SPACE & UPPER ATMOSPHERE RESEARCH COMMISSION (SUPARCO)

Pakistan Space & Upper Atmosphere Research Commission (SUPARCO) is the national space agency, responsible for execution of space technology ad applications programmes. It has been actively involved in the applications of Satellite Remote Sensing (SRS) data since 1972 and established its own Satellite Ground Station (SGS) at Islamabad in August 1989. The station is capable of acquiring data from a number of satellites offering unsurpassed acquisition, frequent revisit capacity and a range of ground resolutions.

SGS COVERAGE ZONE

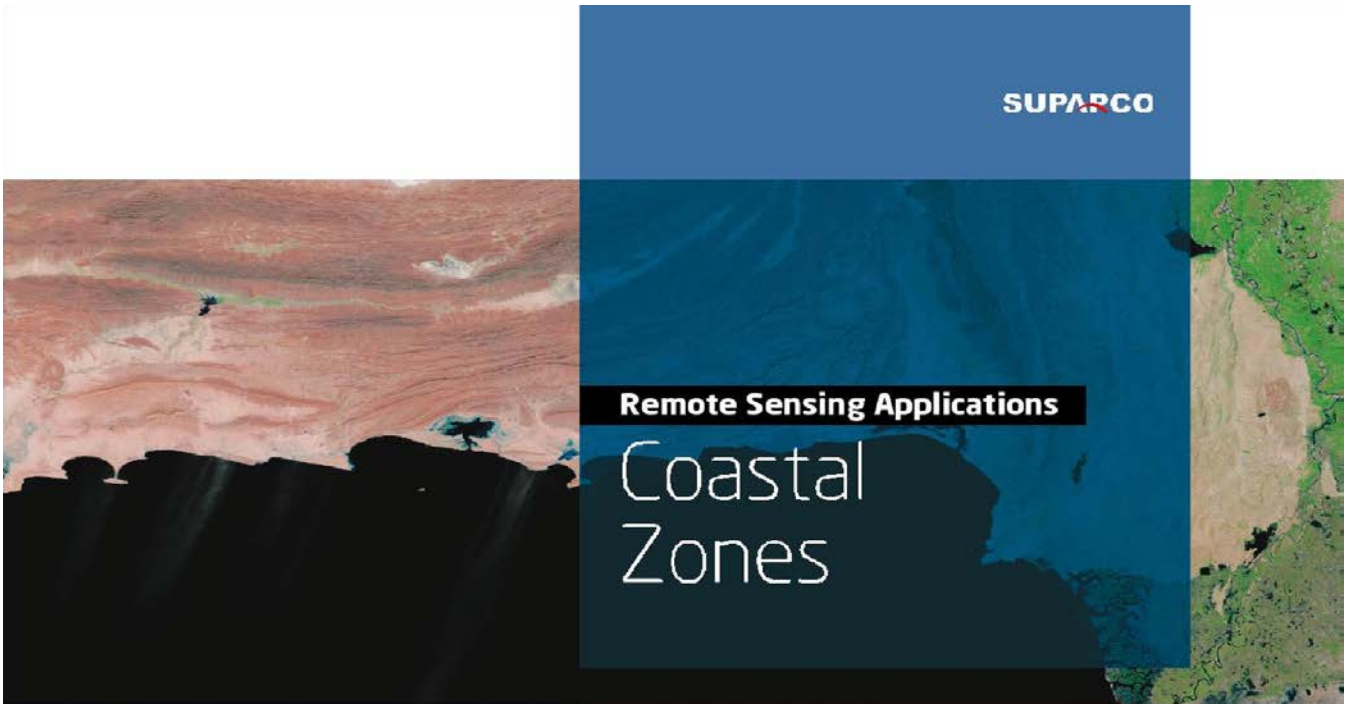
The Satellite Ground Station, located at Rawat near Islamabad, has acquisition zone of approximately 2500 Km radius and covers Pakistan and 25 other countries, wholly or partially, in the South Asian, Central Asian and Western Asian/Middle East Regions.

Satellite imagery is an unrivalled source of information for monitoring, measuring, forecasting and managing natural resources and land use. It is widely used in image processing and Geographic Information System (GIS). It can be processed easily and combined with other geodata to maximize extraction of useable information.

SUPARCO also provides solutions for a host of applications such as agriculture, forestry, land use planning & management, GIS telecom, geology, disaster management & mitigation, environment, hydrology, civil engineering, rural & urban sprawl, gas & oil pipeline planning, highways planning monitoring etc. The data products and related services are offered to different user agencies within and outside Pakistan.



