

Pakistan's Space Activities for Socio Economic Uplift

AGENDA 6: SPACE TECHNOLOGY FOR SUSTAINABLE SOCIO ECONOMIC DEVELOPMENT

PRESENTED AT 57TH SESSION OF STSC;

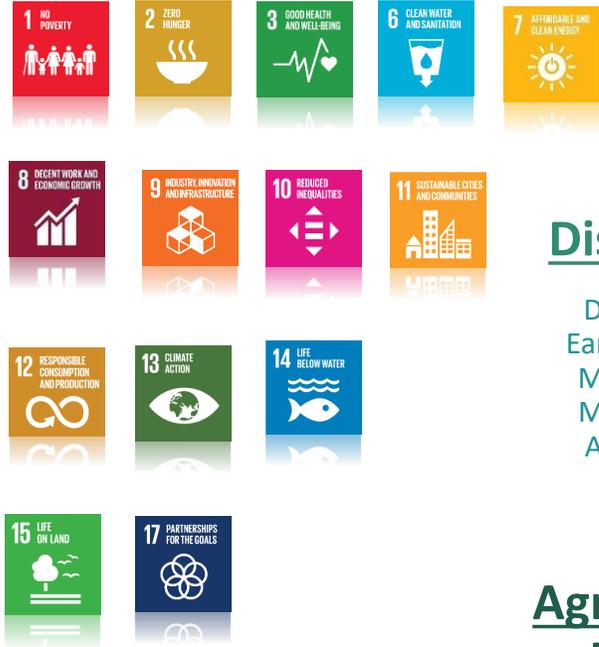
3- 14 FEB 2020; VIENNA, AUSTRIA

Pakistan's Space Program

- Pakistan attaches great importance in utilization of space based assets and their application for achieving objectives of sustainable development goals
- SUPARCO, being the National Space Agency of Pakistan is determined to utilize and promote the use of space technology and its applications for achieving sustainable development targets

Contribution of Space Technology in Socio Economic Development of Pakistan

Socio-economic Services



Environmental Monitoring

Monitor and manage forest assets and operations, deforestation, Detect / analyze change over time for reporting / inventorying, Monitoring of Fog / Smog patterns, Fire location identification

Disaster Management

Disaster Damage Assessment, Earthquake, Flood Modeling and Monitoring, Drought Mapping, Multi-Vulnerability Hazard Risk Assessment, Reconstruction / Rehabilitation

Agriculture and Landcover

Crop Estimation and Monitoring, Land suitability analysis, Farm water & fertilizer management, Support to crop insurance and agriculture loan monitoring programs, Domestic food security

Hydrology

Mapping and monitoring health of watersheds, water bodies, Identification / Check of dam sites, Surface water resources estimation, Snowmelt, rainfall and river runoff modeling,

Sustainable Development & Urban Planning

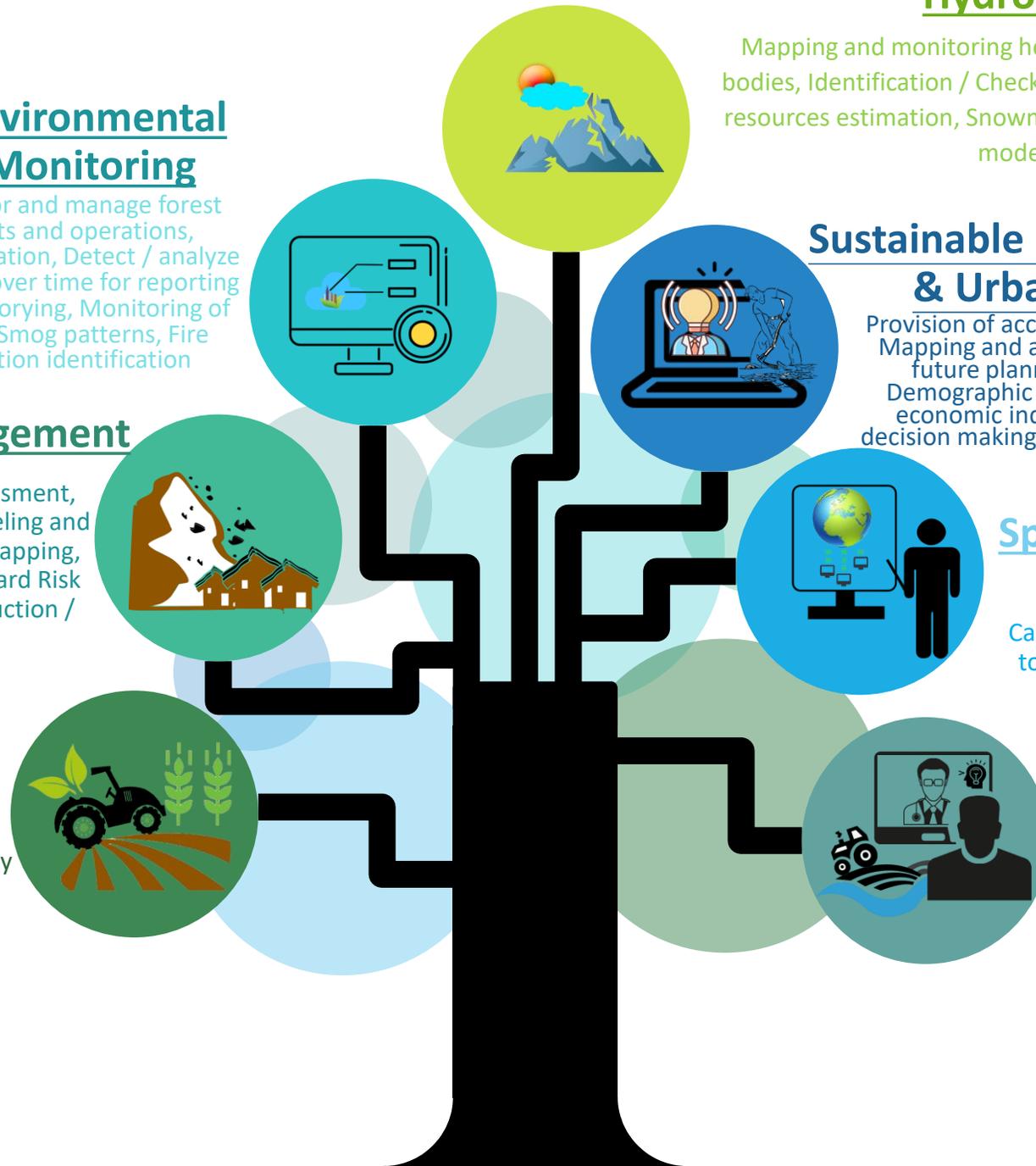
Provision of accurate location information, Mapping and analysis of ground data for future planning and development, Demographic mapping based on socio-economic indicators for planning and decision making, Encroachment monitoring

Space Awareness Program

Capacity Building, Outreach to academia and students

Others

Telemedicine



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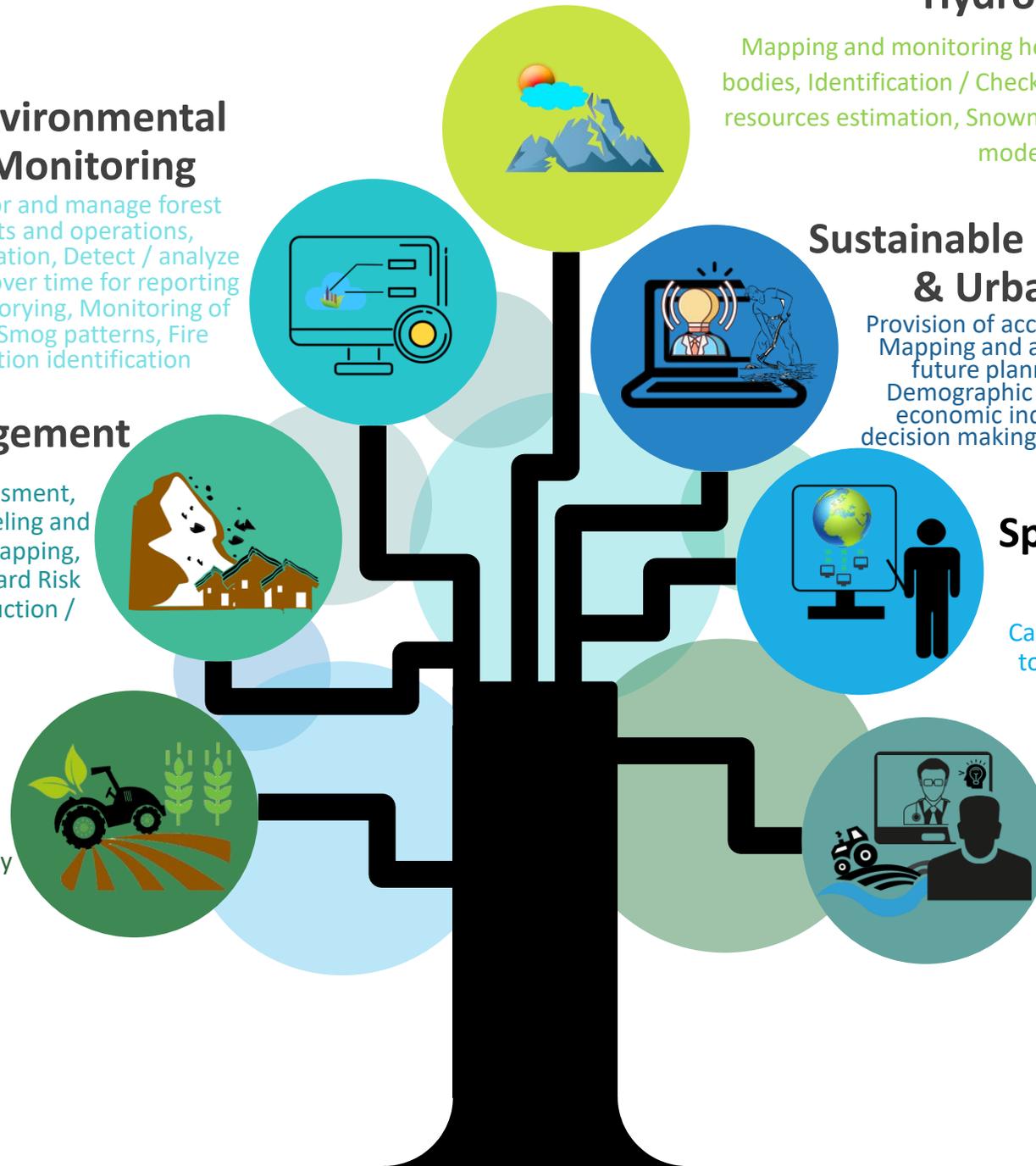
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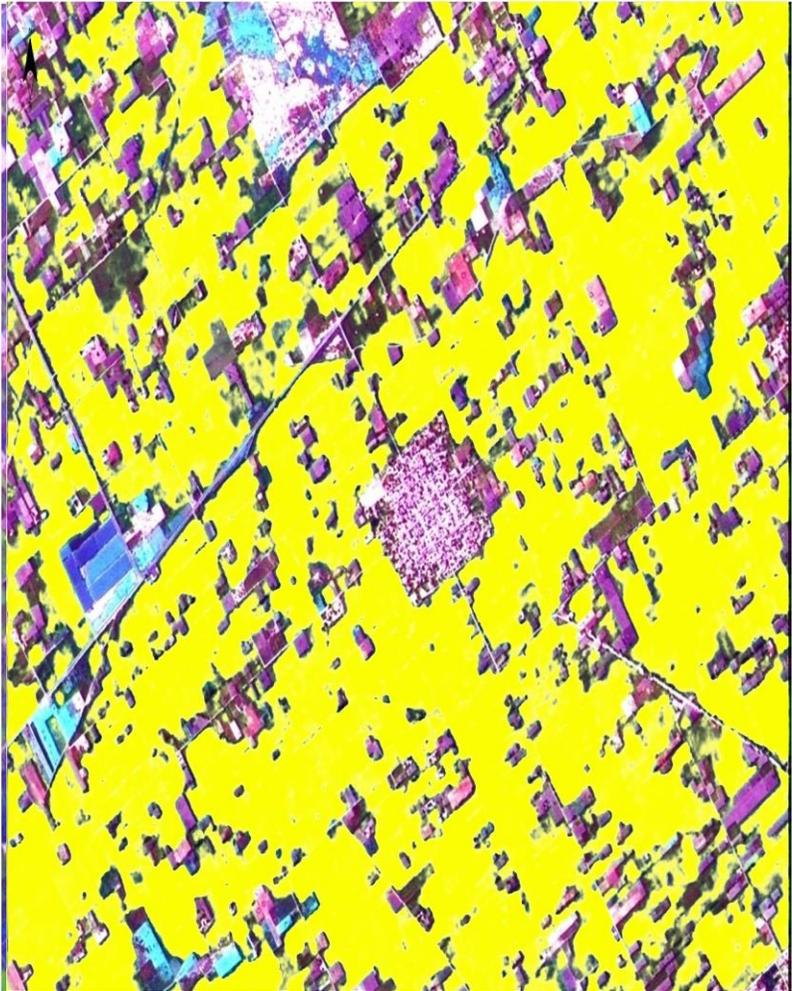
Others

