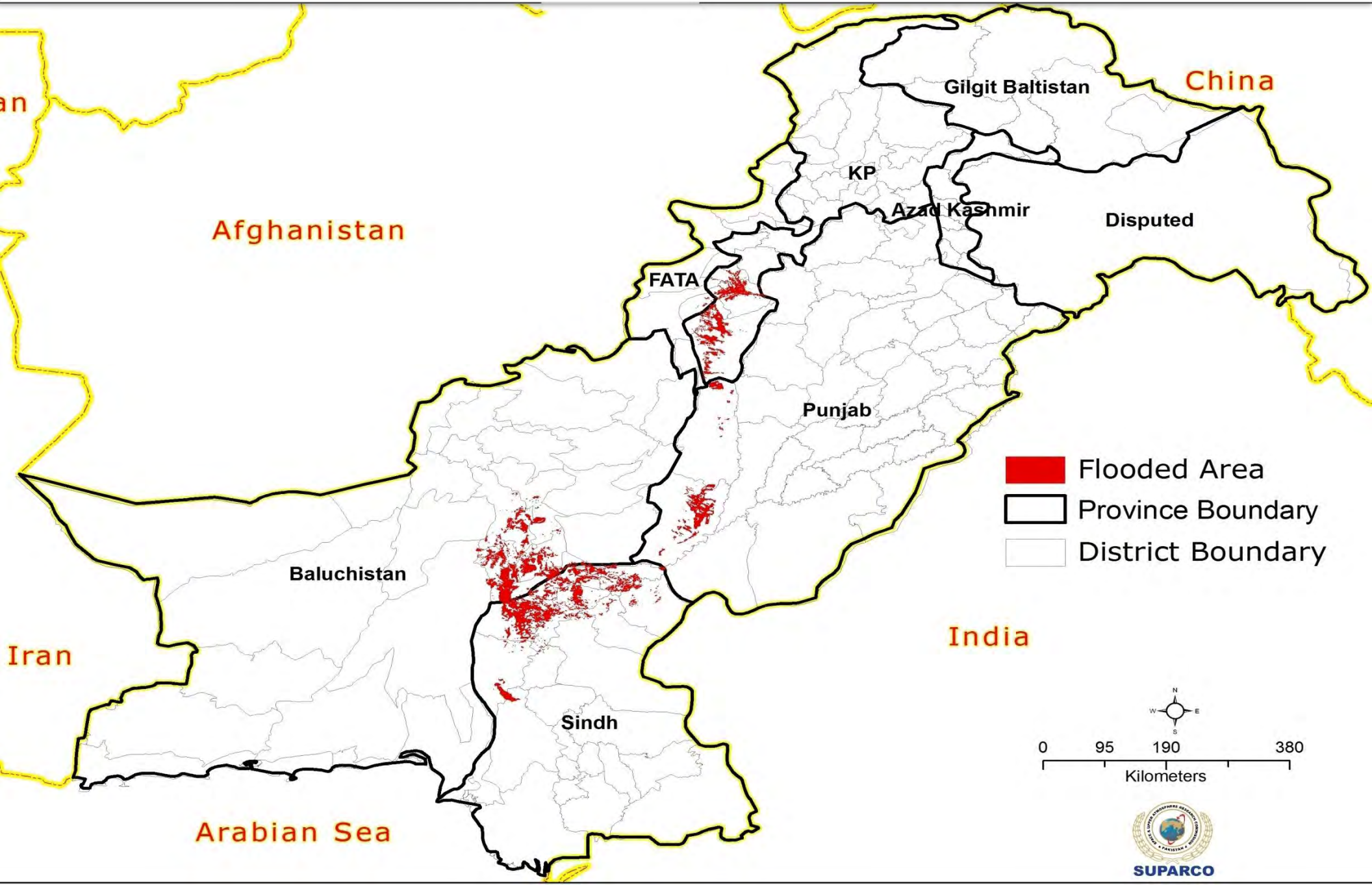
Maximum Flood Extent – 2011



Maximum Flood Extent – 2012

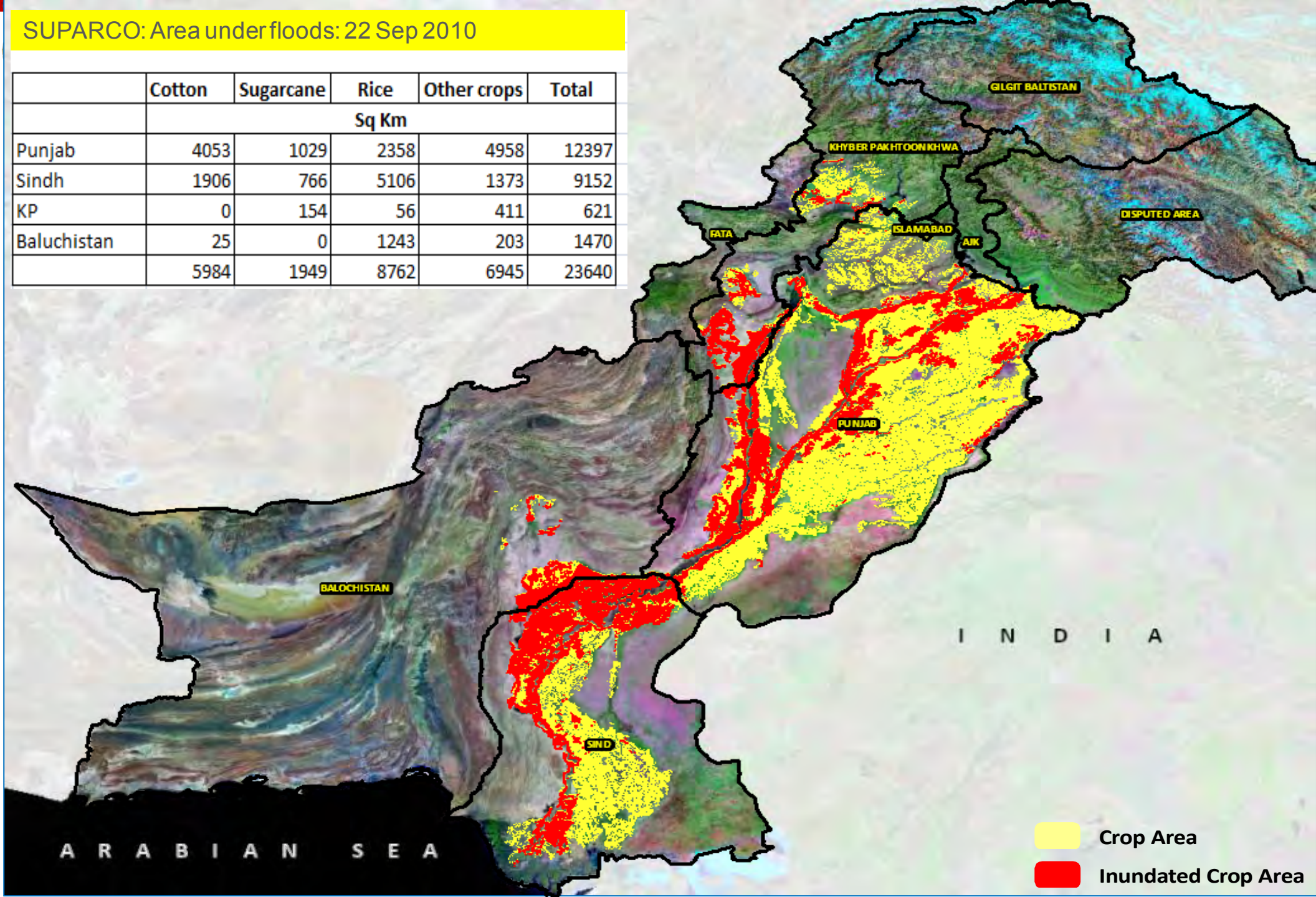


Maximum Flood Extent – 2013



SUPARCO: Area under floods: 22 Sep 2010

	Cotton	Sugarcane	Rice	Other crops	Total
	Sq Km				
Punjab	4053	1029	2358	4958	12397
Sindh	1906	766	5106	1373	9152
KP	0	154	56	411	621
Baluchistan	25	0	1243	203	1470
	5984	1949	8762	6945	23640



Glaciers and GLOF Studies

Collecting Information about Climate Change from Local Residents

- Questions of this Survey:
- Climate change has occurred? (yes or No)
- Extreme weather events in the region have been increased? (yes or No)
- Climate change is changing the environment of the region (yes or No)
- Snowfall events have been decreased? (yes or No)
- Glaciers are melting due to climate change and its size is reducing? (yes or No)

Almost 100% people are of the opinion that climate change has occurred in the region during the last four decades

