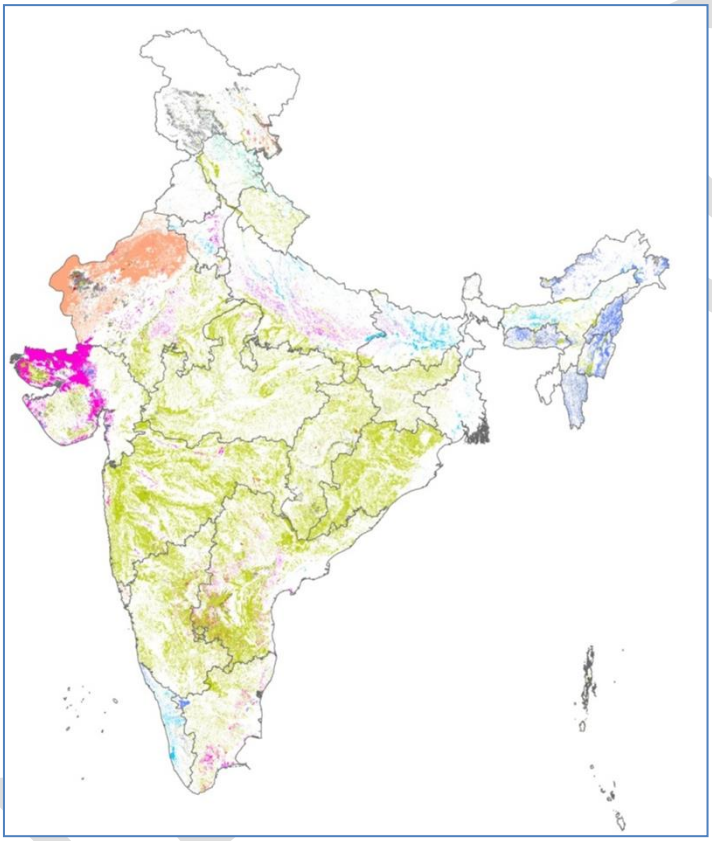
INDIAN LAND DEGRADATION DATA SET

GRIDDED FRACTIONAL AREA OF LAND DEGRADATION COMPATIBLE TO MESOSCALE MODELS OVER INDIAN REGION

Technical Document



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Document Control Sheet

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Title	**Indian land degradation data set : Gridded fractional area of land degradation compatible to mesoscale models over Indian region**
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Abstract	The 5km resolution product indicating the fraction of extent of salt-affected soils should be useful as an input to meso-scale scientific research involving carbon cycle, hydrological cycle, energy budget studies, weather / climate prediction, etc. at regional scales. Mapping of water erosion and wind erosion, salt affected and waterlogging soils on 1:50,000 scale for the entire country has been has been carried out using 3-seasons LISS-III satellite data of 2005-06, SRTM / Carto DEM, Universal Soil Loss Equation, available soil and rainfall as well as land use/cover information. Adequate field checks were carried out for mapping and accuracy assessment. The water erosion (sheet) in the erosion map depicts polygons having soil loss greater than 10 tons/ha/year. The grid wise fraction area of water erosion, wind erosion, salt affected areas and waterlogged areas is generated for 5 km X 5 km grid for India and were subsequently rasterized to 5km grid cell product.
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GRIDDED FRACTIONAL AREA LAND DEGRADATION COMPATIBLE TO MESOSCALE MODELS OVER INDIAN REGION

Introduction

India is endowed with vast natural resources. However, for its size and population, it is one of the most densely populated nations. It suffers from a variety of problems ranging from population explosion to accelerated land degradation. India homes over 16% of world's population in an area, which is 2.42% of global spread. Per Capita arable land in India, which is around 0.15 ha at present, is expected to decrease to a meager 0.09 ha by 2075. The lands are highly vulnerable to degradation and nature takes very long period (say 300 – 1000 years) to form an inch of the top soil. Because of lack of adequate information on soil resources coupled with improper land use planning have resulted in many of the present day land degradational problems in our country such as salinity / alkalinity and waterlogging in command areas, severe erosion in catchments leading to siltation of reservoirs, decrease in productivity of crops etc.

Efforts were made by various organizations across the India to identify various types of degraded lands, their spatial extent and severity levels. According to one of the recent studies, degraded lands increased from 130 million hectares in 1987 to 188 million in 1993 (Annon, 2002). Therefore, in recent years increasing emphasis is laid on the information on the nature, extent, spatial distribution and magnitude of land degradation which plays a vital role in planning the strategies for reclamation /conservation of degraded lands.