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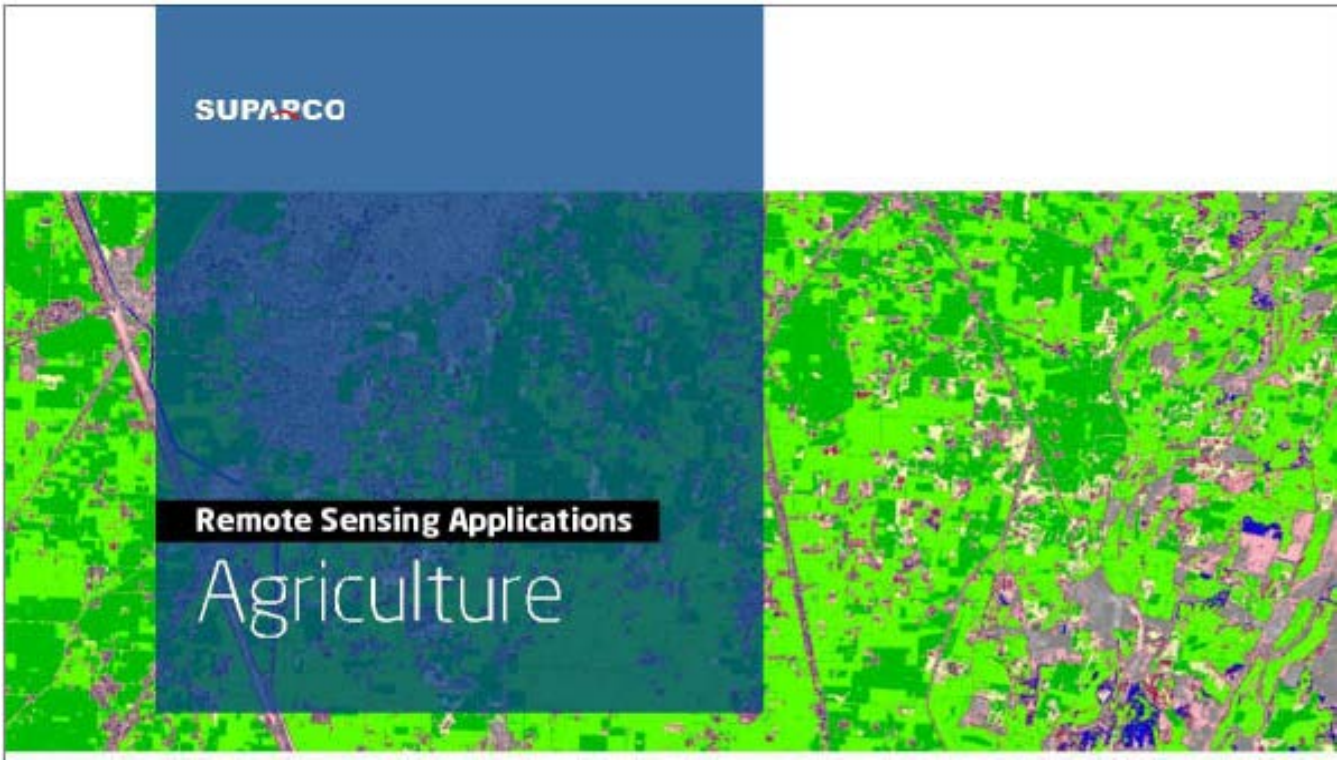




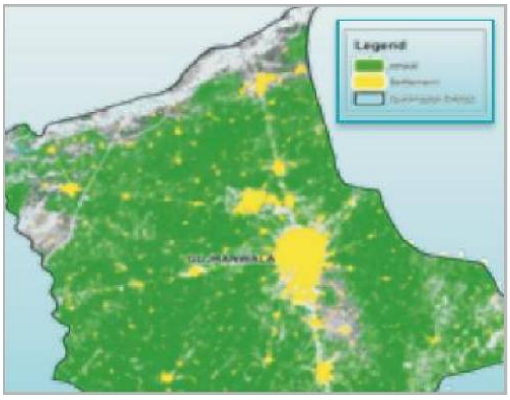
- Asses coastal resources including mangrove forests, salt pans
- Environmental impact assessment in the fragile ecosystems
- Monitor rapid processes of erosion, sedimentation
- Map coastal configuration, bathymetry, navigation channels and landforms
- Select appropriate areas for recreation, urban planning and civil engineering siting projects.



Coastal zones are invariably characterized by rich natural resources. The interaction between land and sea, the major geologic events and climatic changes as well as human activities have frequently caused accretion and erosion of the coastline. Combining the analysis of remote sensing images, field surveys and historical data, one can easily identify and monitor the types of deposition, processes of geomorphologic development and the rate of accretion or erosion of the coastline. Based on the tone and texture of satellite images, one can differentiate between various coastal attributes such as mangrove forests, salt marshes, barren mud and silt flats.

