

Land Use / Land Cover Mapping of than Mines and Surrounding Area using Satellite Data and GIS

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Abstract: Surendra nagar district of Gujarat is bestowed with rich natural vegetation as well as large reserve of mineral resources. About 60% area of Surendranagar district (Gujarat) has very good quality clay deposits. Than town in western part of Surendranagar district is a main centre for clay mining activity. Land use / land cover map is an important input required for environmental analysis of mining area. Land use is also the most fundamental information of any terrain which is required to find out resource availability and planning at a macro and micro level. The main objective of the present study was to mapping of the Land use/ Land cover (LULC) of Than mines and surrounding area using high resolution satellite data. LULC of Than mines and surrounding area were prepared by IRS P6 LISS-IV, LISS III and CARTOSAT data, in ERDAS 9.1 and ARC/GIS 9.2 version software. In the interpretation of Land use/ Land cover mapping, five categories were identified in level -I classification. Statistics of the study area clearly indicates that 47% area in agriculture and 41 % area in waste land categories. In the waste land category, about 6% area is under mining/quarry/industrial waste. However, there is lot more potential for development in the area. Stringent protection measures are needed to save environmental set-up of the study area.

Keywords: Remote Sensing, Land use/Land cover, High Resolution Satellite Data

1. Introduction

Land use / land cover map is an important input required for environmental analysis of mining area. Land use is also the most fundamental information of any terrain which is required to find out resource availability and planning at a macro and micro level. Land use describes how a parcel of land is used such as for agriculture, residences or industry, whereas land cover describes the materials such as vegetation, rocks or buildings that are present on the surface. This information at a regular interval of time in the form of maps and statistics is very vital for spatial planning, management and optimum utilization of land for agriculture, water resources, forestry, pasture, urban-industrial, environmental studies, etc.

Surendra nagar district of Gujarat is bestowed with rich natural vegetation as well as large reserve of mineral resources. Approximately 312.57 km² was delineated in the core of the clay mining areas of the district. Than is the major center for clay mining area. During the last few decades, there has been phenomenal increase in mining of clay and limestone causing large-scale destruction and deterioration of the natural vegetation.

Need for optimum utilization of land assumes much greater relevance today, with the growing population pressure, low man-land ratio and increasing land degradation. Therefore, the information on land use/ land cover can be integrated with other parameters for environmental planning of the area. Though the applications of land use/ cover mapping are manifold the broad aims are the following:

- 1) To utilize available wastelands and forest land
- 2) To assess current land use vis-à-vis land potential
- 3) To suggest changes in land use/ cover pattern.

2. Study Area

Than mines is situated in taluka Chotila of Surendranagar district in Gujarat State. The area lies in toposheet No. 41 N/2, 41 N/3, 41 N/6 and 41 N/7 between Latitude 22°30'50" and 22°40'30"N and Longitude 71°06'45" and 71°18'25" E. Than is 45 km away from Surendranagar district (Figure-1). The topography of the area is plane and surrounded by hillocks. The drainage pattern is of dendritic type. The main industry in the area is ceramics which is completely based on fire clay. Clay production is raised from various mines in the area.

3. Data Used and Methodology

Satellite data: IRS P6 LISS-IV and LISS III and CARTOSAT data

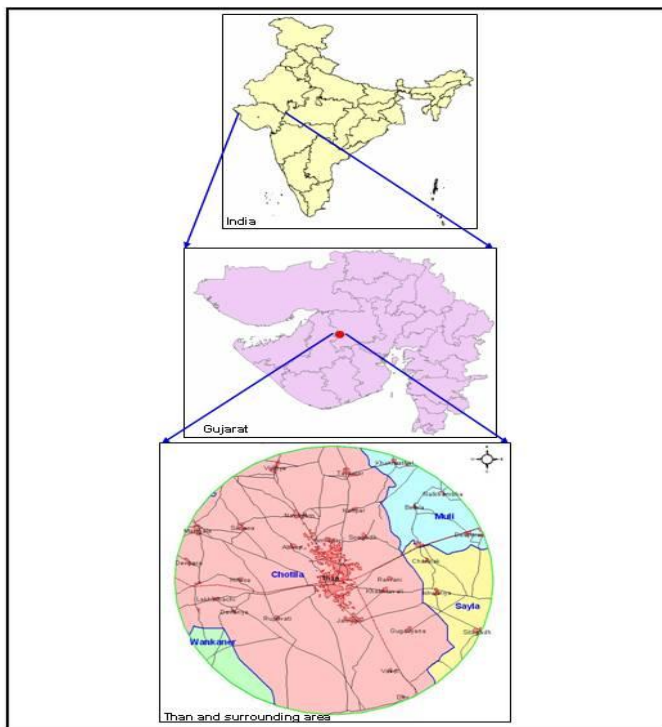
Collateral data: Survey of India (SOI) toposheet on 1:50000 scale, Soil map from NBSS and LUP, Nagpur, Geological, hydrological and geomorphological maps and reports from State Geology and Mining Department, Census 1991 and 2001 data from census department, Rainfall Data from IMD Ahmedabad, Village boundary map from district administration