Glacier and Snow Cover Mapping/ Monitoring

Batura Glacier

Biafo Glacier

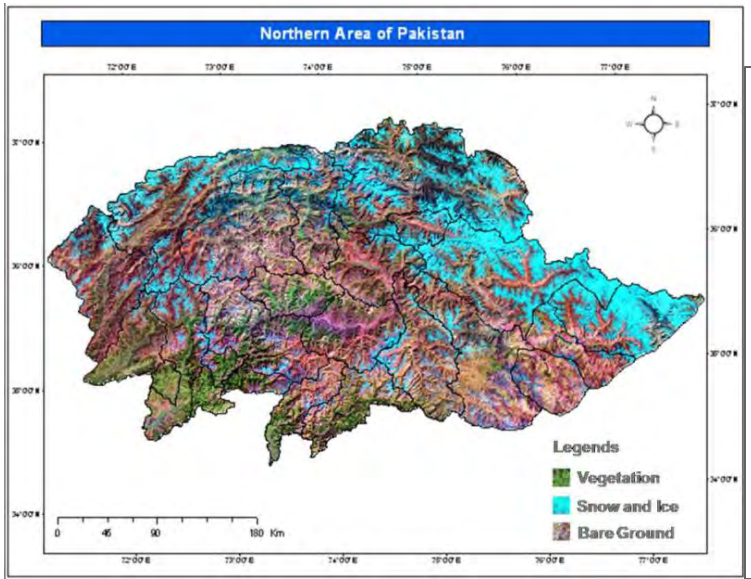
Yazghil Glacier

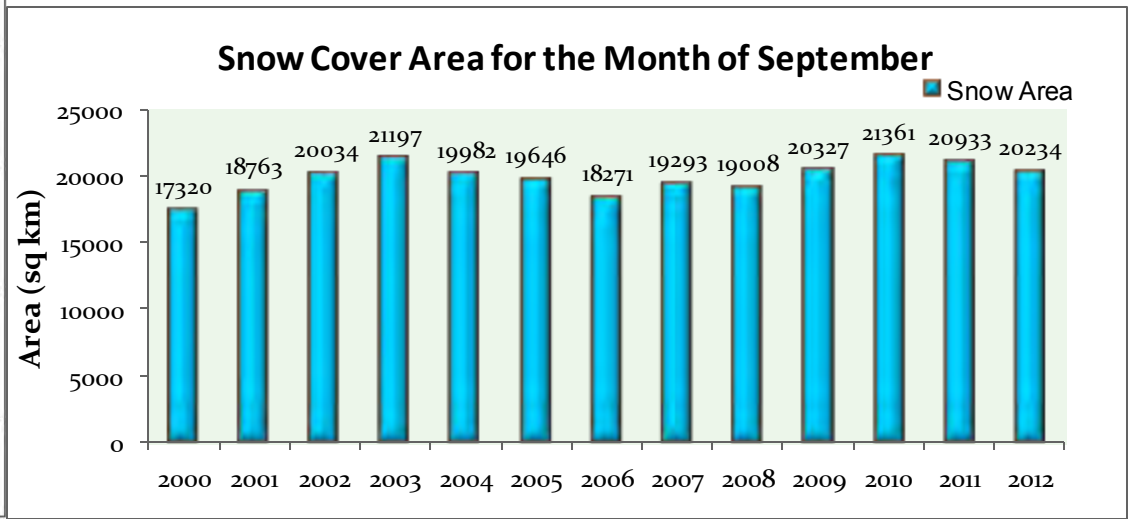
Jutmau Glacier

Passu Glacier

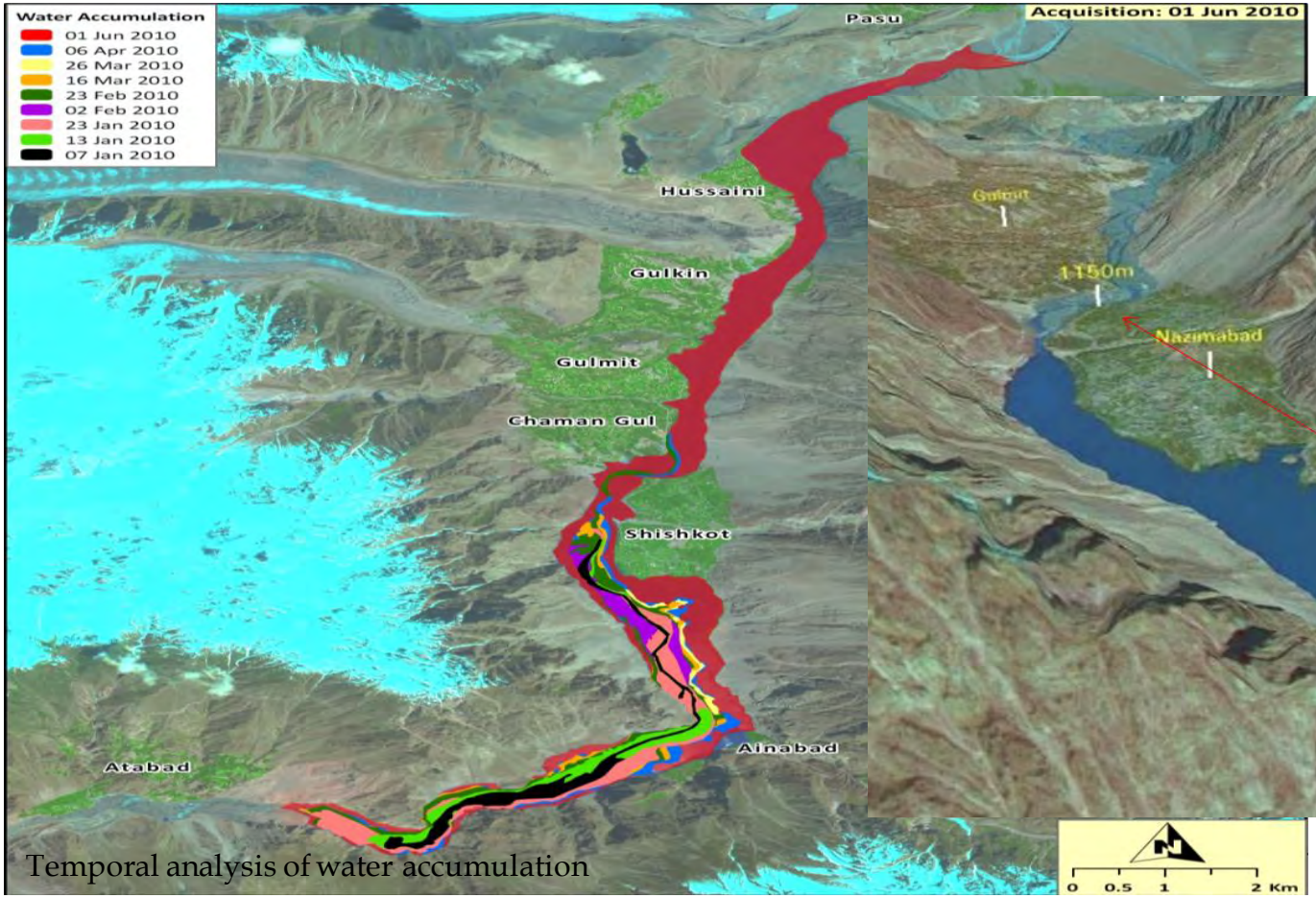
Ghulkin Glacier

Chong Khumdan Glacier