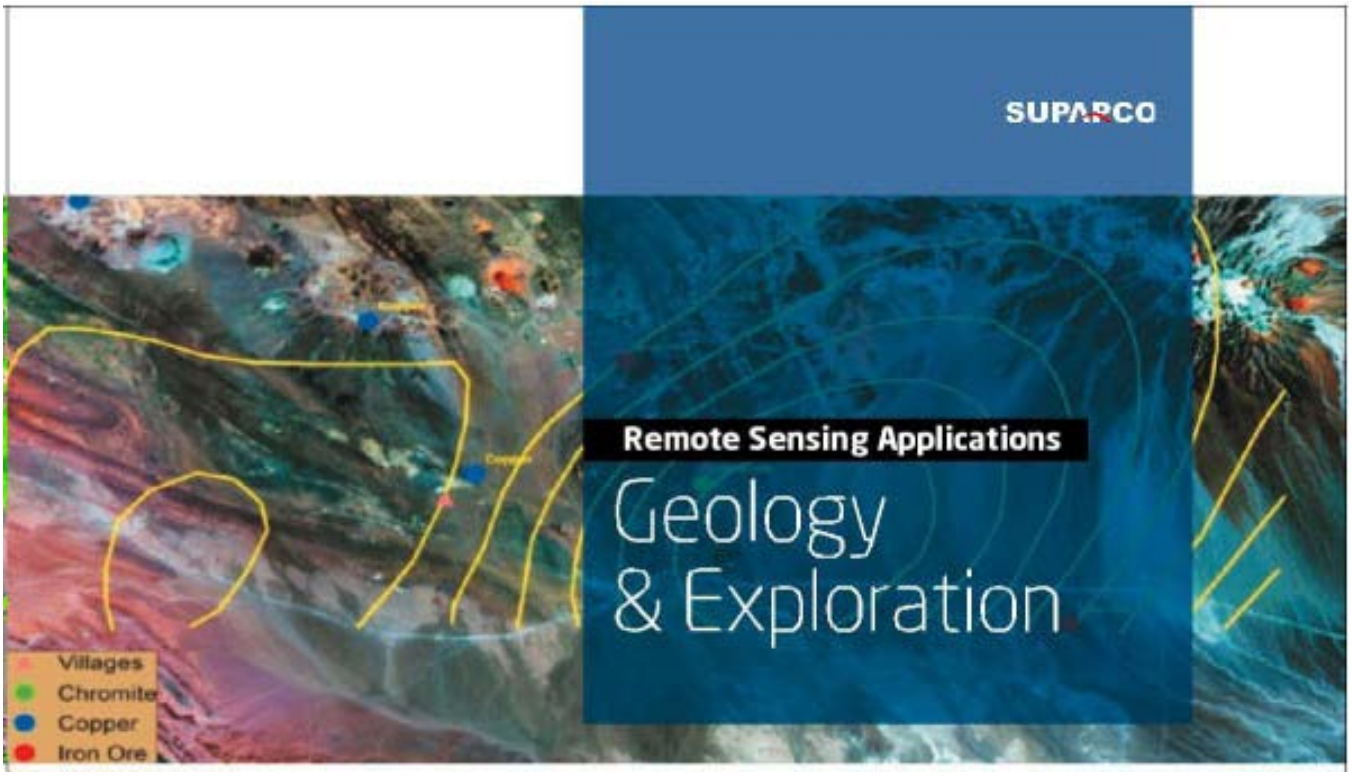


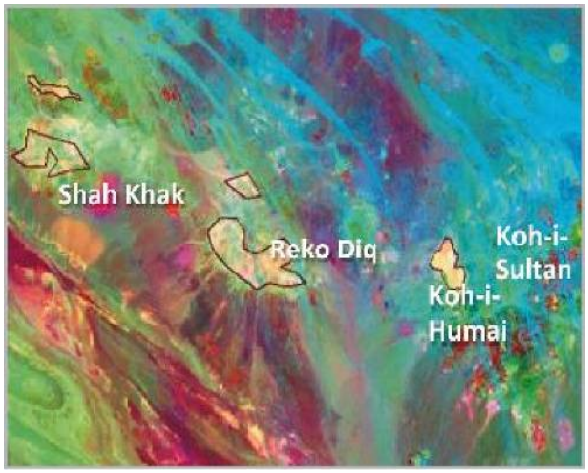
- Crop area estimation
- Crop yield and production forecasting and estimation
- Use of advance technologies for food security
- Better planning for cropping different crops





Satellite Remote Sensing (SRS) plays a vital role in mapping and monitoring agriculture resources. It can directly or indirectly; identify various types of crops, provide crop area estimation, discriminate between healthy and diseased crop, monitor crop growth and also help in crop production and yield estimation with good accuracy. SRS can also be used for planning agriculture inputs and requirement of crops. The identification and determination of fields and respective sizes mostly depend on the spatial, spectral and radiometric characteristics of images.