Methodology: Flow chart of Methodology represented in figure-3

4. Observation and Result

Land use refers to 'man's activities and the various uses which are carried on land. Land cover refers to 'natural vegetation, water bodies, rocks/soil, etc. Although land use is generally inferred based on the cover, yet both the terms are related and interchangeable. The land use/cover map of Than area is presented in Figure- 4. The total area is 312.56 sq. km., which consists of five land use categories, viz. built-

up land, forest land, agricultural land, waste land and wetlands. In each category further classification was carried out based on tone, texture, shape, size, pattern etc. than total ten categories were identified and presented in table- 1.



Study area map
Figure 1: Study area of than and surrounding area.

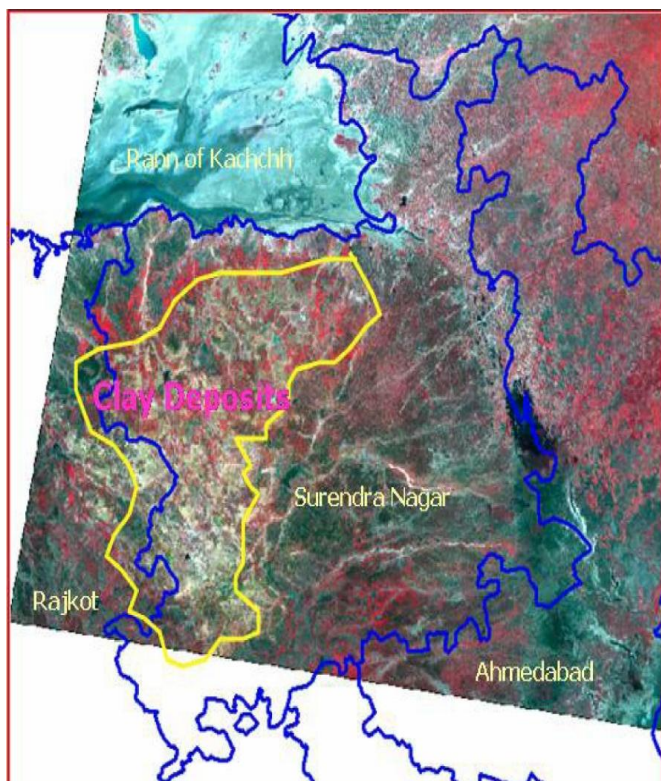
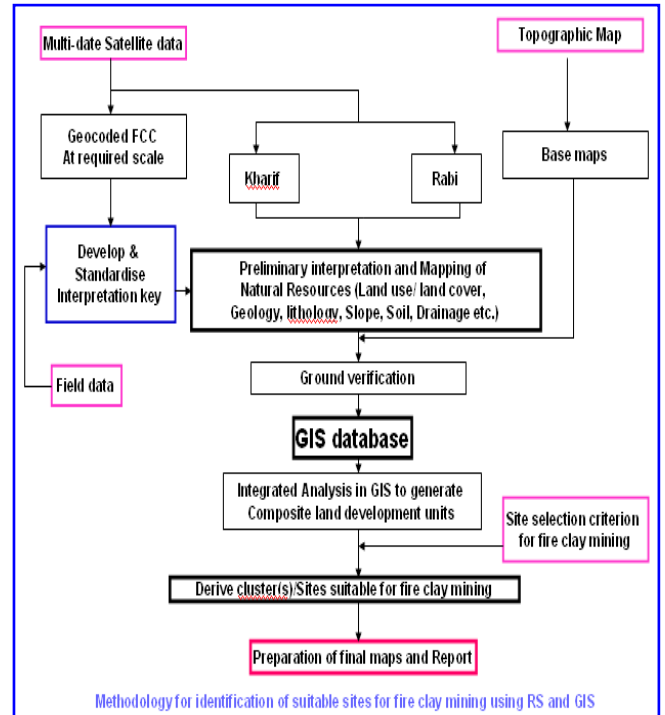


Figure 2: Fire Clay deposits in Surendranagar district, Gujarat



Methodology for identification of suitable sites for fire clay mining using RS and GIS

Figure 3: Flow chart of Methodology

A pre-field interpretation map, Ground truth information, modified Anderson’s classification system and NRSA Manual of Land Use/ Land Cover map (1989) was used for the preparation of Land Use/ Land Cover map. Extensive ground truth data, Farmers/ Villagers interview, Field photographs were helpful for verification of LU /LC map.