Telemedicine



Crops Monitoring

Rice Crop Mask



Rice Crop Mapping



2 ZERO HUNGER

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Rice Area (Ha)	643.1
Avg Rice Yield (Kg/Ha)	2619
Production (Tons)	1684.3

PAKISTAN AGRICULTURE INFORMATION SYSTEM CROP Information Portal



Portal View Government

Crop Data Agri-Variables Pests/Diseases Water Resources

Water Pests Crop Status Crop Report

Output Type: Table Chart Map

Season: Kharif (Nov-Apr) Kharif (May-Oct)

Area of interest:

Type: Province District Taluka

Mode: Composite Comparison by Region Comparison by Commodity Comparison by Source

Commodity: Wheat

Chart Type: Values Anomalies Anomalies (%)

Reference Year: 2012

Range: 2000 2012

Production: 000 tons

Area: 000 hectares

Yield: t/ha

Credits

Map

Full Screen

Layers Legend HELP

- Default
- Admin
 - Labels
 - Populated Places
 - District Boundary
 - Provincial Boundary
- Water Bodies
 - Lakes
 - Reservoirs
 - Canals
 - Rivers
- Transportation
 - Roads
 - Highways
- Hydrology
 - Inflow River
 - Rivers
- Land Cover
 - Land Cover
 - DecOver 2000
 - DecOver 2005-09
 - Land cover 2000
 - Land cover 2010
 - Crop Week
- Topography
 - Contours 1000ft
- Flooding
 - Flooded Areas 2010
 - Flooded Areas 2011
 - Flooded Areas 2012
- Background
 - None
 - Administrative
 - Google Roadmap
 - Google Hybrid
 - Google Terrain
 - Open Street Map
 - MapQuest Open Streets

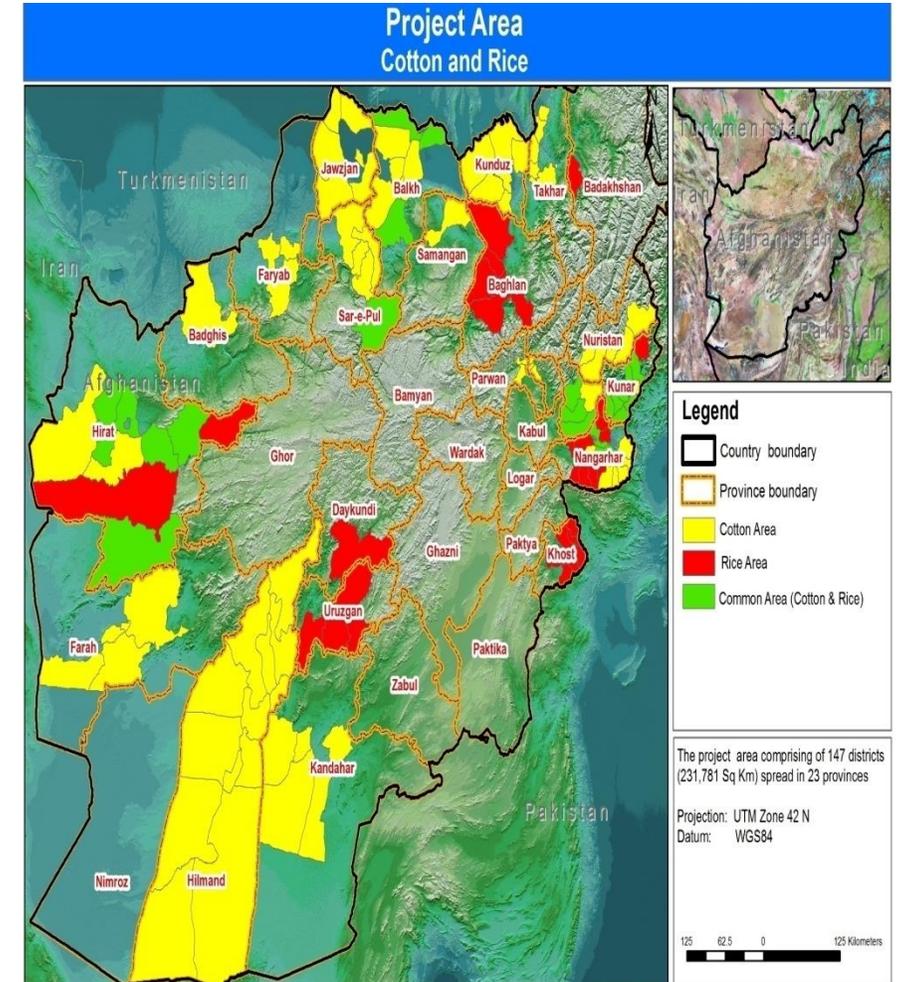
Free Sources of Data

Scale: 1:8730642

Case Study Afghanistan: Monitoring of Rice & Cotton Crops



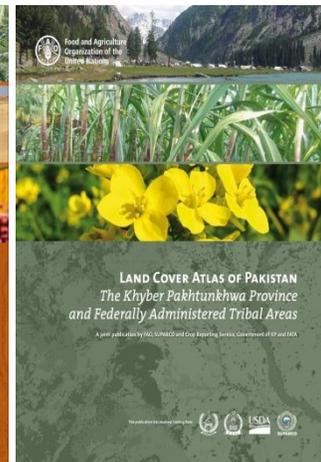
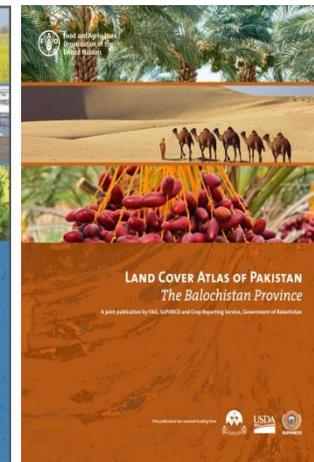
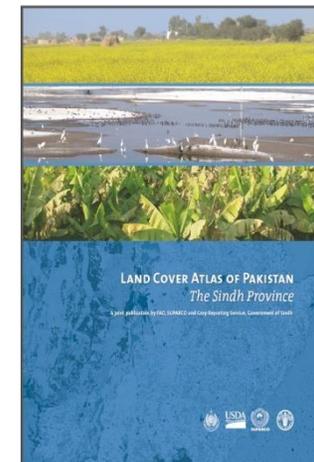
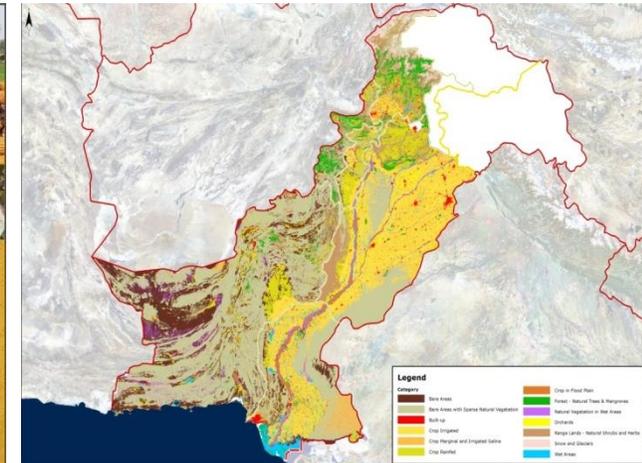
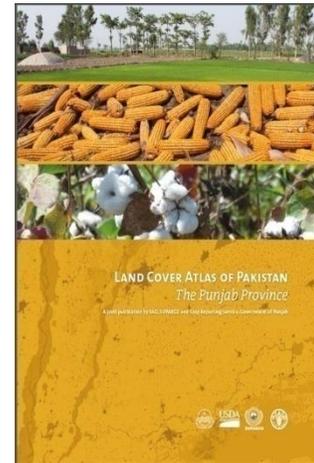
- The FAO-UN asked SUPARCO to carry out a pilot project (3 provinces & 5 districts) for monitoring of rice crop using satellite remote sensing and GIS technologies
- Later, the FAO-UN asked for monitoring of rice & cotton crops using satellite remote sensing and GIS technologies in 23 provinces



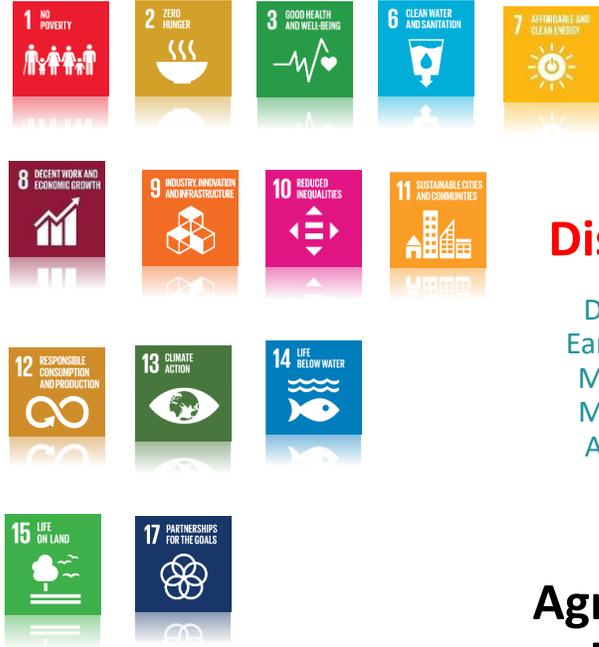
Land Cover Mapping

Accurate land cover information of the Balochistan, Punjab, Sindh & KP has been developed for:

- Planning & development
- Agriculture
- Disasters & hazards monitoring
- Forest management
- Water resources
- Irrigation
- Geological surveys



Socio-economic Services



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Sustainable Development & Urban Planning

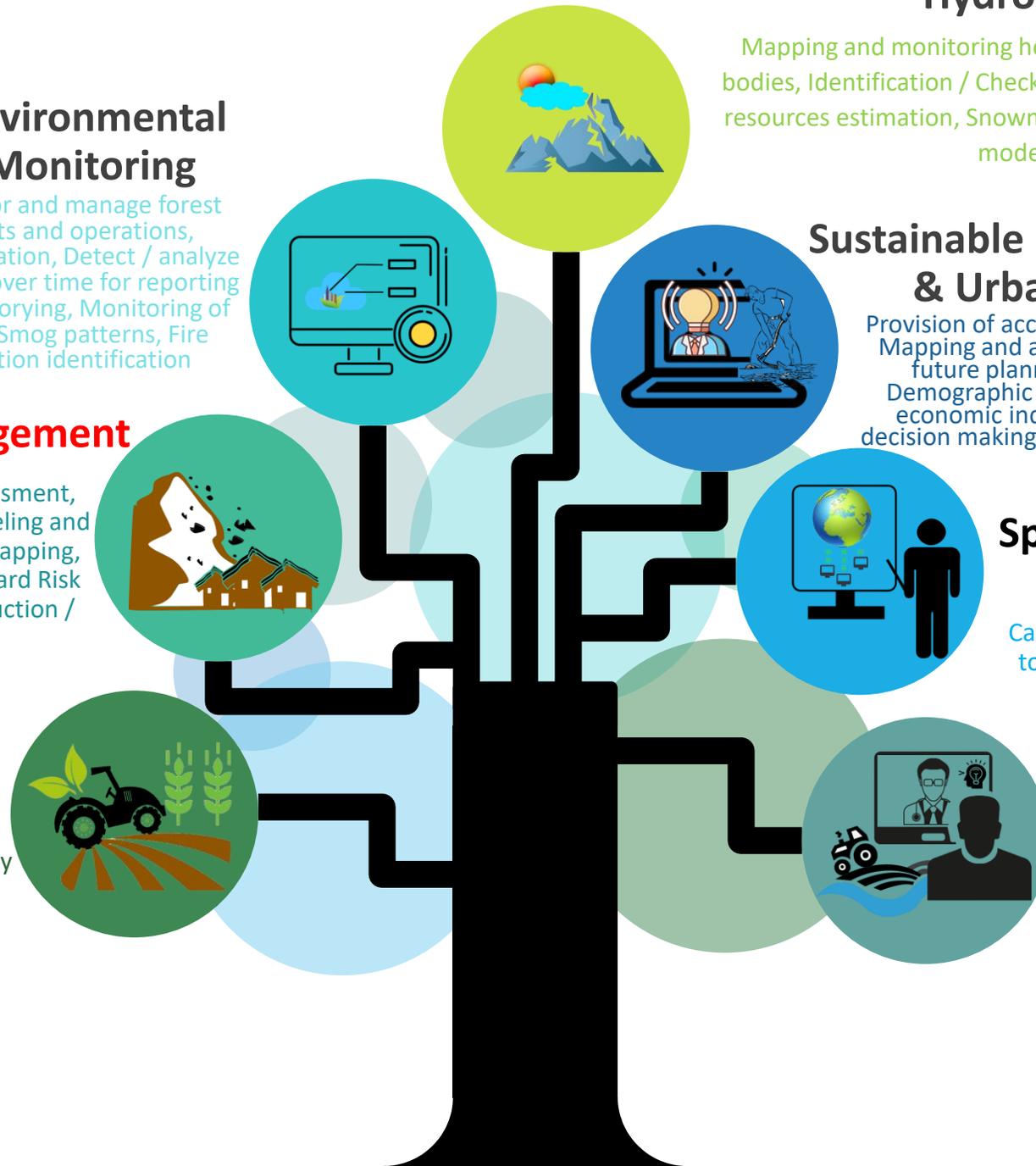
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Space Awareness Program