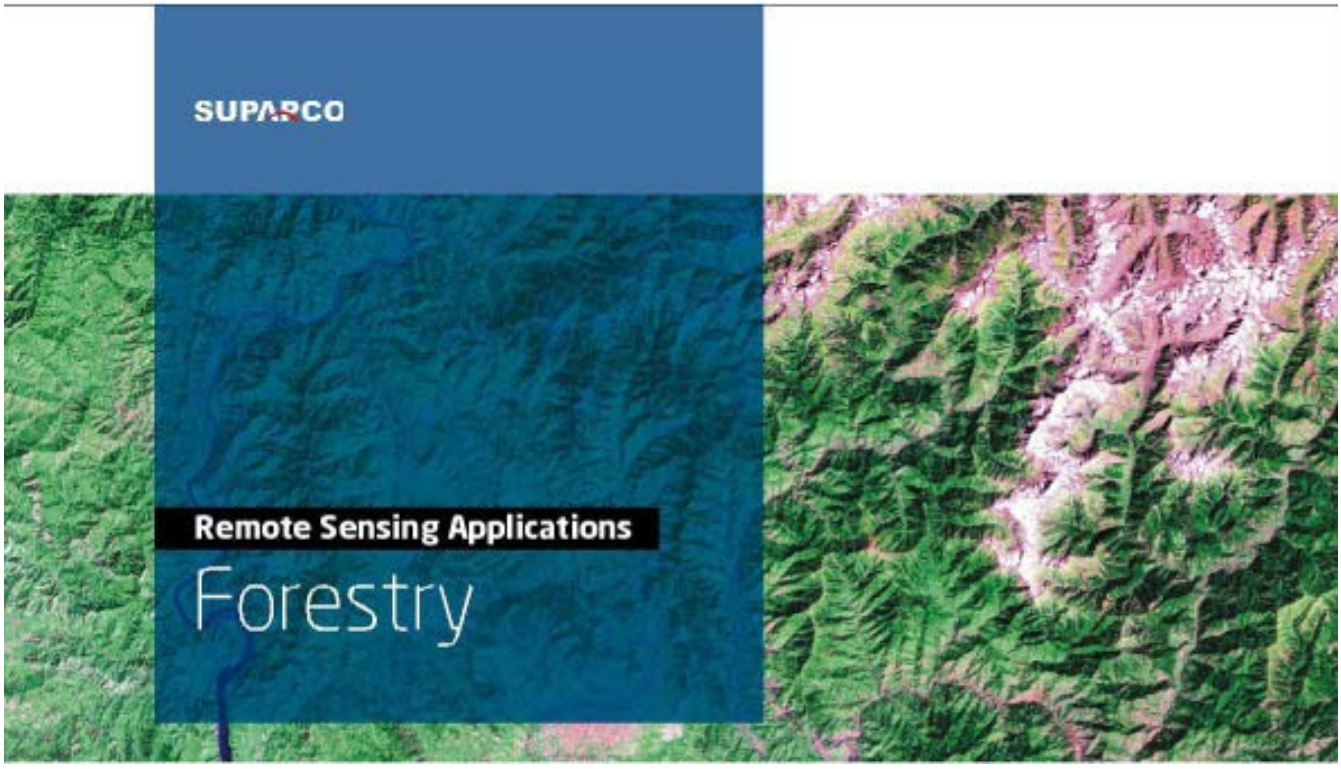




- Identification of regional structural trends ,folds, major faults, lineaments and fracture zones
- Geological mapping, spatial distribution of drilled wells, subsurface correlation of drilled geological formations in a GIS framework and interpretation of potential
- Hydrocarbon zones.
- Selection of potential mineral sites
- Study of plate tectonics and its impact on surface geological structures
- Rock type discrimination and mapping in inaccessible areas



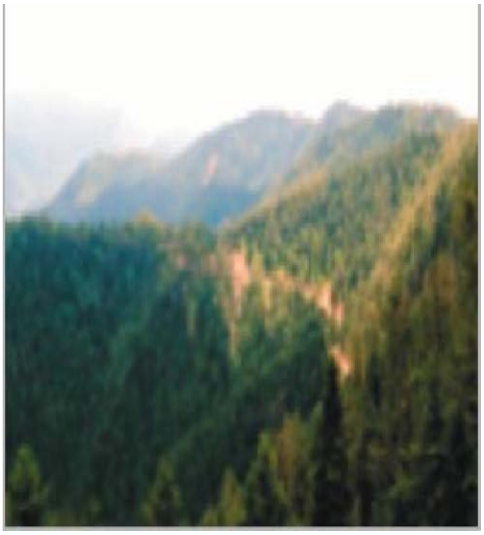
Rock type classification, structural mapping, lineament detection, plate tectonics, mineral, groundwater and fossil fuel prospection are key disciplines of earth sciences where remote sensing techniques provide substantial information. Lithologic contacts can be extended over large areas with a minimum of ground control. Identification of rock types can be extrapolated on the basis of spectral and geomorphic information in terms of landform development, drainage pattern and density, vegetation differences in context of climatic effects. Structural geologic analysis and lithologic mapping are of importance in mineral and ground water prospecting where these information are integrated with conventional geological maps, geophysics and geo-chemistry methods.



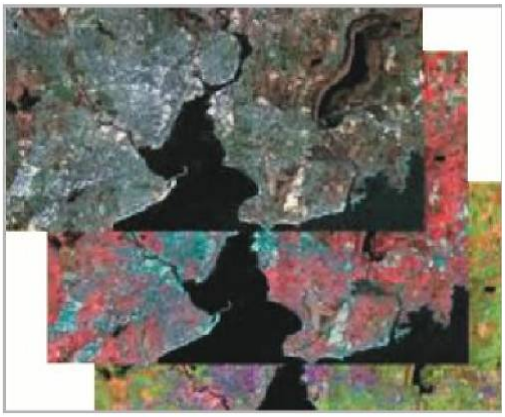
- Classify forest resources extending to inaccessible areas
- Monitor forest sites on regular basis to keep track of a forestation or deforestation
- Manage new and existing forest possessions to achieve commercial as well as environmental goals
- Locate potential forest sites for recreation and leisure