Hunza Landslide / Lake Formation – 2010



Temporal analysis of water accumulation

3D view of Attabad

Evaluation of Remote Sensing Techniques for Drought Study

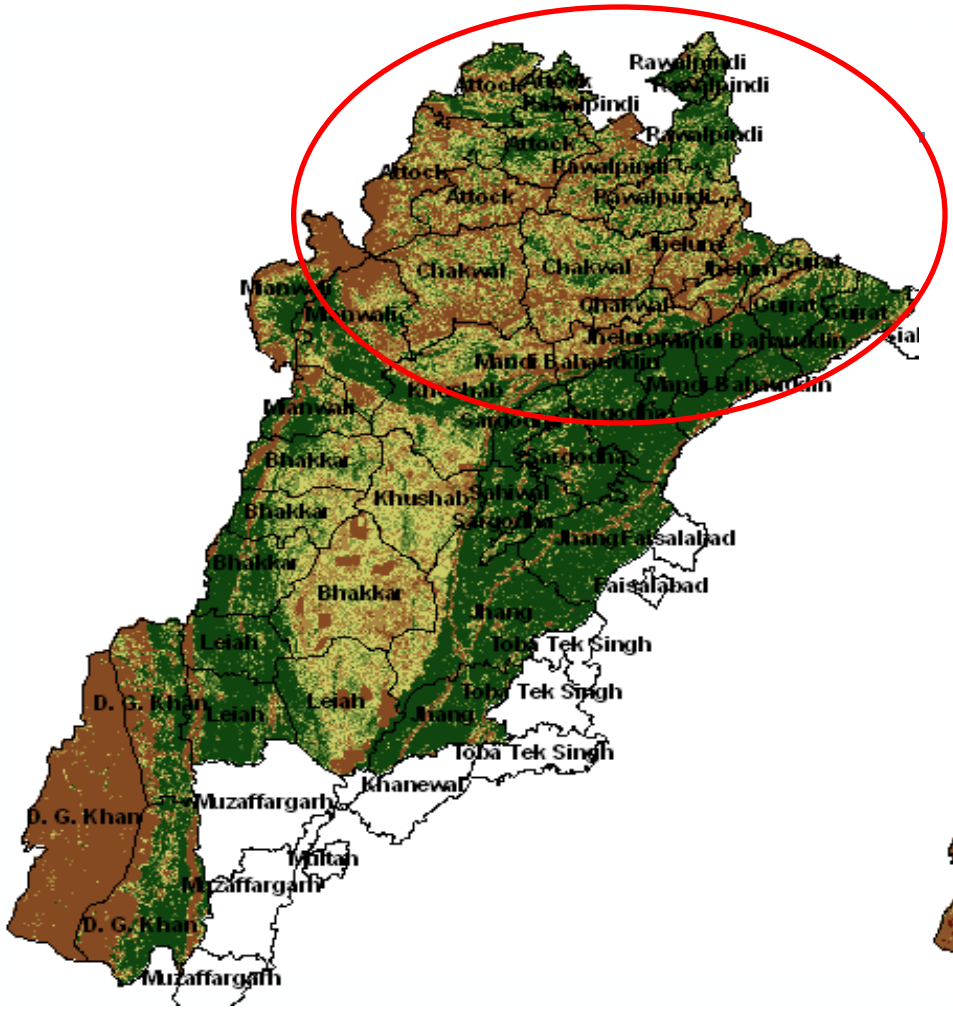
Objectives

- ✓ To integrate RS and GIS tools for the identification and monitoring of drought in rain fed areas of Pakistan
- ✓ Defining and evaluating different indices pertaining to meteorological data and vegetation
- ✓ Impact study of vegetation in rainfed areas as a result of drought
- ✓ Suggest possible strategies towards mitigation of drought related impacts