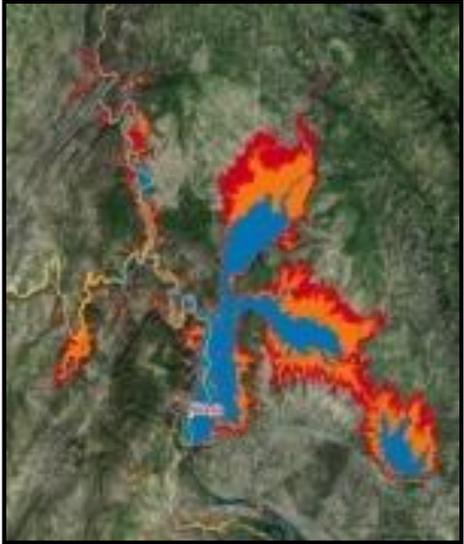
Capacity Building, Outreach to academia and students

Others

Telemedicine



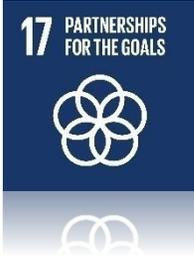
Disaster Management



SUPARCO has been providing assistance for,

- Disaster Damage Assessment
- Flood Modeling and Monitoring
- Drought Mapping
- Multi-Vulnerability Hazard Risk Assessment
- Reconstruction / Rehabilitation

Space Applications Center for Response in Emergency and Disasters



- The centre provides space based information to Federal & Provincial disaster management agencies to rapidly assess the extent of natural disasters and damages
- Center is also host to **UN-SPIDER** Regional Support office in Pakistan and provides assistance to regional countries in case of natural disasters



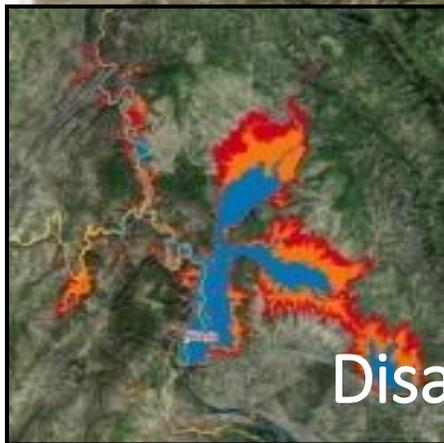
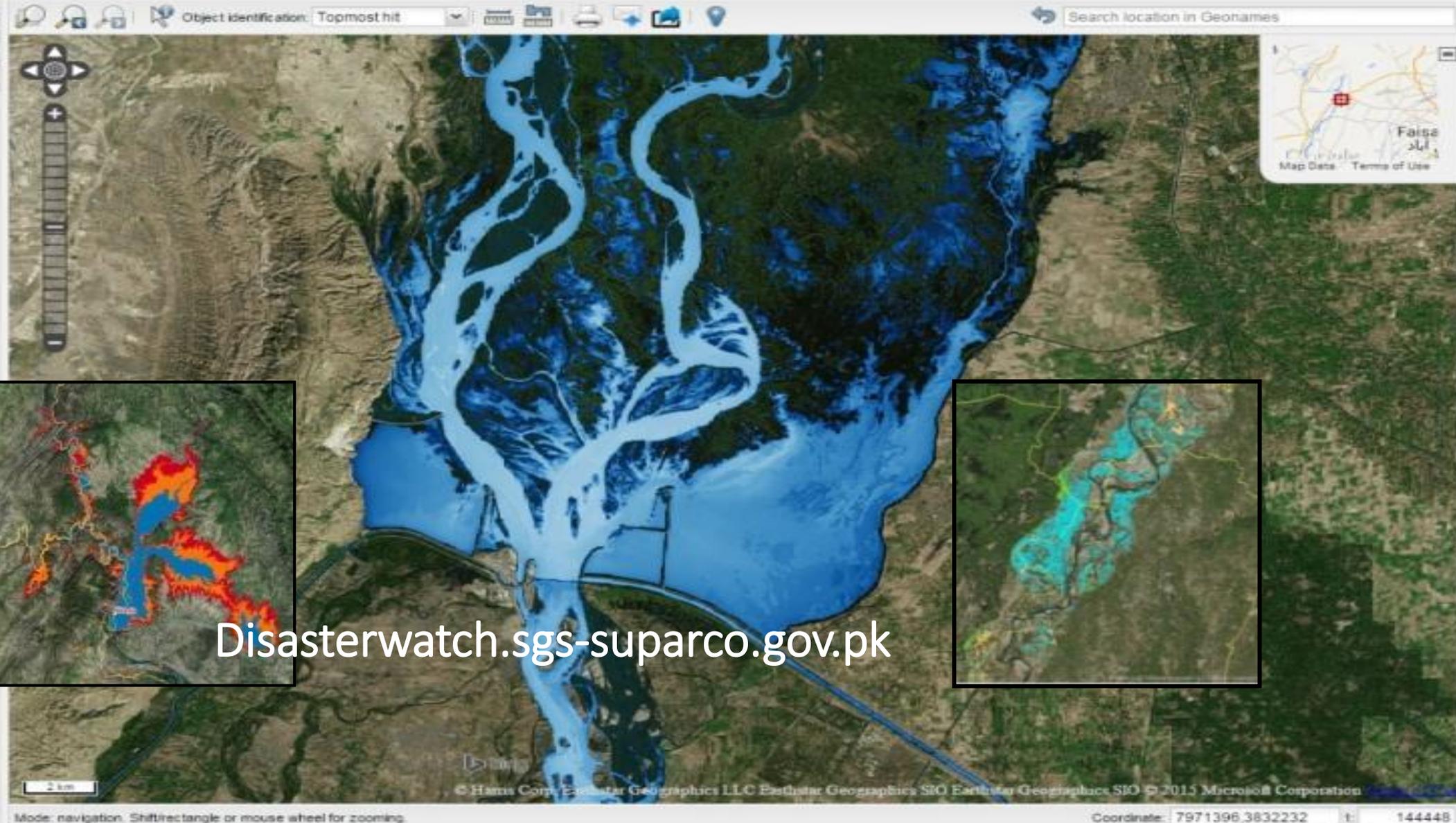
Info and Tools

Map

Map Layers

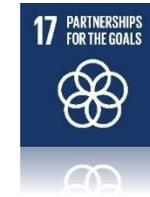
- Disasters
 - Floods
 - EarthQuakes
 - Drought
- Background Layers
 - Google Satellite
 - Google Physical
 - Bing Aerial
 - Bing Aerial with labels
 - OpenStreetMap
 - Aks-e-Pakistan

Layer order



Disasterwatch.sgs-suparco.gov.pk

Recommended Practices for UN-SPIDER Knowledge Portal



Recommended Practice: Flood Hazard Assessment

Recommended by: SUPARCO

Objective: The objective of this practice is to carry out a flood hazard assessment, identify potential flood-prone areas and potentially affected infrastructure (namely roads, settlements, agriculture and inland areas etc.) against a flood hazard of particular return period (i.e. 2, 5, 10, 25, 50 and 100 years). This information can be used by disaster management agencies and other stakeholders to plan flood rescue, relief and mitigation activities.

Disaster type: Flood

Disaster Cycle Phase: Mitigation / Preparedness

Test Site: River Indus (Chashma Barrage D/S to Taunsa Barrage U/S)

Context: The practice was initially applied to the 2010 floods in the Swat River, Pakistan, and was later on used for probabilistic flood hazard assessments in the Swat valley, Pakistan.

Applicability: This practice can be applied to the two dimensional (2D) riverine flood events having unsteady flow dynamics in any part of the world. However, calibration parameters may vary within country or region due to the river bed and floodplain geomorphology.

Related Practices: Flood Mapping and Damage Assessment using S2 Data

Related data: WorldDEM™

Related Software: HEC-RAS Hydrologic Engineering Centers River Analysis System (US Army Corps of Engineers)

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FLOOD HAZARD ASSESSMENT

Flood Mapping and Damage Assessment using S2 Data

Recommended by: SUPARCO

Objective: The objective of this practice is to identify the extent of a flood as well as the affected infrastructure such as roads and settlements and inland areas of interest for example agricultural regions. This information can be used by disaster management agencies and other stakeholders to undertake the rescue and relief activities in affected areas.

Disaster Cycle Phase: Recovery & Reconstruction / Relief & Response

Main Hazards: Flood

Test Site: Fitzroy River at Rockhampton, Queensland, Australia.

Context: The practice developed by the "Space Application Centre for Response in Emergency and Disaster" of SUPARCO (Pakistan) was initially applied to the flood event in Punjab (Pakistan) in July 2010. Thereafter, it was used annually for river monitoring during monsoon season. The extraction of the flood extent was applied to the river Jhelum upstream of Timaru Barrage, while the map generation covered the River Indus and its tributaries in Punjab, Pakistan.

Applicability: Part A of this Recommended Practice can be applied to most flood events around the globe. The flood inundation is extracted from Sentinel-2 visible bands at 10 meters spatial resolution. The method can therefore only be applied for satellite scenes with little to no cloud cover. Part B then maps and quantifies the flood affected and damaged areas and can be applied to all satellites that are being included in the analysis.

Related Practices: Flood Hazard Assessment

Related data: Sentinel-2 - Imagery

Related Software: Quantum GIS

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Submitted by: Patricia Zundtsohn on Mon, 27/06/2018 - 15:00

FLOOD MAPPING AND DAMAGE ASSESSMENT

Recommended Practice

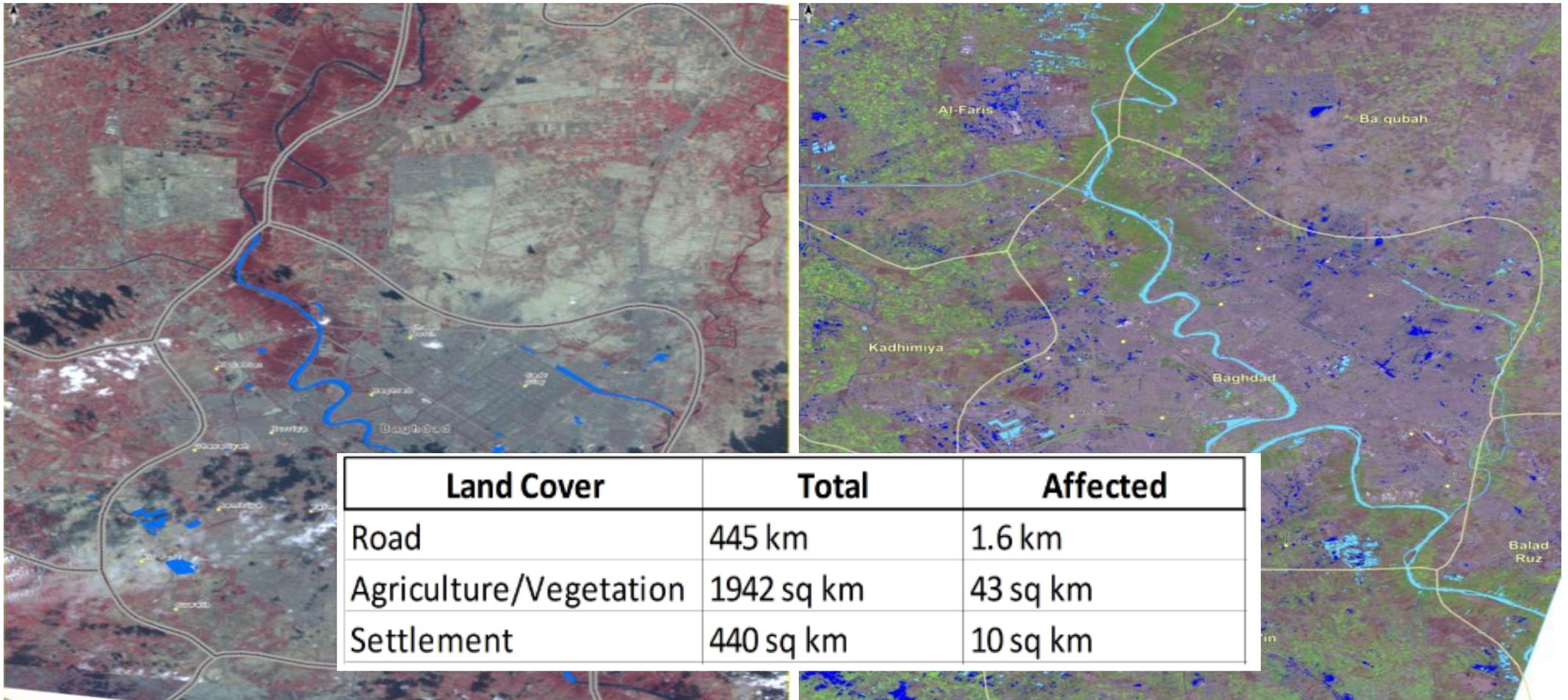
Flood Hazard Assessment and mapping – 2D flood Model