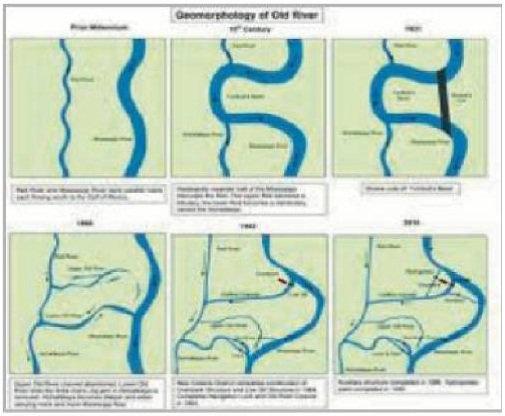


Overall Pakistan forest resources are limited, covering only 4.8 percent of total land area, which is far below the optimal standard of 25%, forest cover for a country. However scarce, forests of Pakistan are very rich in terms of biodiversity and present a fair blend of trees, shrubs, grasses and animal species, living across various ecological zones, from sea level in the south, to high altitude alpine pastures in the north. Most of the natural forest resources of Pakistan are concentrated in the mountainous regions of the north covering Himalaya, Hindukush and Karakoram ranges. The rest of the forest resources are distributed among the south-western mountains of Baluchistan, plains of Punjab and the coastal areas of Sindh. Diversity in these resources ranges from mangroves in the south to alpine pastures up in the north. Remote sensing technology with its ability to repetitively acquire synoptic images of the earth surface in different spectral regions, provide possible means of monitoring and mapping changes in forests on a continuing basis.









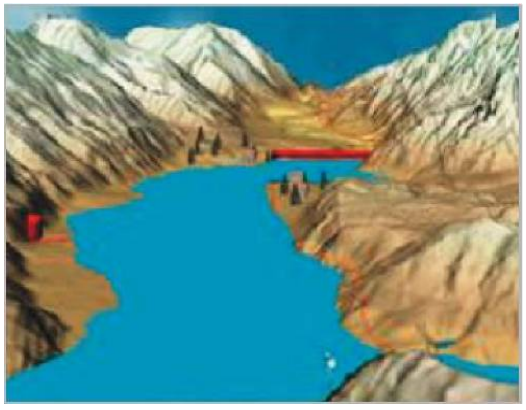
- Distinguish, classify and analyze landforms of variegated origin at the crust of earth
- Study and monitor the modification of landforms
- Prepare maps of land forms and terrain for detailed analysis
- Integrate various information data sets to monitor dynamic changes
- Assess geo-technical characteristics for civil engineering projects

Geomorphic processes are mainly governed by the interaction of wind, water and ice that sculpture the face of the earth. The processes vary greatly with location and climate. Remote sensing helps in discovering very large surface features and structures, which may otherwise be ignored because of lack of continued regional information on conventional data. Owing to scarcity of vegetation, arid lands are especially amenable to spectral remote sensing. Satellite remote sensing has efficiently been used to monitor inter-related erosional and depositional processes and patterns in the deserts, coastal, glaciated and mountainous territories, and the fluvial ecosystem. Today, advantages in the resolution of satellite images have increased its use in geomorphologic mapping even up to 1:10,000 scales. These maps are of great value for environmental management.



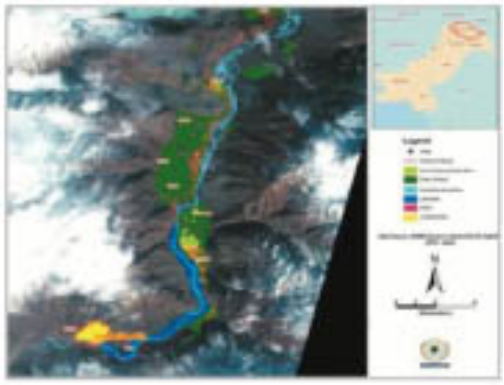
- Monitor areal extent of snow cover
- Estimation of snowmelt rainfall runoff
- Water resource management
- Diversion of flood water for effective utilization





Satellite sensors are able to provide a real extent of snow and ice which is of great importance to hydrologists since snowmelt is a major contributor to river runoff in many river basins. Glaciers have long been known as sensitive indicators of climate change and are powerful agents of erosion and deposition. They have significant effect on regional topography, environment and hydrology. Satellite derived quantitative estimates of snow and ice parameters require evaluation for potential use in hazard assessment, active monitoring and complex environmental analysis. The study of glaciers is also important in the context of hazard monitoring since glacial movement can cut communication links, block or divert rivers, create lakes, produce devastating floods and trigger landslides.