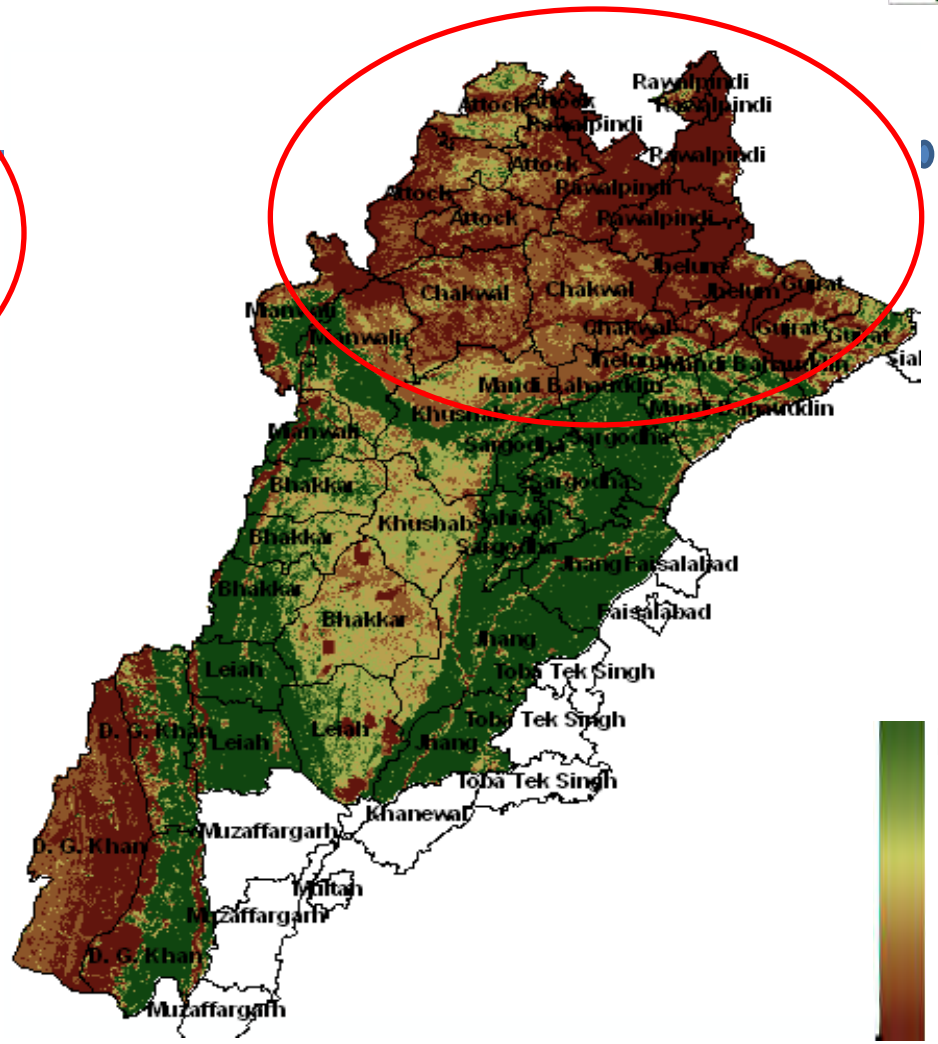
Benefits

- ✓ Sustainable agriculture practices and better food security arrangements
- ✓ Mitigating the effects of drought
- ✓ Drought vulnerable maps
- ✓ Scientific publications
- ✓ Capacity building