SPACE APPLICATION CENTER FOR RESPONSE IN EMERGENCY AND DISASTER SUPARCO

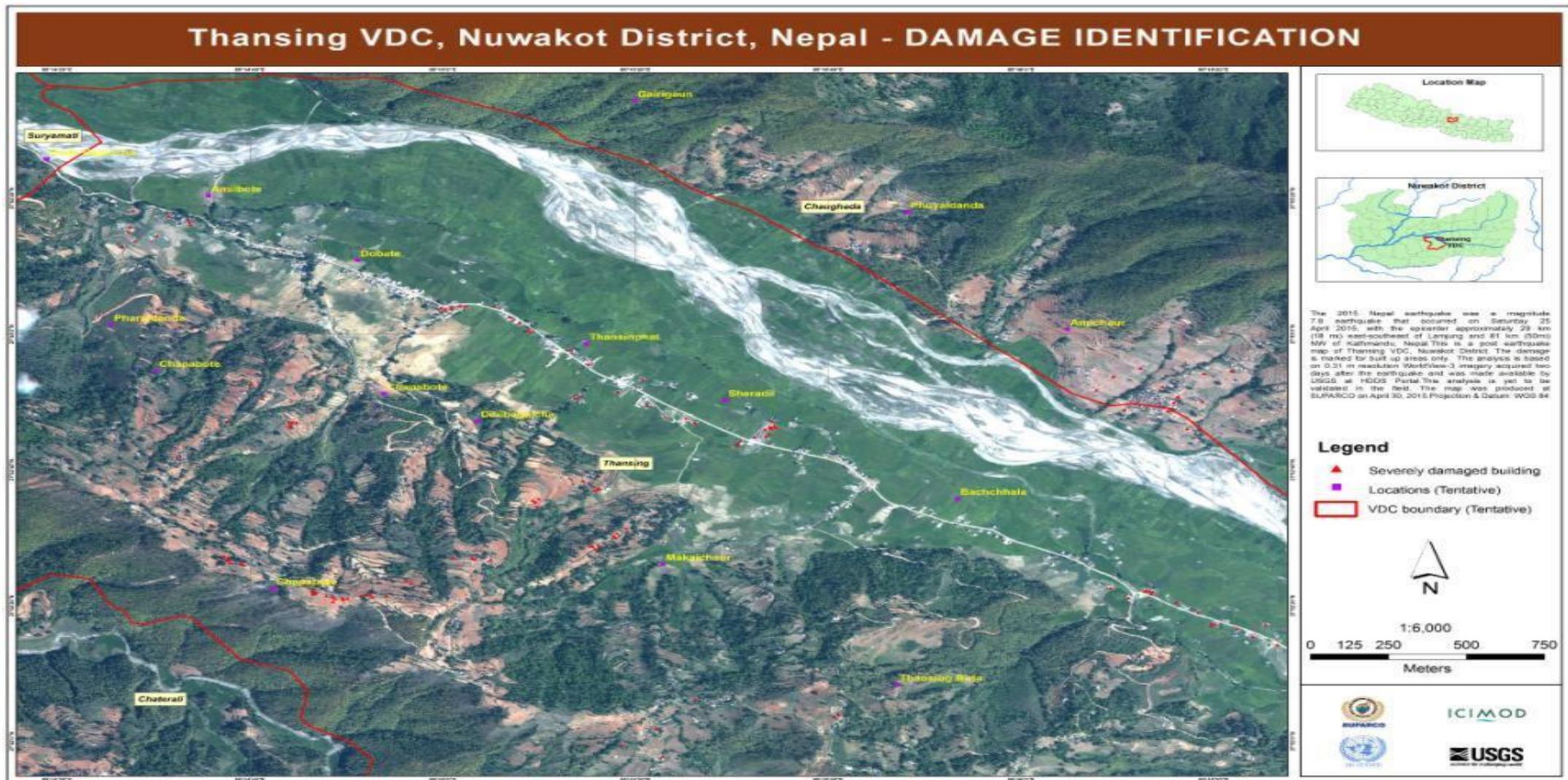
DROUGHT HAZARD ASSESSMENT

Disaster Management

IRAQ FLOOD



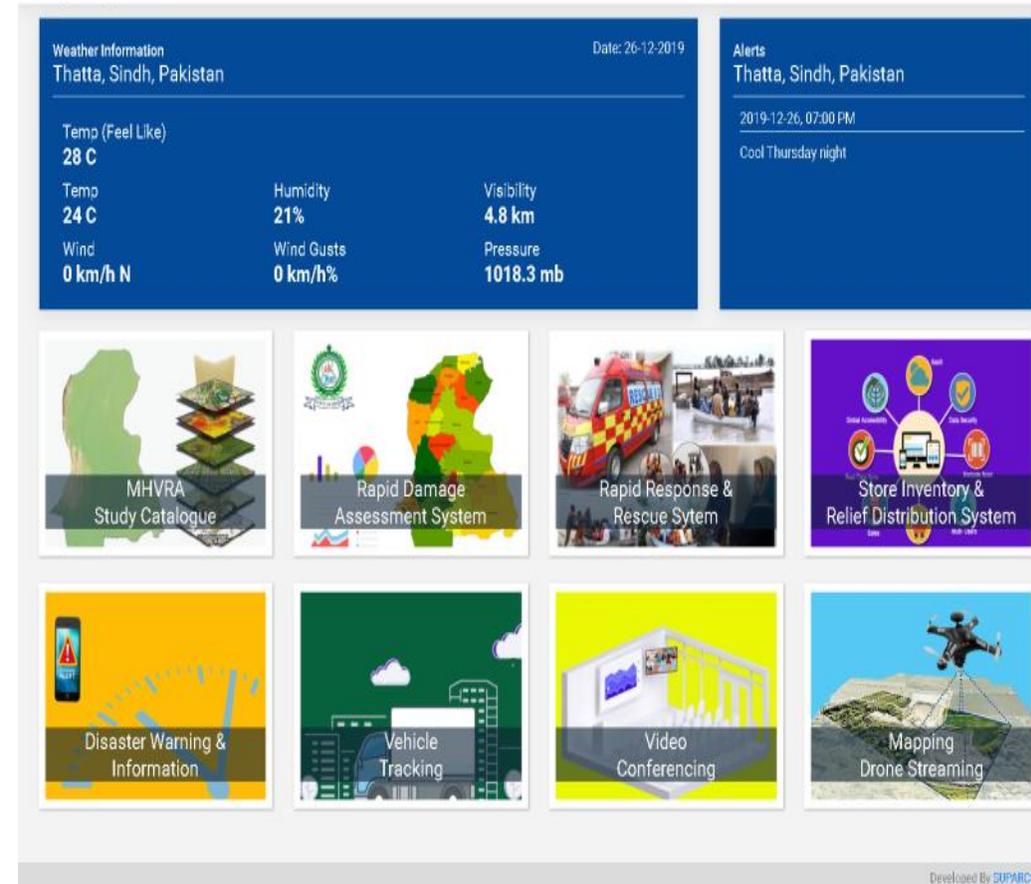
Disaster Management – Nepal Earthquake



National Catastrophic Model

- National Catastrophic model of Pakistan is under development using Satellite Technology
- Multi Hazard Vulnerability Risk Assessment (MHVRA) Informed Disaster Management Plans and Disaster Management Information System is being prepared for following natural disasters in first phase :-
 - Floods, Droughts, Tsunami
 - Cyclone and Storms
 - Heat Waves
 - Earthquakes

Disaster Management Information System PDMA, Sindh, Pakistan



Intl Collaborations in Disaster Management



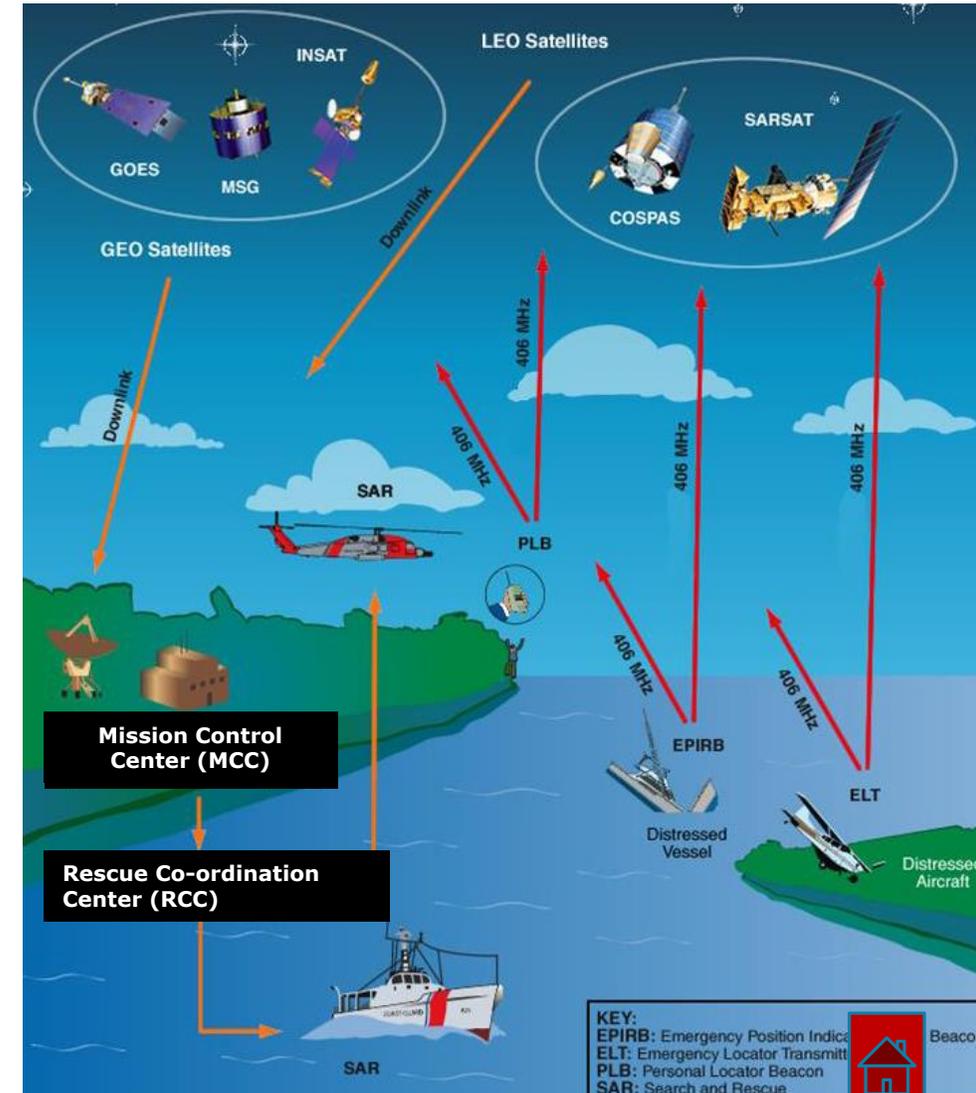
- SUPARCO is host to UN-SPIDER Regional Support office in Pakistan
- SUPARCO is the Authorized User (AU) of the International Charter Space and Major Disasters on behalf of NDMA
- SUPARCO is a member of JPTM-3 project of Sentinel Asia and is registered as Data Analysis Node (DAN)
- SUPARCO is also Member of APSCO Disaster Management Framework



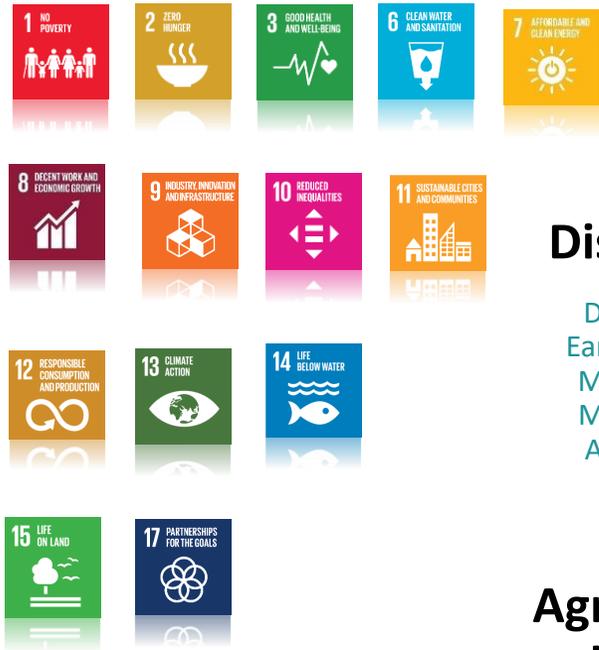
Search and Rescue Program – COSPAS SARSAT

Satellite based system to receive data from Medium Earth Orbit Search and Rescue (MEOSAR) satellites. The benefits are:

- Improved location accuracy, speed and reliability of detection and location 406 MHz
- First Burst Detection followed by Continuous Detection of Location
- Return Link Service
- Presently 6 LEO satellites to be augmented by 70 MEO satellites