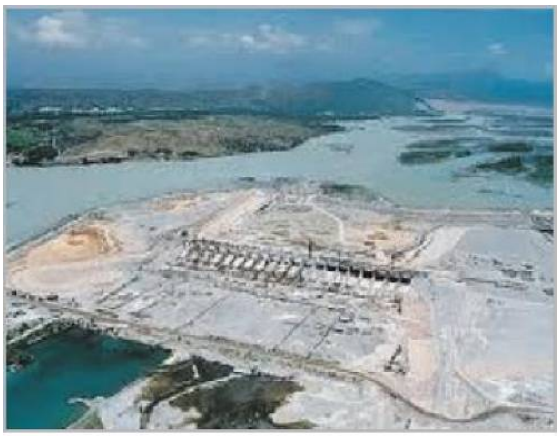
- Monitor, forecast and map various hazards
- Prepare maps and management plans against each type of hazards
- Damage assessment in the affected areas
- Map flood prone areas
- Detect and monitor extensive forest fires
- Monitor areal extent of areas affected by tsunami



The vulnerability of Pakistan to natural hazards can be described as moderate to high. Pakistan's relatively high level of disaster risk is attributed to its peculiar geographical location, climate variability, topography, the nature of its economy and associated trends of population concentration, urbanization and environmental degradation. The country is exposed to multiple hazards including earthquakes, floods (riverine, flash and urban), landslides, droughts, heavy rains and high waves caused by cyclones in the Arabian Sea. The synoptic and repetitive converge provided by satellite remote sensing system has provided an inexpensive tool for mapping and monitoring of various natural hazards almost in near real time.

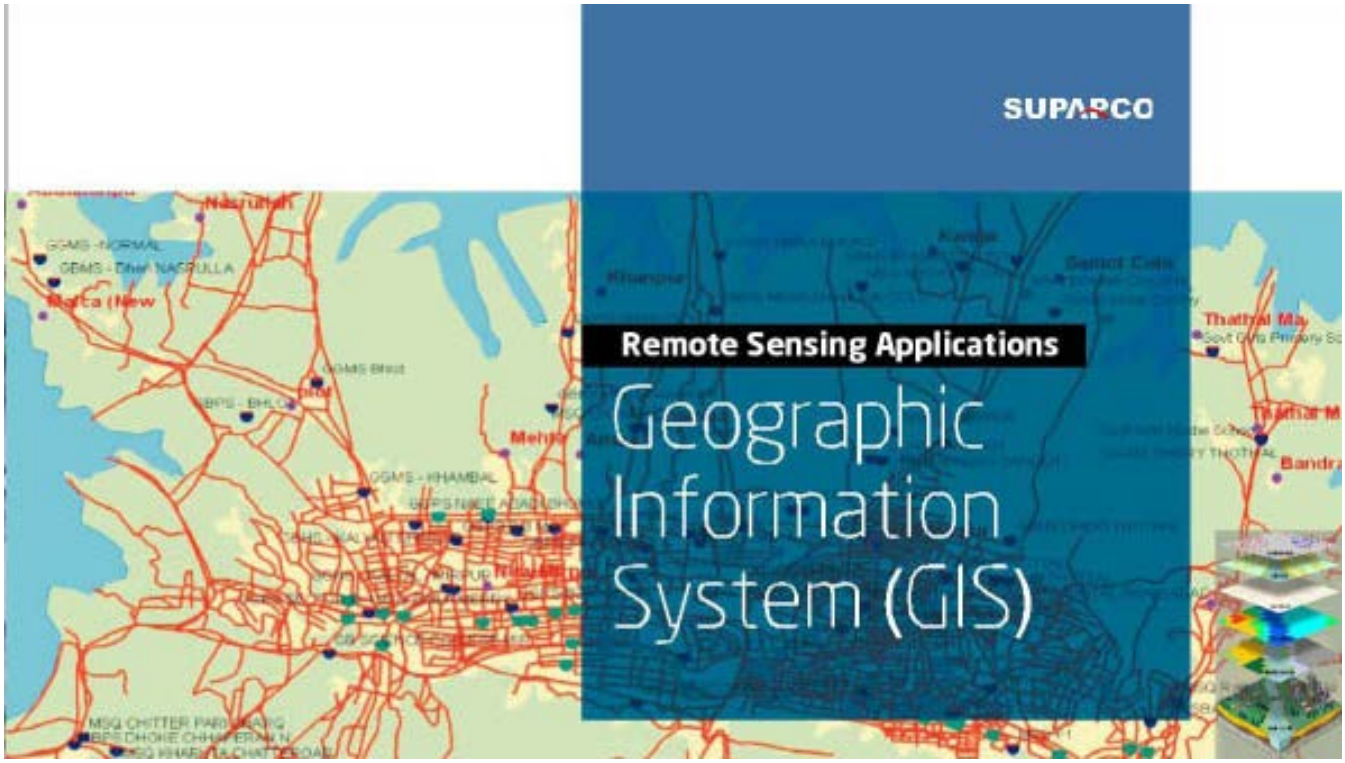


- Prepare maps of soil, land use, land cover for engineering and urban planning projects
- Locate appropriate sites for dams, bridges and airfields
- Select suitable land corridors for railway, highway and pipeline routes
- Identify sites for locating coastal infrastructure like recreational zones, beach development and harbors
- Analyze dynamic nature of stream erosion, deposition and course change to design flood protection bunds





Remote sensing techniques are applied in various disciplines of civil engineering such as terrain analysis, site investigation and regional planning, water resources engineering, transport route location and others. Engineering applications involve the recognition of basic landforms as indicated by the pattern elements on the image, like topography, drainage, soil texture, vegetation, cultural features and environment. A detailed examination of all the pattern elements together usually is critical in determining terrain characteristics of landforms for evaluating the suitability of an area for engineering infrastructure sitting. The massiveness and hardness of the rocks, drainage density and pattern, configuration and gradient of gullies, all provide important clues to the terrain characteristics.