The land use statistics of the study area clearly indicates that it is largely agriculture (47%) and waste land area. About 35 % land is under waste land category. 6 % area is under mining/quarry/industrial waste. However, there is lot more potential for development in the area.

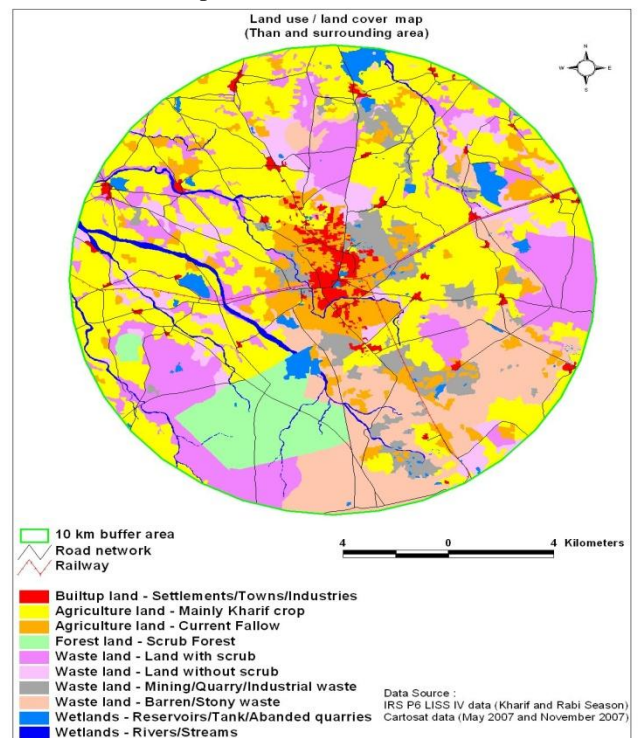
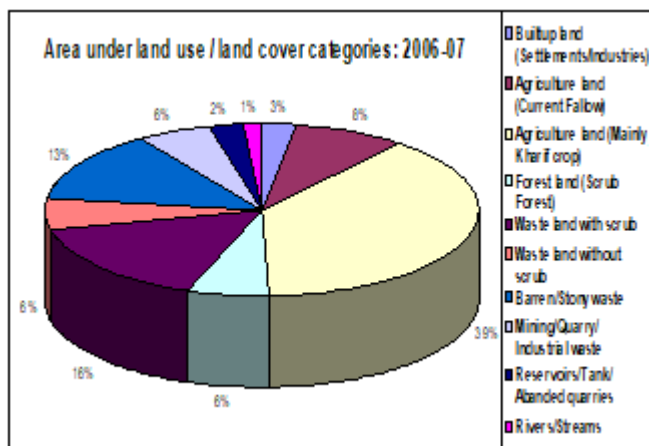


Figure 4: Land use / Land cover map

Table 1: Statistics of LU/LC classes of than and surrounding area

Sr. No.	Land use / Land cover category	Area (ha)
1	Builtup land - Settlements/Towns/ Industries	794.9
2	Agriculture land - Current Fallow	2620.2
3	Agriculture land - Mainly Kharif crop	12080.4
4	Forest land - Scrub Forest	1852.4
5	Waste land - Land with scrub	4936.1
6	Waste land - Land without scrub	1868.4
7	Waste land - Barren/Stony waste	4192.1
8	Waste land - Mining/Quarry/Industrial waste	1723.5
9	Wetlands - Reservoirs/Tank/Abanded quarries	731.8
10	Wetlands - Rivers/Streams	457.1
	Total	31256.7

**Figure 5:** Land use / land cover area statistics

5. Discussion

Fundamental information collected from land use / land cover analysis form an important basis for mining area at micro and macro levels. Need for optimum utilization of land resources assumes much greater relevance today with the growing population pressure low man land ratio and also more due to land degradation. Areas under land use / land cover categories for 2006-2007 have been presented in figure-4 and are as follows

- | | |
|---------------------------------|-------|
| (a) Agriculture | 47% |
| (b) Wasteland | 35% |
| (c) Mining and industrial waste | 5.10% |

Two patches of forest land and some wastelands are still available for plantations and afforestation. Stringent protection measures are needed to save environmental set-up of the study area. Wasteland without scrub and the scrub lands are under heavy pressure from the local community for fuel, fodder etc. Tree plantation activity, controlled grazing, stall feeding of livestock, wood collection, gap planting for filling gaps and natural regeneration in the area seem to be the need of the hour. The top- soil of the fallow lands is fast eroding, as the fallow-cycles are longer and thereby exposing these land patches to the action of erosive forces.