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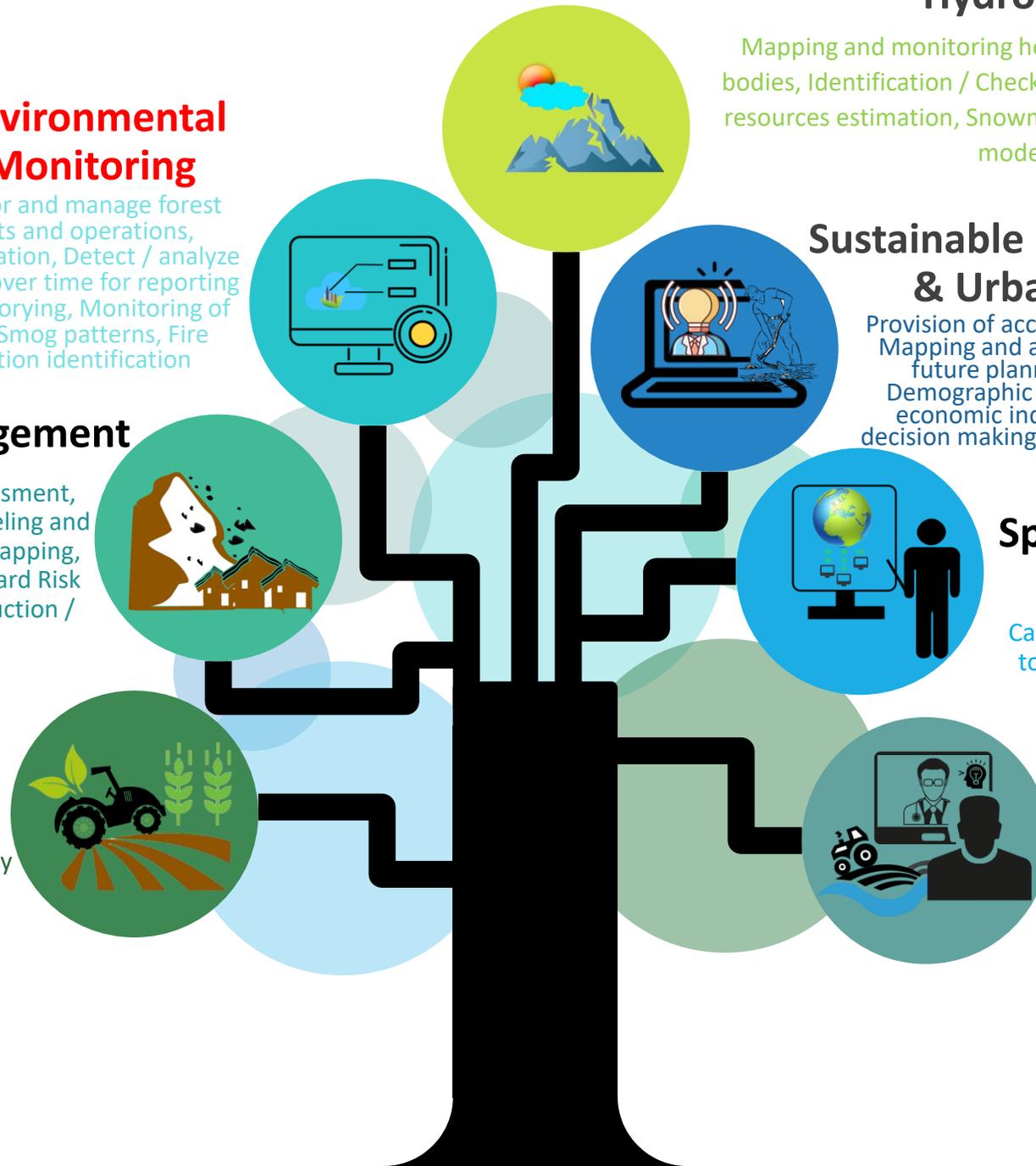
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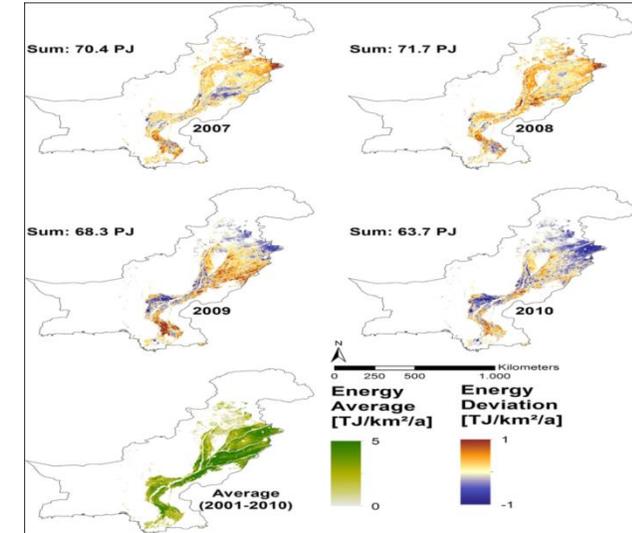
Others

Telemedicine



Environmental Monitoring

- Monitoring of glaciers and conducting research studies / expeditions
- Monitoring of Fog / Smog patterns, origin and its impact
- Development of baseline environmental profile and compilation of emission Inventory
- Environmental Impact Assessment for industries and power plants
- Support in policy formulation



Important Facilities / Labs



SUPARCO Air Monitoring Mobile Laboratory



Atmospheric Chemistry Lab



Smart Air Quality Mobile Lab

Satellite Based Glacier Research Studies



- SUPARCO has been monitoring Glaciers of Pakistan using Satellite Technology
- Carried out multiple expeditions with ITP-CAS
- Glacial hazards monitoring and mapping
- Atmospheric and Hydrology studies
- Aerosols and Gaseous Pollutants Data Collection
- Water Quality and Hydrology Studies



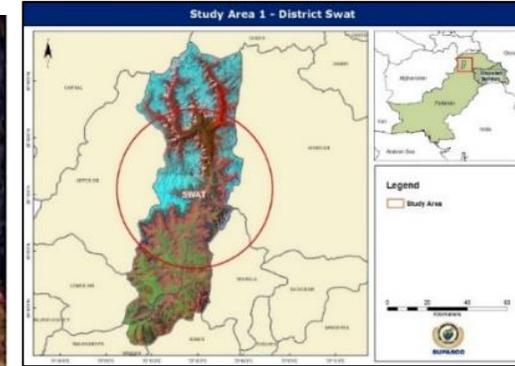
Forest Monitoring

- Identification of areas suitable and available for forestation
- Monitor survivability and provide timely input to improve afforestation
- Assess the spread and impact of any disease

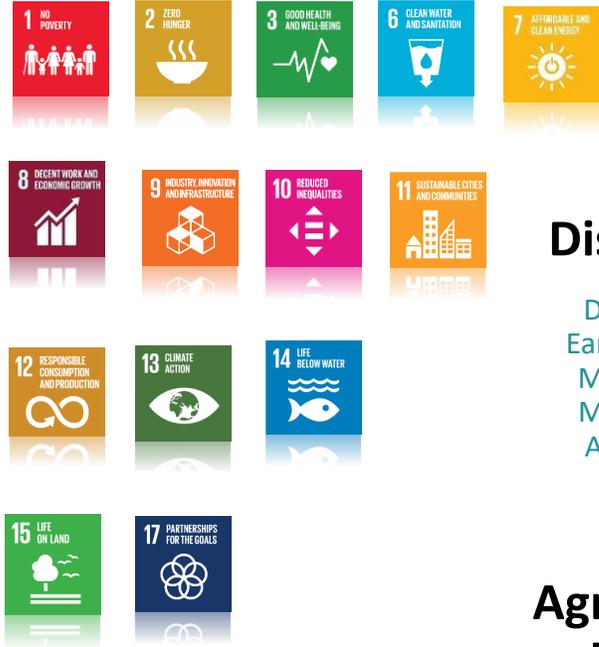


Forest Carbon Stock Assessment Using Geospatial Technologies

- This is a collaborative project with APSCO (Pakistan as a lead country) having intangible benefits in the form of capacity building of SUPARCO officials on advance satellite datasets and technology
- The project will help to strengthen SUPARCO capacity in qualitative as well as quantitative assessments of forest carbon stocks



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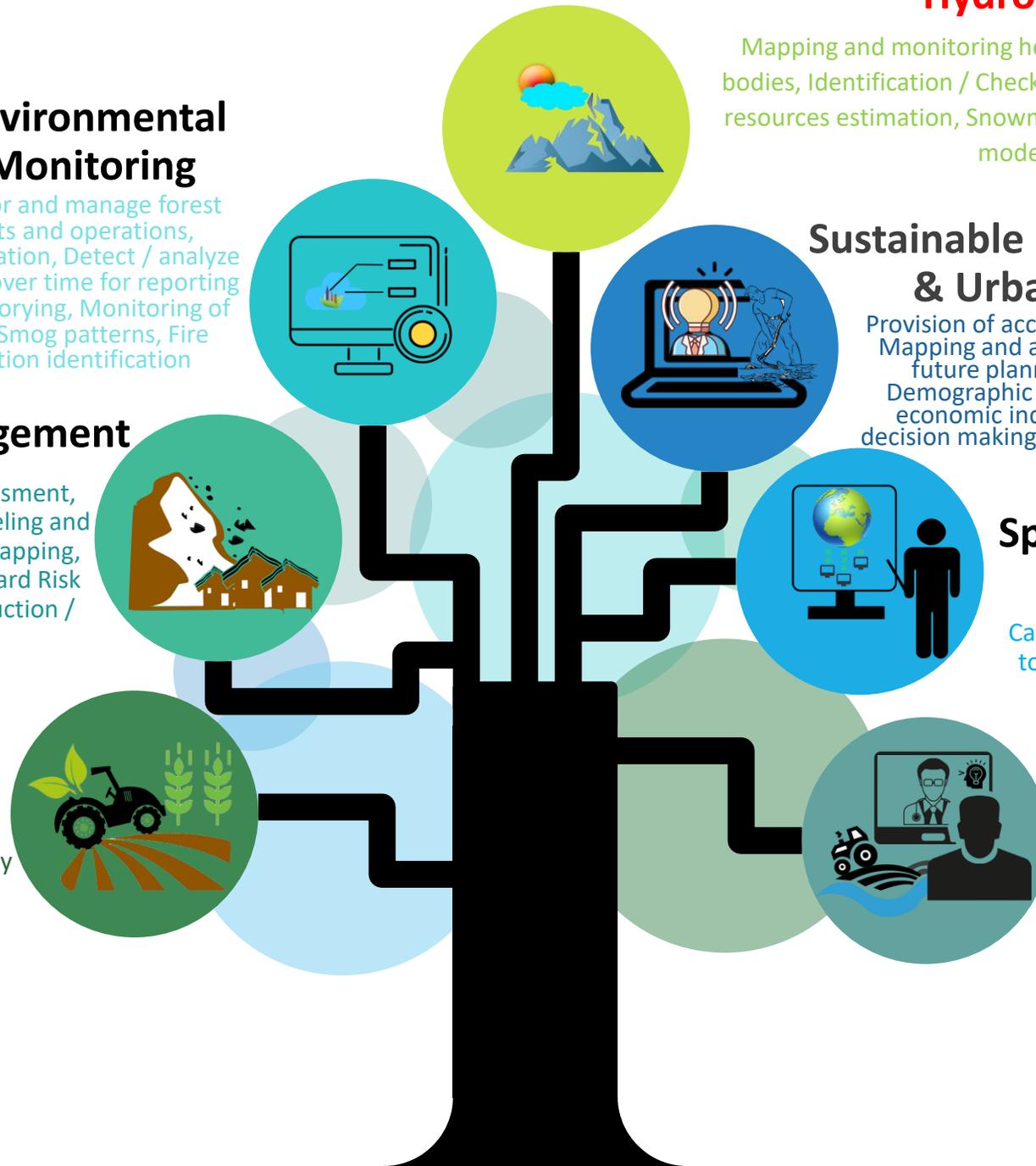
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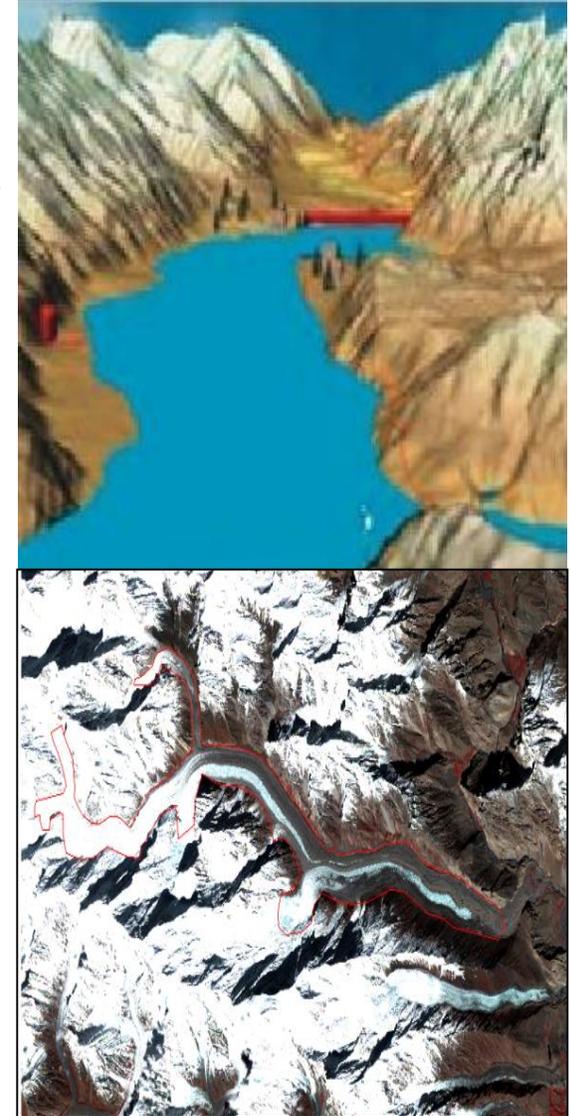
Telemedicine