Under Natural Census Programme (NRC) of ISRO, it was contemplated to monitor the land degradation once in 10 years on 1:50,000 scale. In this context mapping of Land degradation on 1:50,000 scale for the entire country has been carried out by NRSC using 3-seasons (kharif, rabi and summer) LISS-III satellite data of 2005-06 supported with SRTM / Cartosat DEM, available soil and rainfall as well as land use/cover information. Adequate field checks were carried out for mapping.

Objective

The basic objective of the land degradation mapping is to have the status of land degradation in the country on 1:50,000 scale and to generate first ever spatial maps on this scale. Using this data as input the present exercise focuses on generating fractional area of a few important

components of land degradation namely water erosion, wind erosion, salt affected and water logging at 5km x 5km spatial resolution for India.

Background

At NRSA several studies were carried out to map various aspects of land degradation. In one of its earlier attempts NRSA (1990) had developed a methodology to map the potential soil erosion for parts of north eastern states using remote sensing techniques. Subsequently NRSA (1995) took up a national initiative to map salt affected soils of the country at 1:250,000 in association with NBSS & LUP, AIS&LUS and state government agencies of different states. The salt-affected soils were also mapped at 1:50,000 scale using geo coded FCCs from TM/IRS LISS-II sensors for a few areas like Mainpuri and Unnao districts of Uttar Pradesh and south coastal districts of Andhra Pradesh. LD map of India was prepared by NBSSLUP (2005). Recently, NRSC had prepared a seamless digital data base of Land degradation for the entire country at 1: 50,000 scale using multi temporal satellite data. An area of 910,030 sq.km (28 % of our nation's TGA) was found to be under various processes of land degradation. Mapping of natural resources has been an on-going activity for more than three decades.

Data Source

Satellite data

Three seasons' Ortho-rectified Resourcesat-2 LISS III satellite data viz. Kharif, Rabi & Zaid for the years 2005-2006 were used as base data for visual analysis. Approximately 300 LISS-III scenes were used for each season mentioned above. The initial mapping was carried out with Lambert Conical Conformal (LCC) projection. The final outputs were later converted Albers equal area with following parameters.

Projection:	Albers Conical Equal Area projection
Spheroid:	WGS84
Datum:	WGS84
Standard Parallel 1:	28:00:00 N
Standard Parallel 2:	12:00:00 N
Central Meridian:	78:00:00 E
Origin of Latitude:	20:00:00 N

False Easting: 2000000 Meters

False Northing: 2000000 Meters

Legacy/ancillary data

For mapping land degradation on 1 : 50,000 scale, available land use/land cover, wetland and wastelands thematic information from similar scale was used. Besides, forest cover map generated by FSI were also referred to. The 1:250000 scale salt-affected map generated under national mission was also used as reference information while mapping. Apart from this district boundaries from India WRIS and Survey of India topographical maps, meteorological data, soil maps and DEM information were used as inputs Universal Soil Loss Equation to assess the soil loss especially while mapping water erosion categories.

Methodology

The various steps in the methodology adopted for 1:50,000 scale mapping are : geo-rectification of satellite data, design and development visual interpretation cues and process matrix for consistent mapping by various partners, delineation of land degradation categories through on-screen visual interpretation, ground truth collection, soil chemical analysis, finalization of erosion polygon boundaries, quality checking, area estimation and statistics compilation. Brief details of methodology are as follows:

- Georectified Resourcesat LISS-III data of 2005-06 covering Kharif (August – November), Rabi (January - March), Zaid (April - May) seasons was used to map various land degradation processes.

- Land degradation classes were mapped through on-screen visual interpretation satellite data FCCs with land use, waste lands, 1:250000 scale salt-affected maps, DEM in the back drop. Standard visual interpretation techniques with interpretation cues / classification scheme developed for the project were used while mapping.

- Sample points were identified for various land degradation classes through stratified random sampling. Soil samples were collected and analyzed for their chemical properties especially for salt-affected soils and soil acidification.

- The preliminarily interpreted land degradation map was finalized in light of ground truth data, soil chemical data and soil characteristics to arrive at the final map.

- Entire data was organized as geodatabase for proper organization and retrieval.

- For generating NICES data set, water erosion, wind erosion, salt affected areas and waterlogged area classes were extracted as separate layers.

- The Zonal area of above land degradation classes were generated using 5kmx5km Albers equal area grid to compute the zone-wise areas of water erosion, wind erosion, salt affected soils and water logging.

- The grid wise fraction area these classes were generated and fractions areas were joined to attribute table of 5kmx5km grid.

- The 5kmx5km grid was converted to raster on the basis of zone-wise areas for the entire country.

Outputs

The process-wise land degradation maps at their original scale were provided as thematic service on Bhuvan at following URL.

http://bhuvan.nrsc.gov.in/gis/thematic/index.php

http://www.india-wris.nrsc.gov.in/wris.html

They are also available as Web Map Service (WMS) layers through :

http://bhuvan5.nrsc.gov.in/bhuvan/wms

The following 5km X 5km equal area gridded outputs were generated from the above process:.