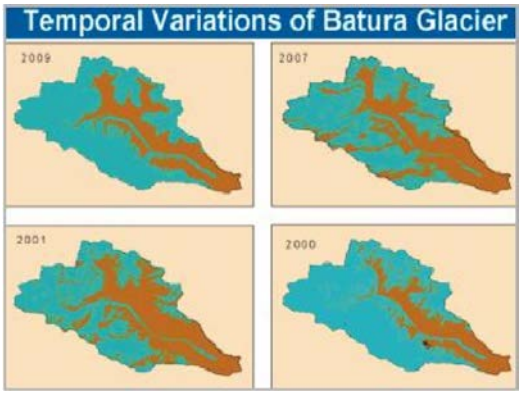


- Infrastructure mapping through satellite technology
- Mobile Irrigation survey system
- Vehicle tracking and fleet management
- Information system for emergency response and disaster prevention, surveying and navigation

Geographic Information Systems (GIS) is being widely adopted by organizations and individuals to monitor and follow up their operations at any level. GIS is a computer-based tool for mapping, monitoring and analyzing features on earth. It involves map querying, generating reports and performing spatial analysis on user requirements. It allows to link databases with maps to create dynamic displays and inter-relate spatially multiple types of information assembled from a range of sources. GIS manages location-based information and provides tools for display and analysis of various statistics, including population characteristics, economic development opportunities and vegetation types etc. These benefits make GIS a valuable tool for a wide range of organizations to explain events, predict outcomes, and plan strategies.