Hydrology

Satellite data is being used for:-

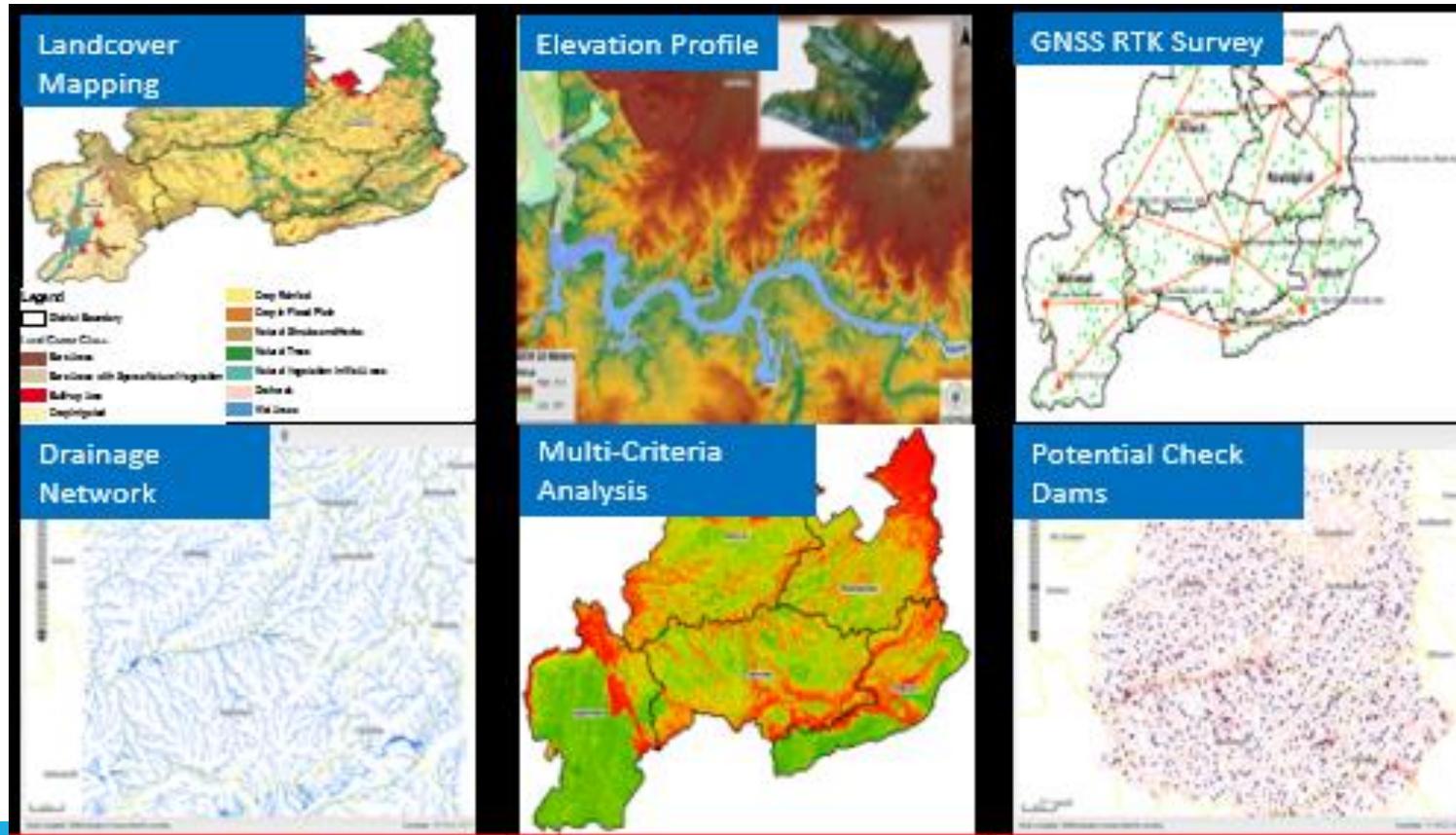
- Mapping and monitoring health of watersheds, water bodies, and hydro systems both in country and trans-boundary regions
- Identification of Small / Check dam sites
- Water harvesting identification
- Surface water resources estimation
- Snowmelt, rainfall and river runoff modeling



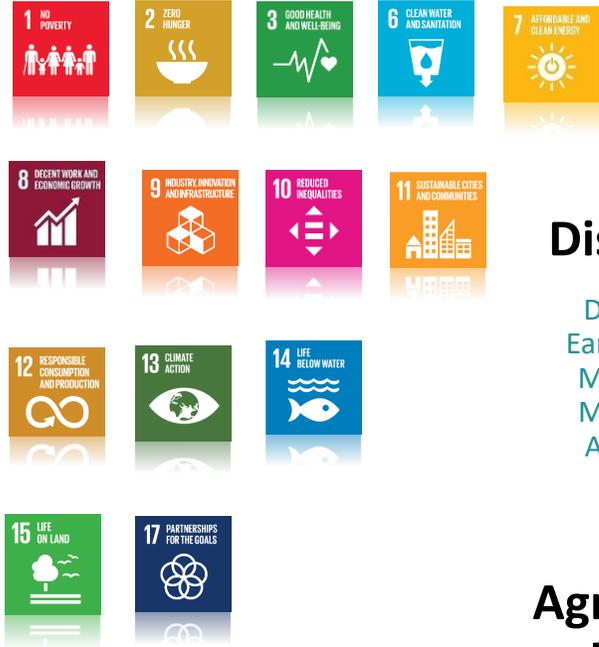
Identification of Potential Check Dam Sites in Potohar Region

A Project of Agency for Barani Area Development (ABAD)

Satellite imagery and geospatial datasets & tools were used for the identification of potential sites in 5 districts of Potohar region



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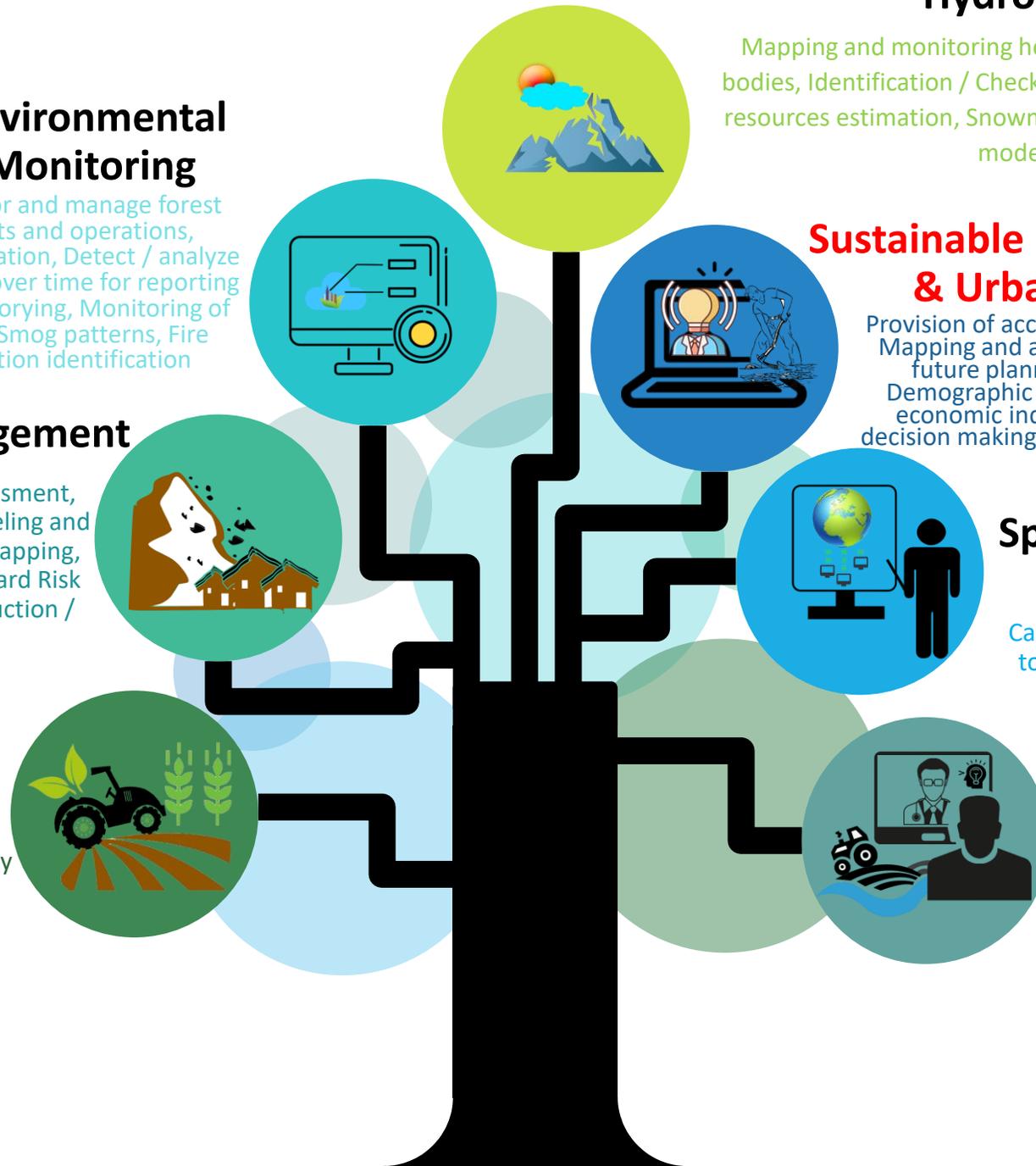
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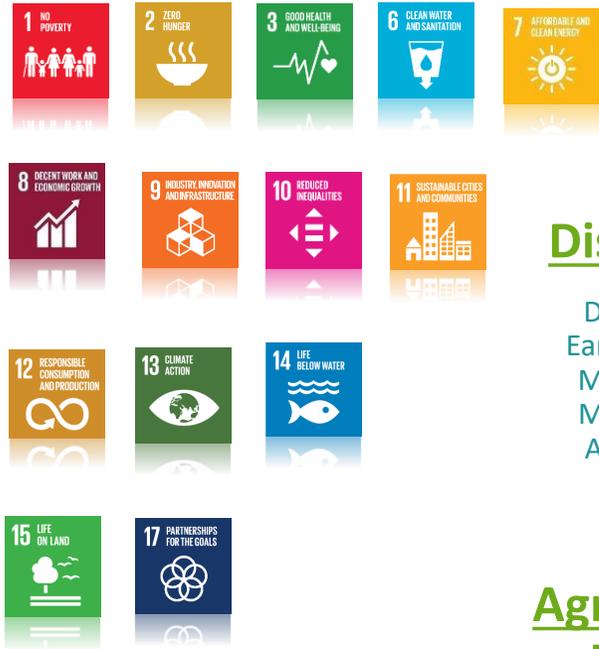
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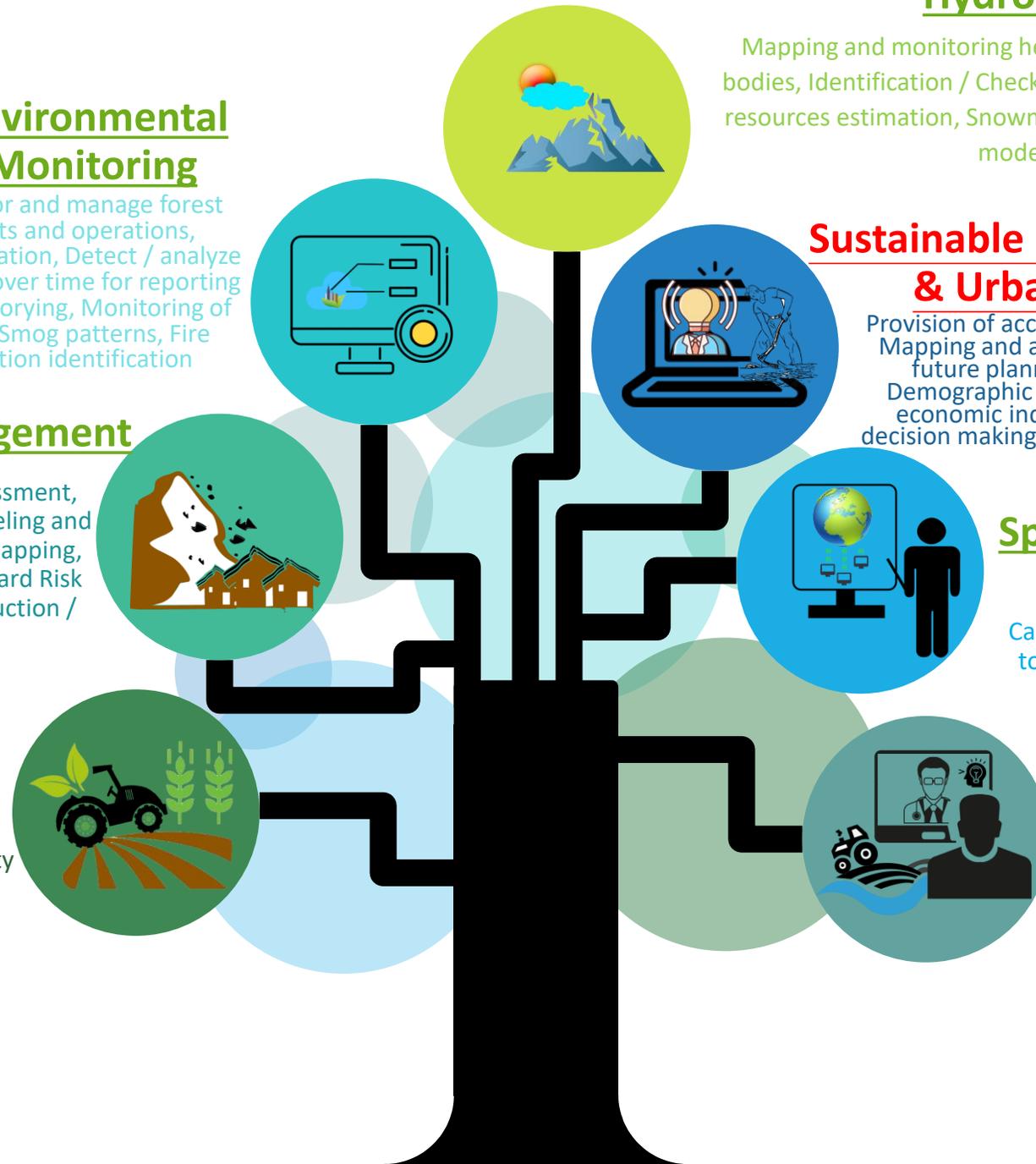
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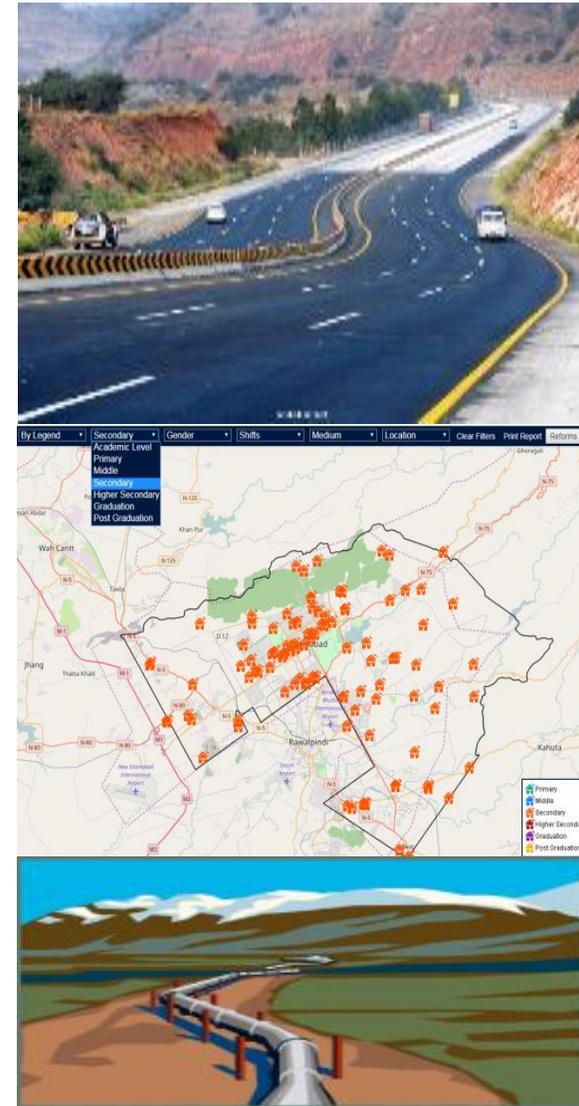
Telemedicine