- Fraction area- water erosion
- Fraction area – wind erosion
- Fraction area – salt affected areas
- Fraction area – water logging

The above products consist of the fractional extent of each land degradation class with in a 5km grid cell. These outputs may be useful in regional modeling of land surface processes, carbon cycle, hydrological cycle, energy budget studies, weather / climate prediction etc. The outputs are appended as following figures:

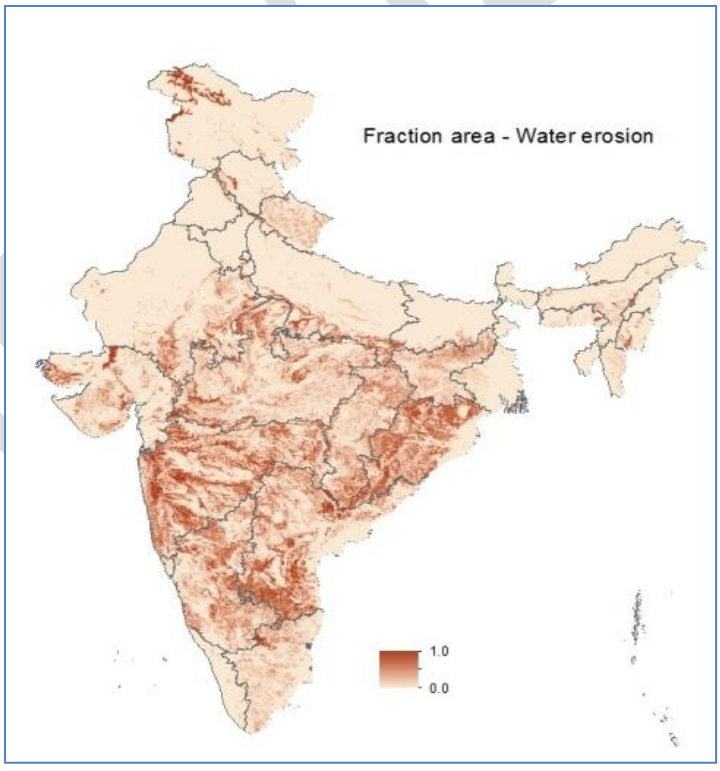

Fig-1. Fraction area of water erosion.

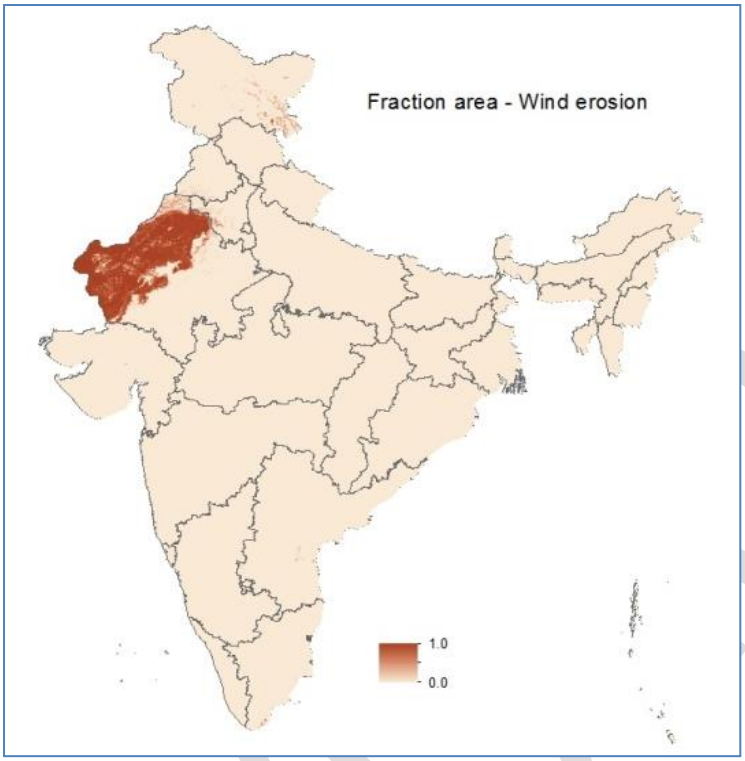

Fig-2. Fraction area of wind erosion.

Acknowledgements

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References:

NRSC (2007). Nationwide mapping of Land degradation using multi-temporal satellite data. Project Manual. Soil and Land Resources Assessment Division, Earth Resources Group, RS &GIS application area, Department of Space, Govt. of India, Balanagar, Hyderabad, India.