However, Palria V. et. al. (2009) in his yearly report has reported details of land utilization of study area, forest land 32.0%, Irrigated area nil, Un-irrigated area 5.00%, Cultivated waste land 10.00% and area not available for cultivation 53.0%. Further land utilization information as presented by the same authors include for forest land /

agriculture land nil, Govt. wasteland 18.4%, private land/ agriculture land nil and grazing land nil. Thus, there is more potential for development in this area.

6. Conclusion

Land use / land cover map is most fundamental information for environmental analysis of mining area. Present study shows wasteland category including mining area have more area in LU LC map. More base line data is required for future planning of land use / land cover to minimize the impact of mining activities on environment.

References

- [1] **Alrababan, M.A. and Alhamad, M.N. 2006.** Land use/ land cover classification of arid and semi-arid Mediterranean landscapes using Landsat ETM. *Int. J. of remote sensing.* 27(13):2703-2718.
- [2] **Brahmbhatt, V.S., Dalwadi, G.B., Chhabra, S.B., Ray, S.S. and Dadhwal, V.K. 2000.** Land use / Land cover change mapping in Mahi canal command area, Gujrat, using multi-temporal satellite data. *J. Indian Soc. Remote Sens.* 28(4):22-232.
- [3] **Chakraborty, K, Joshi, P.K. and Sarma, K.K. 2009.** Land use / land cover dynamics in Umngot watershed of Meghalay using geospatial tools. *J. Indian Soc. Of Rem. Sen.* 37:99-106
- [4] **Chaurasia, R.Minakshi. and Sharma, P.K. 1999.** Land use / Land cover mapping and change detecion using satellite data – A case study of Dehlon block, district Ludhiana, Panjab. *J. Indian Soc. Remote Sens.* 27: 115-121.
- [5] **Chen, Z.and Wang, J. 2010.** Land use and land cover change detection using satellite remote sensing techniques in the mountainous Three Gorges area, China. *Int. J. of remote sensing.* 31(6):1519-1542.
- [6] **Jayakumar, S. and Arochiasamy, D.I. 2003.** Land use / Land cover mapping and change detection in part of Eastern Ghats of Tamil Nadu using remote sensing and GIS. *J. Indian Soc. Remote Sens.* 31: 251-260.
- [7] **Kumar, V., Rai, S.P. and Rathore, D.S, 2004.** Landuse mapping of Kandi Belt of Jammu Region. *J. Indian Soc. Remote Sens.* 32:323-328.
- [8] **Lobo, A. Legendre, P., Rebollar, J.L.G., Carreras, J. and Ninot, M.J. 2004.** Land cover classification at a regional scale in Iberia: separability in a multi-temporal and multi-spectral data set of satellite images. *Int. J. of remote sensing* 25(1):205-213.
- [9] **Palria, V.S., Parihar, S.K. and Tak, S.2009** Yearly project report on studies of mining and beneficiation techniques and proposal for the improvement: A case study of fire clay deposits near Than in Gujarat.
- [10] **Palria, V.S., Sharma, N., Tak, V., Parihar, S.K. and Palria, S. 2008.** Environmental Impact Assessment of Fire Clay mines in Than area, (District Surendranagar) Gujarat using high resolution satellite data and GIS. Abstracts of the ISRS National Symposium Ahmedabad pp 193.
- [11] **Tak, V.and Palria, S. 2011.** Environmental Planning for fire clay deposits of Than area of Surendranagar district, Gujarat using remote sensing and GIS

techniques. Abstracts of the Geomatics 2011 National Conference, M.D.S. University, Ajmer. Pp 80.

- [12] **Tak, V.and Palria, S. 2010.** Environmental Planning for mineral deposits of Than and surrounding area, Surendranagar district, Gujarat using remote sensing and GIS techniques. Abstracts of the Geomatics 2010 National Conference, Ahmedabad. Pp 118.