Governance

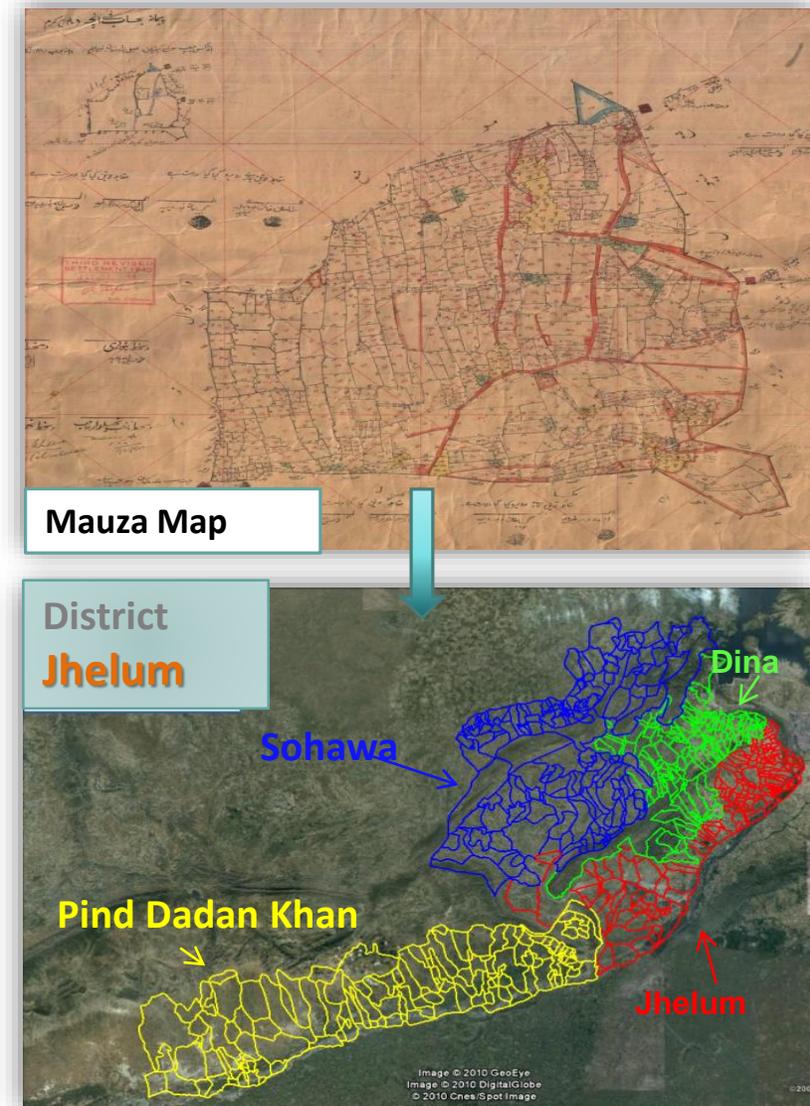


- Provision of accurate location information
- Mapping and analysis of ground data against recent and historical topographic information for future planning and development
- Demographic mapping based on socio-economic indicators for planning and decision making
- Encroachment monitoring for better urban planning



Revenue Estate Mapping

- SUPARCO assisted the GoP in development of mauza level digital maps and a web portal
 - Masavi scanning & mauza level mosaics
 - Georeferencing with Satellite Imagery
 - Mauza level digital maps of all districts
 - Database connectivity with Population Census & Agriculture Census info
 - Web portal development



Land Acquisition Systems



Khasra Number	227
Circle:	Chilas
Mouza:	Jalil Village
Land Area (Marla):	33
Owner Name:	Abdul Mateen
Father/Husband Name:	Badar Jamil
CNIC No:	71202-1230097-5
Land Compensation (Rs.):	2,268,750
Trees Compensation (RS.):	358,000
Total Compensation (Rs.):	2,626,750
Payment Date:	21/09/2015



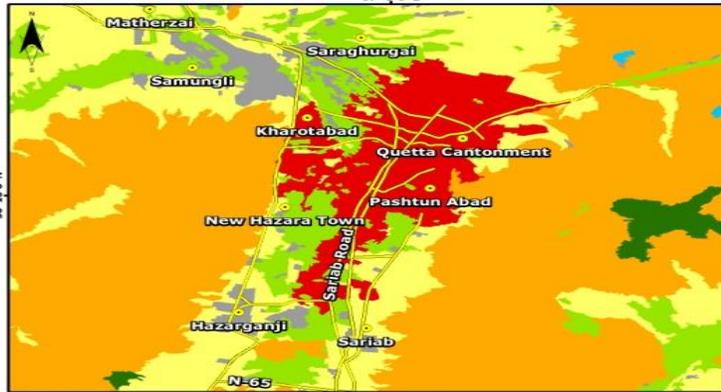
Owner Photo



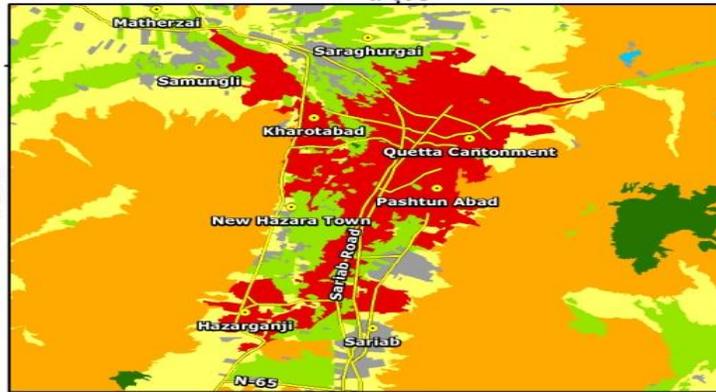
Thumb Impression

Urban Sprawl

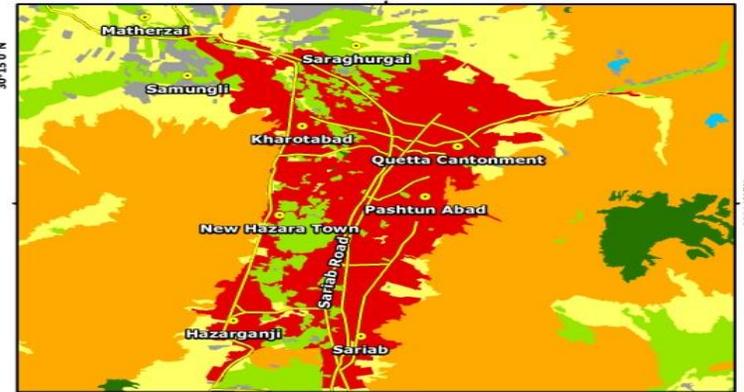
Urban Landcover Map of Quetta for Years 2000, 2010, 2013 & 2018



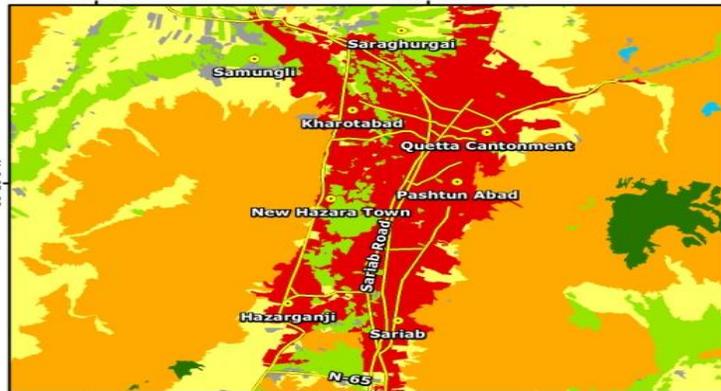
2000



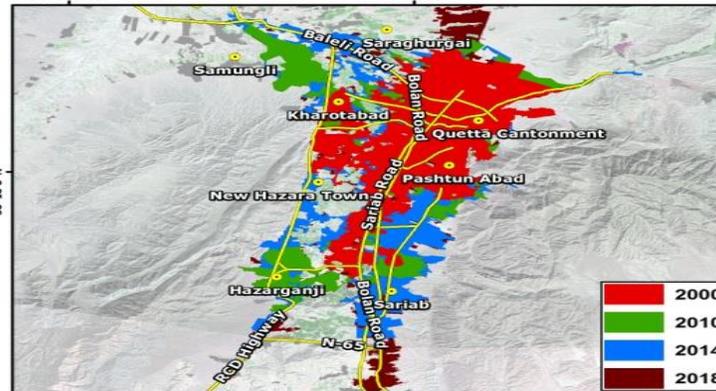
2010



2013



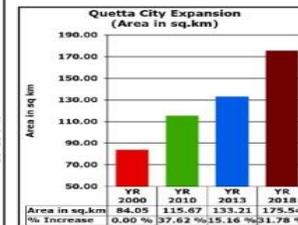
2018



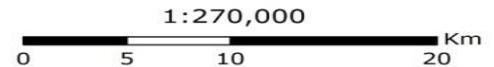
Quetta City Expansion

Landcover Classification

- Quetta City
- Other Settlements
- Agriculture
- Natural Vegetation
- Open/barren land
- Rocky Areas
- Water Bodies



Map Name: Urban Landcover Map of Quetta
 Date: 14 Jan 2018
 Source: SPOT and Pleiades Imagery
 Map Projection: WGS 1984 Mercator



