Remote sensing applications in natural resources mapping and management- An Indian Context


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BACKGROUND

• By 2025 India’s population is expected to reach 1.45 billion (UN, 2006). It is necessary that food production in India must increase by 5 mt annually to ensure food and nutritional security (Kanwar, 2000).

• Globally, about 1900 million hectares of land is affected by land degradation (UNEP, 1999) and about 2.6 billion people in more than 100 countries are affected due to land degradation (Adams and Eswaran, 2000).

• Hence, sustainable management of land resources assume a greater significance in view of climate change, droughts, floods to ensure livelihoods and food security.

• Land resource management involves inventory, characterization, analysis and generation of different types of spatial data for appropriate site specific interventions to manage land resources on sustained basis.

• Applications of RS and GIS in management of land resources are increasing rapidly due to great strides made in space-borne remote sensing satellites in terms of spatial, temporal, spectral and radiometric resolutions.
An overview of remote sensing applications in natural resources mapping and management

- Digital terrain analysis for landform mapping
- Land resource inventory and mapping
- Harmonization of wastelands and degraded lands
- Mapping extent and severity of salt affected soils
- Mapping and assessment of soil erosion
- Development of soil reflectance libraries
- Monitoring and management of natural resources
RS Data in Natural Resources Mapping
Digital terrain analysis using SRTM 90m DEM
RS Applications in Soil Resource Mapping at 1:250,000 Scale

Landsat TM used in physiography mapping at national level
Temporal (FCC)

IRS-1D LISS-III

Nagpur Area

October

January

April
Remote sensing applications at different scale of soil mapping

Soil units in different scales of mapping at Nagpur
Landsat ETM data used in Soil Resource Mapping at 1:50,000 Scale
IRS-P6 LISS-III data in Soil resource mapping at 1:50,000 scale
IRS-P6 LISS-IV data IN Detailed soil mapping (1:12,500 scale) - Village level
IRS-P6 LISS-IV data in landforms mapping at 1:10,000 scale
IRS-P6 LISS-IV data in landforms mapping at 1:10,000 scale
Sentinel-II data in landforms mapping at 1:10,000 scale
IRS-P6 LISS-IV and Cartosat-I DEM data in landforms mapping at 1:10,000 scale
IRS-P6 LISS-IV data in LULC mapping at 1:10,000 scale
IRS-IC LISS-III Data in Soil resource mapping at watershed level
Use of Fused Cartosat PAN + LISS IV Data in LRI

Fused Cartosat PAN (2.5m) + LISS IV (5.8 m) Data
Landsat-OLI data in LULC mapping at 1:10,000 scale
Harmonization of degraded and wastelands of India

Total area under Dense forest: 37.31 Mha (11.35%)
Land degradation map of India

Degraded and Wastelands 120.72 Mha
Status of land degradation in irrigated and rainfed areas in India
Temporal Satellite Data in mapping of land degradation at 1:10k
Temporal Satellite data in Assessment of Soil Erosion

Legend (t ha⁻¹ yr⁻¹)
- Very Slight (< 5)
- Slight (5 - 10)
- Moderate (10 - 15)
- Moderately severe (15 - 20)
- Severe (20 - 40)
- Very severe (40 - 80)
- Extremely severe (> 80)
Land degradation at 1:50,000 scale in collaboration with NRSC
Mapping of Salt affected soils in IGP

- Satellite data acquired between 1st March and 15th April has been found most appropriate for mapping salt affected soils in the Indo-Gangetic plains.

- October - November image is suitable for differentiation between poorly drained and well drained soils.

- Similarity of tone of salt affected soils and sandy soils on satellite data has been resolved with integration of thermal remote sensing data (10.5-12.5µm) with FCC.
Spectral Reflectance Libraries of Indian soils
RS Data in Natural Resources Monitoring
Crop status monitoring

NDVI Profiles of part of IGP

Year 2010
Day 1 (Julian date)

• NDVI profile shows moderately cropped areas

Source: MODIS 250m data
Crop status monitoring

- NDVI profile shows current fallows

Day 129 (Julian date)
Crop status monitoring

Day 241 (Julian date)

- NDVI profile shows moderately cropped area
Monitoring of Prolonged water logging

Changing water logged scenario from 1992 to 2005 in coastal region of A.P.
RS Data in Natural Resources Management
State Soil based thematic database for crop planning
Soil resource data for crop planning
Soil-site suitability for cotton in part of Akola District
Red Soils in India
Alluvial Soils in India
Soil Nutrient Database
Way Forward

- Advance space technology need to be used extensively in mapping of land resource to develop reliable databases for site-specific agricultural land use plans at national, state, district, block level

- Develop National Level institutional mechanism to periodically monitor the crop types and intensities to utilize in National, State, District, Tehsil level agricultural land use planning.

- Temporal Remote Sensing data need to be used in developing climate smart agriculture applications especially in rainfed agriculture

- Identify the national and international institutions and Research Partners to carryout the collaborative projects in space based applications in Indian agriculture

- Exchange scientific knowledge and expertise in the field of remote sensing technologies as a part of capacity building