Satellite Based Drought Study



21-31Jan 2009



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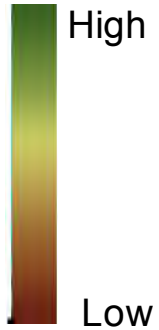
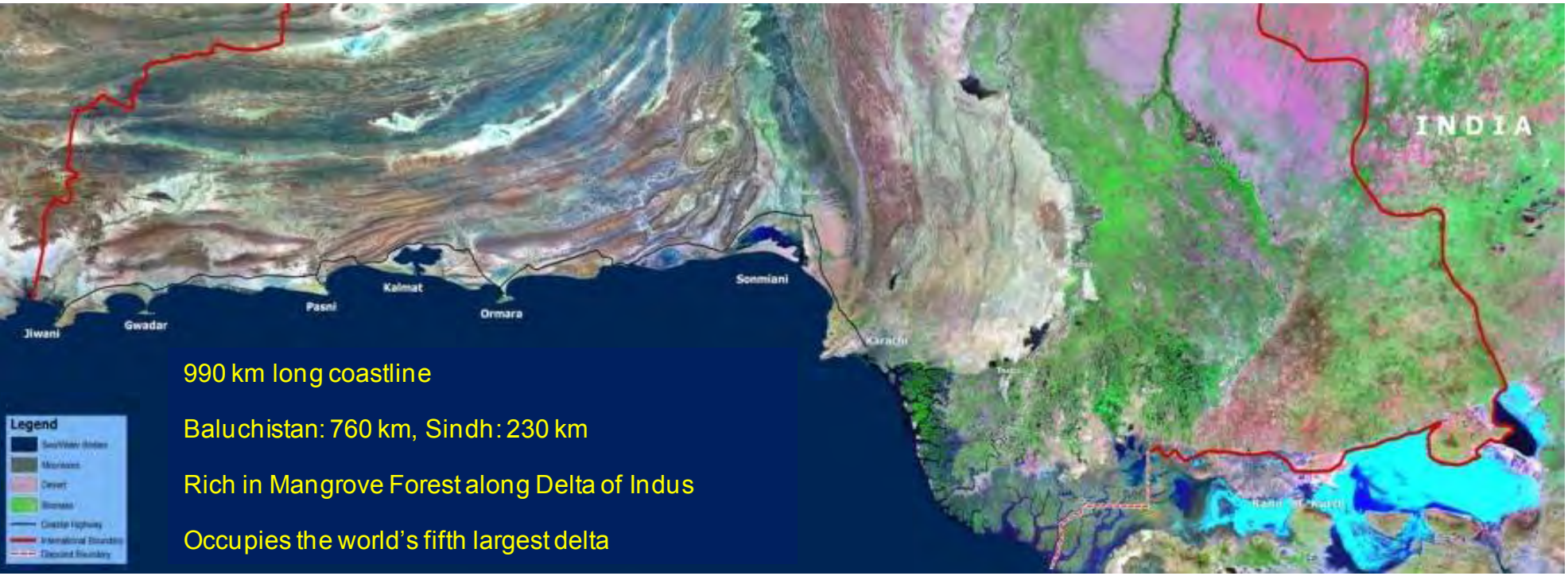
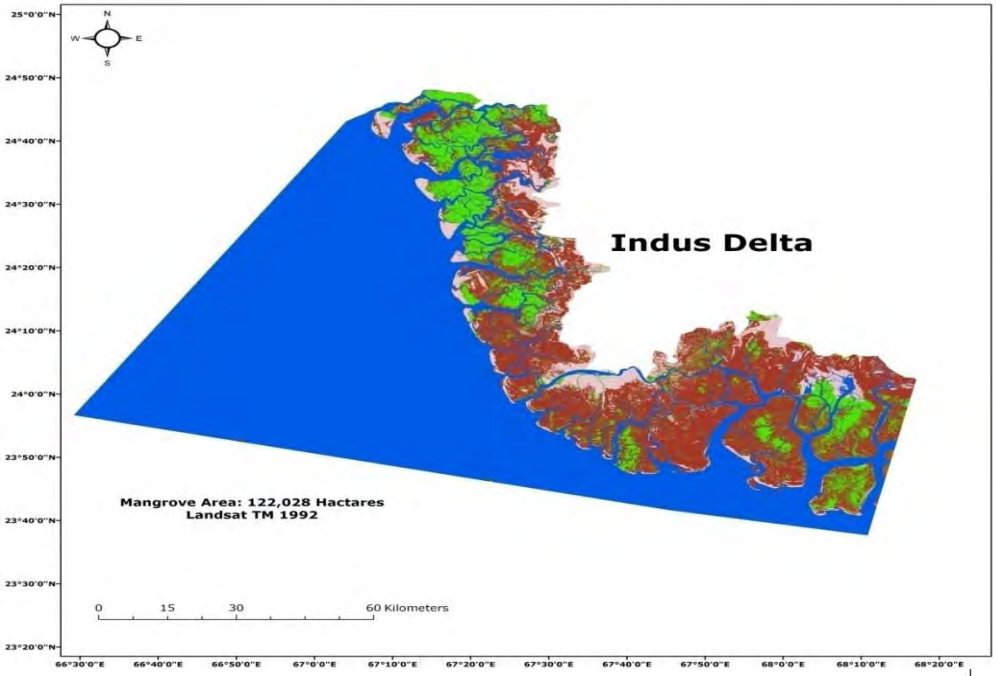