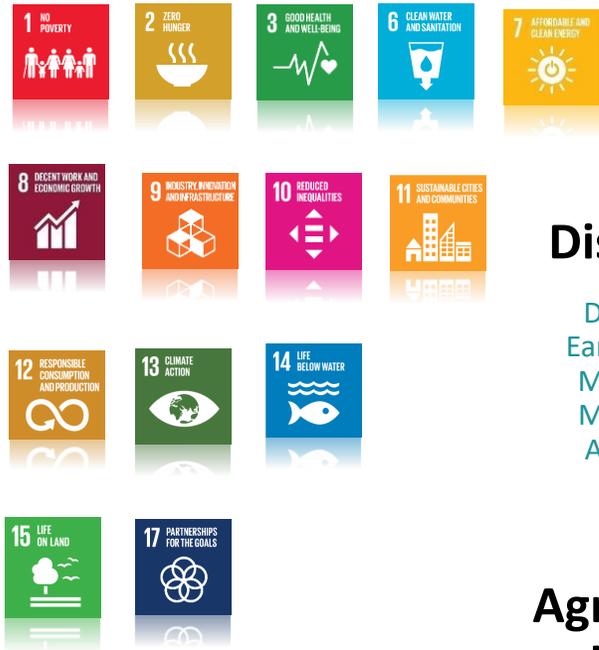
Support in Planning & Monitoring of National Projects

- Space based support is being provided to Govt of Pakistan in major areas:-

- Production of Base Maps using satellite imagery
- Landcover/ Landuse analysis of various infrastructure projects of:-
 - Highway Construction program
 - Railway Construction program
- Spatial spread of projects in correlation with human settlements
- Integrated coastal and maritime spatial planning and management



Socio-economic Services



Environmental Monitoring

Monitor and manage forest assets and operations, deforestation, Detect / analyze change over time for reporting / inventorying, Monitoring of Fog / Smog patterns, Fire location identification

Disaster Management

Disaster Damage Assessment, Earthquake, Flood Modeling and Monitoring, Drought Mapping, Multi-Vulnerability Hazard Risk Assessment, Reconstruction / Rehabilitation

Agriculture and Landcover

Crop Estimation and Monitoring, Land suitability analysis, Farm water & fertilizer management, Support to crop insurance and agriculture loan monitoring programs, Domestic food security

Hydrology

Mapping and monitoring health of watersheds, water bodies, Identification / Check of dam sites, Surface water resources estimation, Snowmelt, rainfall and river runoff modeling,

Sustainable Development & Urban Planning

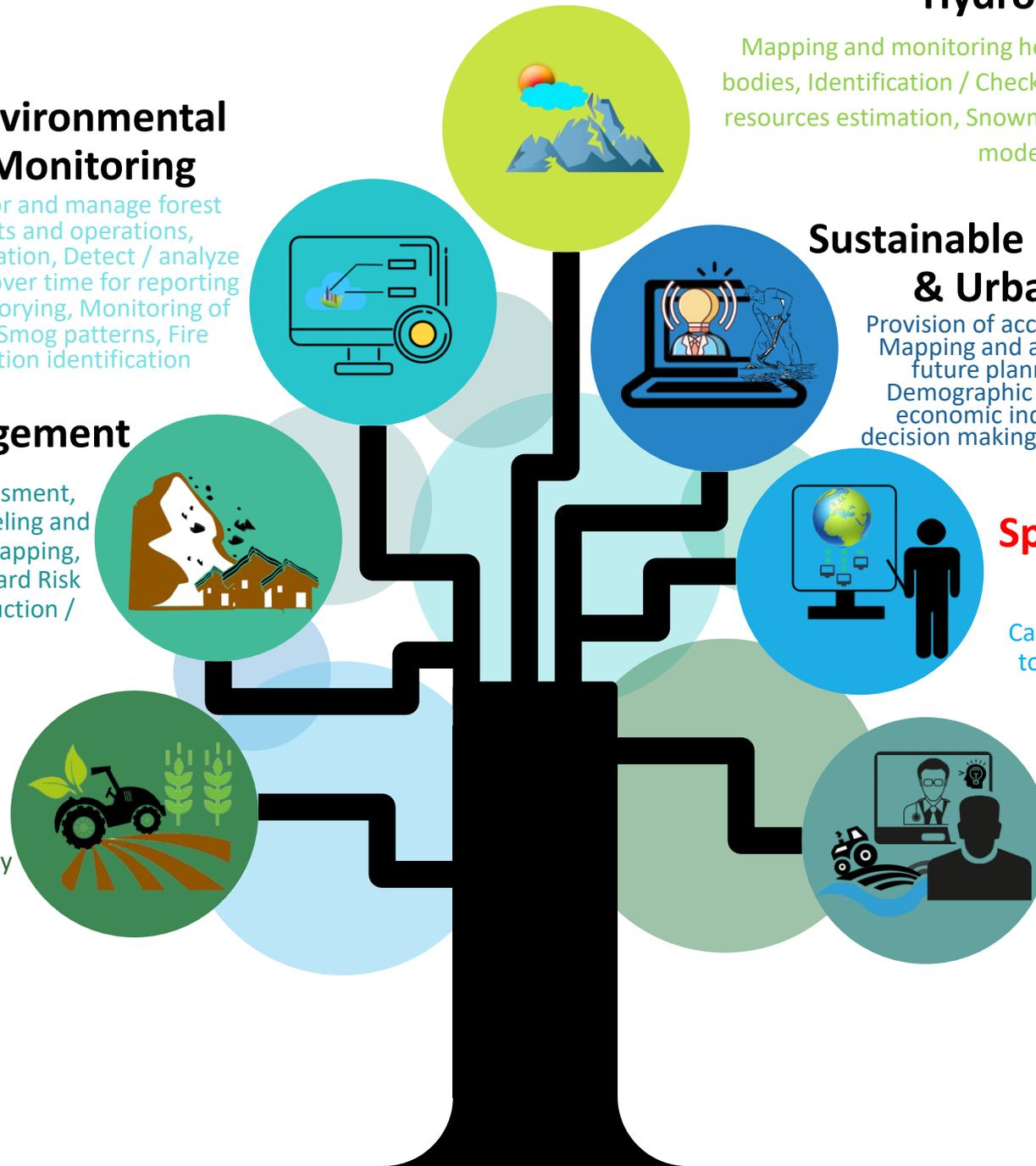
Provision of accurate location information, Mapping and analysis of ground data for future planning and development, Demographic mapping based on socio-economic indicators for planning and decision making, Encroachment monitoring

Space Awareness Program

Capacity Building, Outreach to academia and students

Others

Telemedicine



Space Education & Awareness Program

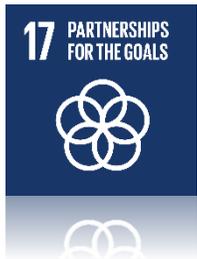
- Pakistan Space & Upper Atmosphere Research Commission (SUPARCO) is the key coordinator for space related activities in the country
- SUPARCO is committed to promote education and awareness in space science and technology
- Various activities are carried out throughout the year under the Space Education & Awareness Directorate (SEAD) by SUPARCO
- SEAD regularly takes initiatives to enhance the outreach and awareness on space science & technology throughout the country



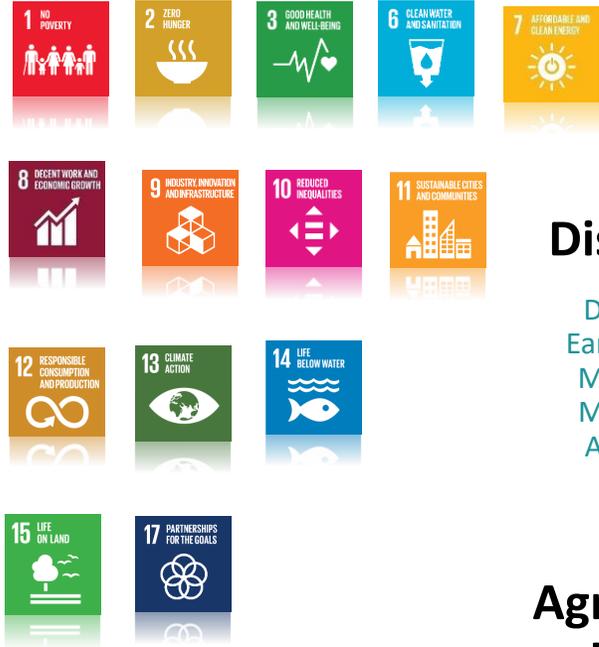
SEAD Present Activities



SEAD International Activities



Socio-economic Services



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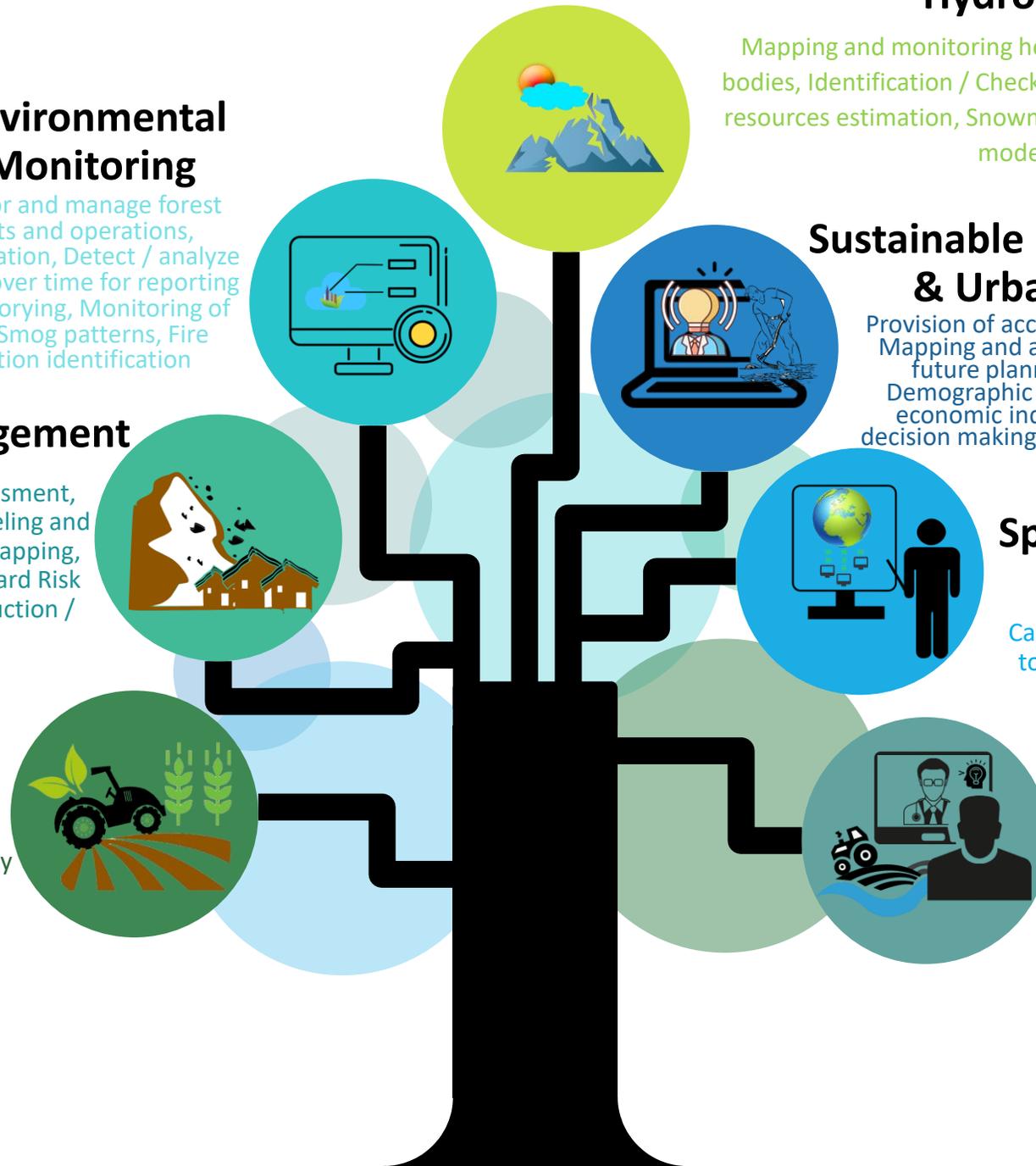
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Telemedicine



Tele Medicine Product



SUPARCO, being a national space agency, initiated a Satellite Communication based Telemedicine network as a pilot project for the duration of two years which was established and utilized effectively



Technology

VSAT state of art technology was selected to provide broad band (satellite) connectivity, for live video conferencing, transfer of high quality biomedical images

Sites Connectivity

Two sites were linked up through Paksat-1 satellite transponder. , one at Jinnah Post Graduate Medical Center (JPMC) at Karachi, as hub hospital and other at Shikarpur civil hospital (interior Sindh) as remote site with the quality of video conferencing and data transfer services

Tele Medicine Product

Features

Tele-medical consultation between doctor at hub site and patient at remote

Tele-medical education/training of Doctors/staff at remote site

Benefits

Specialty healthcare easily accessible to underserved rural population

Easy and quick access to medical specialists

Better organized healthcare unit

Cut down cost of travelling and associated costs for patients

Continuous education and training for rural healthcare professionals

Results

Approximately 3143 patients were benefitted



National Policies Supporting Space Activities



Conclusion



Conclusion

- Pakistan is committed to deliver space technology application solutions for socio-economic development both at national and regional levels
- Partnerships and innovative approaches are key to achieving the SDGs
- Pakistan will continue to play its role in facilitating the implementation of the global sustainable development agenda under any programme of regional and international cooperation for socio-economic uplift

Thank you