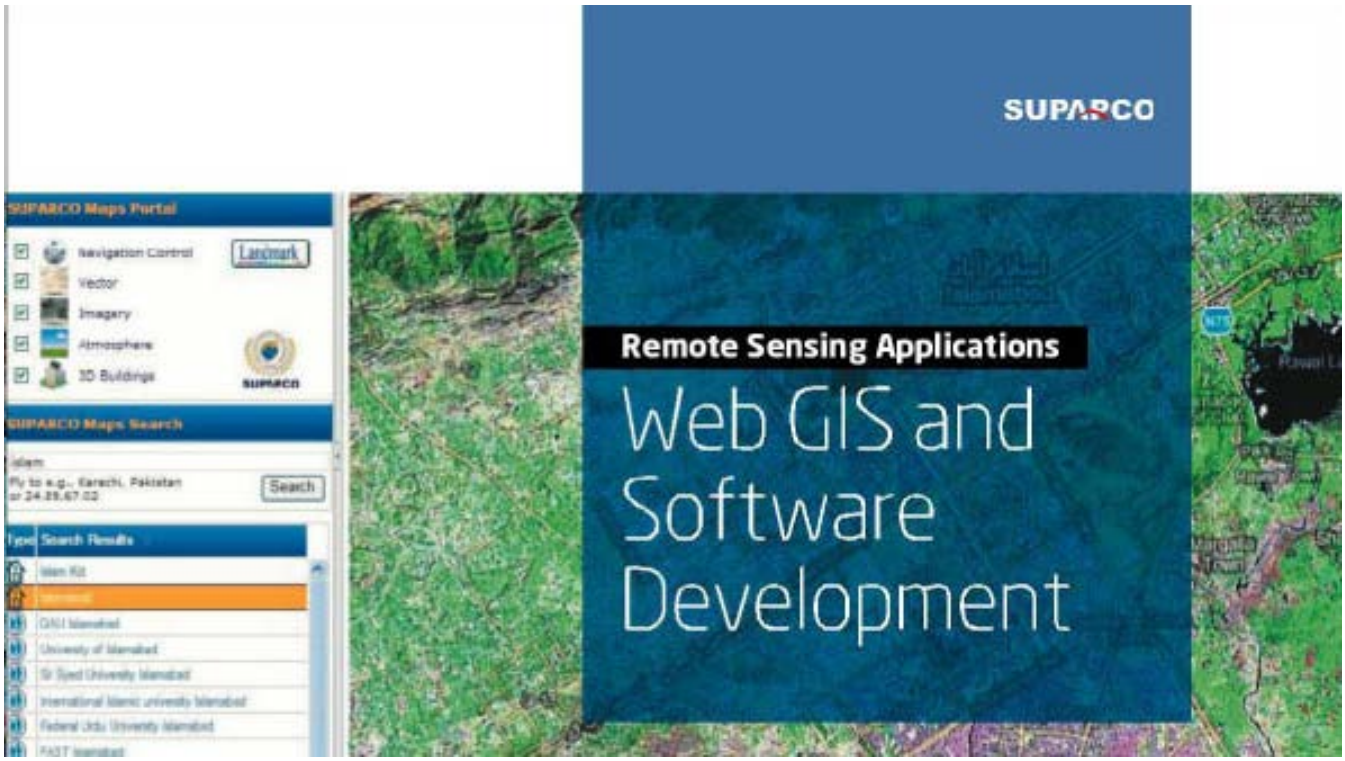


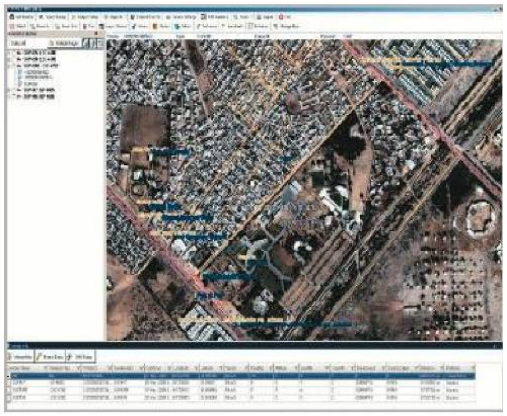
- Estimation of variations in glaciers size through historical satellite data
- Study indicators related to glacial hazards
- Development of regional glacier database
- Estimation of snow cover area and related runoff
- Study atmospheric conditions of the glaciated and snow cover areas



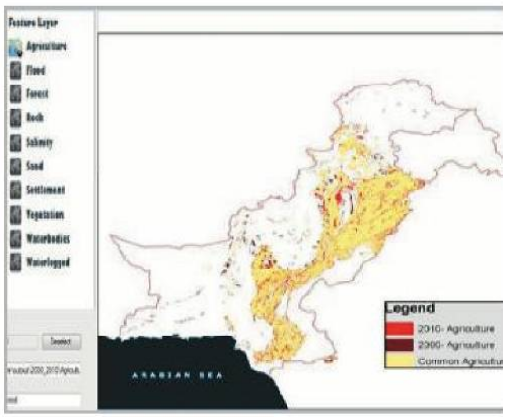
Glacier changes, especially recent abrupt melting, can affect our resources especially drinking water supplies, agriculture, hydroelectric power, transportation, tourism, coastlines, and ecological habitats. Glacial changes can also leave an immediate impact on communities that rely on glaciers for their water supply, or on regions susceptible to floods, avalanches, or landslides triggered by abrupt glacial melt. Monitoring of glaciers for estimation of the melted glaciated area is, therefore, important. Satellite data can be effectively used for such monitoring, where the area is vast and inaccessible. Multi temporal data is helpful in estimation of present changes and using it for prediction of future changes in glaciated area and also track size and movement of glaciers.







- Turn-key solution with multi tier application
- Integration of external gadgets and data connectivity with multiple servers
- Quick searching of landmark data and selection of features
- Flexible architecture to add imagery and landmark data in the future
- Customized user interface software development on multiple platforms
- RS & GIS customized front end with third party integration feature



GIS is the technique to visualize, manipulate, analyze, and display spatial data. Simply it combines layers of information about a place to give you a better understanding of that place. When GIS data and functionality a re made available over the Internet, the system is referred to as a "Web GIS". Users do not need to be an expert on GIS application to operate the system or to run analysis according to ever changing requirements as the functionality is made available through a regular web browser and an integrated viewer with a simple, user-friendly interface. Digital maps would be visible on web through a web browser. Maps would be stored in a central spatial database server and serving of those maps is done through different customized services.



- Monitor desert encroachment, overgrazing and depletion in biomass
- Monitor coastal zone ecosystem, accretion, erosion, marine pollution, mangroves
- Measure forest clear cutting and its impact on the ecosystem
- Identify areas of intense soil erosion produced by running water and wind
- Analyze sediment movement and turbidity patterns in shallow waters



The long-term utilization of productive lands has resulted in resources degradation and economic failure. In some areas vegetation has completely disappeared. Rangelands have been destroyed. Irrigation over-exploitation has induced water logging and salinity and hence groundwater resources are being contaminated or depleted. Sand dunes are getting reactivated and deforestation is increasing which results in excessive soil erosion and siltation. The satellite sensors capability in identifying, monitoring and mapping desertification parameters has been established in several countries of the world. The long term impacts of continued surface change cannot be assessed without keeping continued track of the terrain. These changes can effectively be monitored by analyzing sequential satellite images.



SUPARCO

Remote Sensing Data Products and Services



STANDARD PRODUCTS

Digital Data

SPOT
- Multispectral 10 meter resolution data
- Pan 5 meter resolution data
- Pan 2.5 meter resolution data
- Multispectral 2.5 meter resolution data

Landsat TM (Historical 1989-99)
- 30 meter resolution data in 7 bands

AQUA/Terra MODIS
- 250 meter resolution data
- 500 meter resolution data
- 1000 meter resolution data

Analog Data

- Landsat TM B & W paper prints
- Landsat TM color paper prints
- SPOT XS/Pan B & W paper prints
- SPOT XS color paper prints
- MODIS color products

VALUE ADDED PRODUCTS

Satellite Remote Sensing & Image Processing
- Agriculture
- Water Resources
- Forestry
- Urban Planning
- Landuse/Land cover
- Route Planning
- Civil Engineering
- Disaster Monitoring
- Coastal Eco-system
- Digital Elevation Modeling
- 3D Modeling
- Shaded Relief Mapping etc...

GIS
- Develop GIS for planning & management projects
- Customized solutions to the client

TRAINING

- Digital image processing using various application softwares
- Image interpretation
- GIS development
- Natural resources mapping
- Environmental monitoring