Coastal/Marine Study

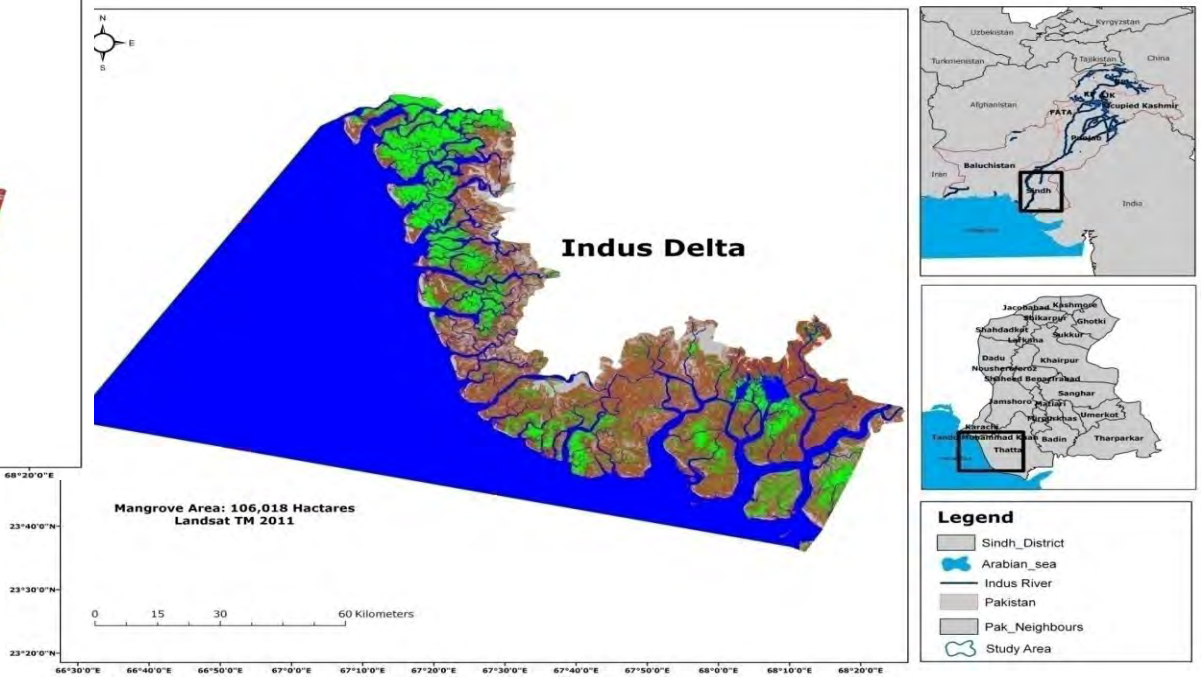


- Mapping of Mangroves Forest, Sea-grass and Mud
- Identification and digitization of creeks
- Training of concerned departments in Marine/coastal resource management
- Potential Fishing Zones EEZ
  - ✓ Sea Surface Temperature (SST) & Chlorophyll concentration

Mangrove Forest – INDUS DELTA



Mangrove classification of Indus Delta 1992



Mangrove classification of Indus Delta 2011

National Environmental Information Management System

- Temporal environmental monitoring application at national level.
- Analysis of dominant environmental changes covering different parameters such as; air pollution, water, biodiversity (agriculture, forest), desertification (water logging, salinity), sea surface temperature mapping and trend analysis .
- To detect changes in Landuse Categories, Agricultural Land, Forests and Natural Vegetation, Waterlogging and Salinity, Sand and Deserts Rocky areas, Water bodies, Settlements and Snow/Glaciers

Collaboration: **Ministry of Climate Change**

Digital Environmental Mapping of Urban Sindh

- Application of GIS, SRS and GPS technologies in assessing the existing situation of urban environment, climate, pollution, marine life, coastal areas, disasters, hazards, water resources, industries, etc eenvironmental planning in the Urban Sindh through assessment of environmental impacts of different human activities, making them compatible with the objectives of sustainable development.
- To have baseline information about the urban areas of Sindh province
- To provide SRS/GIS based facilities for future planning and analysis
- To provide the environment-related information to all the stakeholders

Sindh Environment Protection Agency

International Cooperation

Organizations

- UNESCAP / UNSPIDER/UNDP
- World Bank
- Chinese Academy of Sciences
- University of Salzburg, Austria
- JAXA /APRSAF

Objectives

- Bilateral and multilateral cooperation
- Joint research projects
- Capacity building and technology up-gradation
- Scientific & technical trainings

Training Courses/ Workshops

- UNESCAP Workshop on Developing Capacity for Resilience to Water related, March 2012

  Disaster in Pakistan through Space Application and Flood Risk Management, 1-4 March 2011, Islamabad, Pakistan
- Environmental Monitoring & Impact Assessment using S.R.S & Ground-based Techniques, April 2011
- Satellite Remote Sensing & GIS Applications in Marine Study, Karachi, July 2010
- Remote sensing & GIS Applications in Environmental Monitoring, Islamabad, 2010
- International Workshop on Applications of RS&GIS for Natural Resource Management, Nov 2009
- Short Training Course on Satellite & Ground Based Environmental Monitoring, Karachi, July 2009
- Short Training Course on Climate Change & Natural Resource Management, Lahore, July 2008
- Short Training Course on Satellite Remote Sensing Using Coarse Resolution Data, Dec 2008
- Short Training Course on Atmospheric Science, Karachi, July 2007
- Climate Change & its Impacts on Natural Resources, Peshawar, March 2006

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Conclusion & Recommendation

- Over the years, Pakistan made some sporadic efforts related to climate change mitigation & adaptation, but a concerted policy & strategy framework is required
- To cope with effects of climate change, early warning systems & allied information systems are required to be made more effective to enhance disaster preparedness
- Measures for improving forest management & biodiversity conservation should be taken
- Appropriate climate change policy should be adopted into development planning at all scales, levels & sectors
- Farmers should adjust their crop calendar
- New varieties of wheat, rice and sugarcane should be introduced, which mature faster, survive in unexpected rains and prolonged drought

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Conclusion & Recommendations

- Modern technologies can be effectively utilized to minimize the effects of disasters
- Capacity should be developed in making use of specialized tools in satellite image processing for disaster risk mapping
- Community should be involved in the decision making, planning & implementation process for sustainable solution
- The support provided by international community in the event of disaster is greatly appreciated
- Appreciations are due to international originations for their continuous support in monitoring & mapping damages thru provision of timely data & satellite images

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Thank You