Vol. 11, pp. 84-87 (2011)
Journal of Agricultural Physics
ISSN 0973-032X
http://www.agrophysics.in

Short Communication

Assessment of Aeolian Sand Affected Wasteland Area in Sirsa District using Remote Sensing and GIS

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ABSTRACT

Over exploitation of natural resources is causing land degradation and ecological imbalance. Simultaneously land degradation due to desertification, soil salinity, water logging, flooding, droughts, excessive soil erosion due to deforestation and unscientific agricultural practices have resulted in the creation of wastelands. Wasteland mapping was carried out for Sirsa district in Haryana, India using satellite remote sensing and GIS techniques for the year 2003. Landsat ETM+ satellite data and corresponding SOI (Survey of India) toposheet were used for the study. The satellite image was classified on the basis of visual satellite image interpretation and ground truth information available. The total study area under present investigation was 65176.93 ha which is 15.24% of geographical area of Sirsa District. Mainly two broad types of wasteland were delineated in study area: moderately affected aeolian sand and severely affected aeolian sand occupying 3881.77 ha and 545.79 ha, respectively.

Key words: Waste Land**,** Remote Sensing, GIS, Aeolian

Management of natural resources particularly, land and water are very essential for sustainable development of living beings on the earth. The increasing population pressure, urbanization and industrialization have put a great stress on natural resources resulting in the decrease in agricultural area. To cater to the needs of ever increasing population for food, fibre, shelter, fuel and fodder, the natural resources have been excessively exploited causing land degradation and ecological imbalance. Therefore, there is an urgent need to identify and reclaim to some productive use of these degraded lands in the country. Vast tracts of the land are, however, degraded but can be brought under plough with some conscious efforts.

In India, about 47.22 million hectares of land has become a wasteland. It makes a whopping 14.91% geographical area of the country, excluding Jammu & Kashmir (National Remote Sensing Centre, 2010). The J&K part because of restricted accessibility has not yet been covered. In India, the cultivated area at the end of 1993-94 was estimated to about 142 m ha. Indications are that because of pressure on land due to increasing population, it may not be possible to further increase the cultivated land. Nearly all-cultivable

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area, which can be brought under cultivation, is already being cropped. Any further increase in crop area is possible only by bringing degraded wasteland under cultivation. The three main causes of land degradation are over-grazing, arable farming and deforestation. Overall, overgrazing is blamed for 35% of soil degradation, deforestation for 30% and agriculture for 27%. Remote and GIS are information tools which can be employed to delineate areas under different types of degradation.

Sirsa is situated at the northern border of the Thar Desert and most of the land here comes under semi-desert sandy plain type. It lies between 29°14' and 30°0' North latitude and 74°29' and 75°18' East longitudes. From agriculture point of view, district Sirsa comprises of three agricultural sub-divisions namely Sirsa, Dabwali and Ellenabad. Total geographical area of the district is 0.427 million hectares which is spread oven in 326 villages. Total cultivable area, net cultivated area, total cropped area, and Net irrigated areas in district are 0.43, 0.38, 0.60 and 0.28 m ha, respectively (http*://sirsa.gov.in/htfiles/25agriculture.html)*.

In the present study the wastelands of Sirsa district, Haryana have been delineated and mapped at 1:50,000 scale through visual interpretation of Landsat ETM+ 2003 geocoded digital data of October 2003. Available information such as published reports, paper and maps were used. Topographical maps were mainly used for identifying terrestrial village location, major transport network, cultural features and annotation of major towns and cities. Toposheet wise layers were prepared. These maps were digitized and digital (vector) data base was created under GIS environment (ArcGIS 9.2). Spatial distribution, characteristics and present status of wasteland as well as their image characteristics were interpreted. The methodology flow chart is shown in figure 1.

Based on the standard image characteristics such as tone texture pattern, shape, size location and association etc. on-screen visual interpretation of remotely sensed data was carried out using a hybrid approach. Following the standard legends

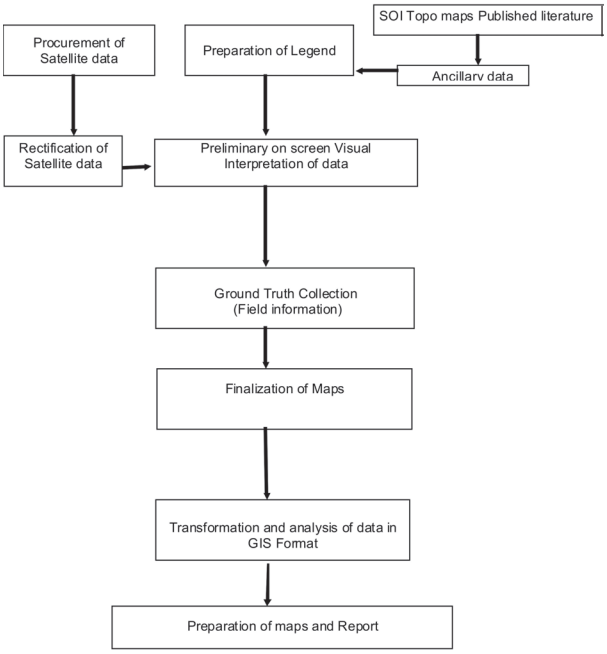

Fig. 1. Flow diagram of the methodology followed in the study

prepared by the Department of Space, different wastelands categories were delineated. A separate layer of the settlement areas along with their names and major roads was also prepared. All the major patches of wastelands were physically verified from ground truth. Other collateral data and published reports were used for mapping different wasteland categories. The map showing areas affected by aeolian sand is shown in figure 2.

Total geographical area of the district is 4.27 million hectares which is 9.66 % of area of the Haryana. The area covered under the present study is 65176.93 ha, which is 15.24% of total geographical area of the Sirsa district. The wastelands in the study area covers 4427.55 ha which is 6.79% of the area of Sirsa district. The main category identified in the district is Aeolian sand. These lands are characterized by accumulation of sand in the form of varying size of sand dunes that have developed as a result of transportation of soil through Aeolian processes. The area being adjacent to Rajasthan State is typically under arid climatic condition. So, soil erosion due to wind is a very frequent

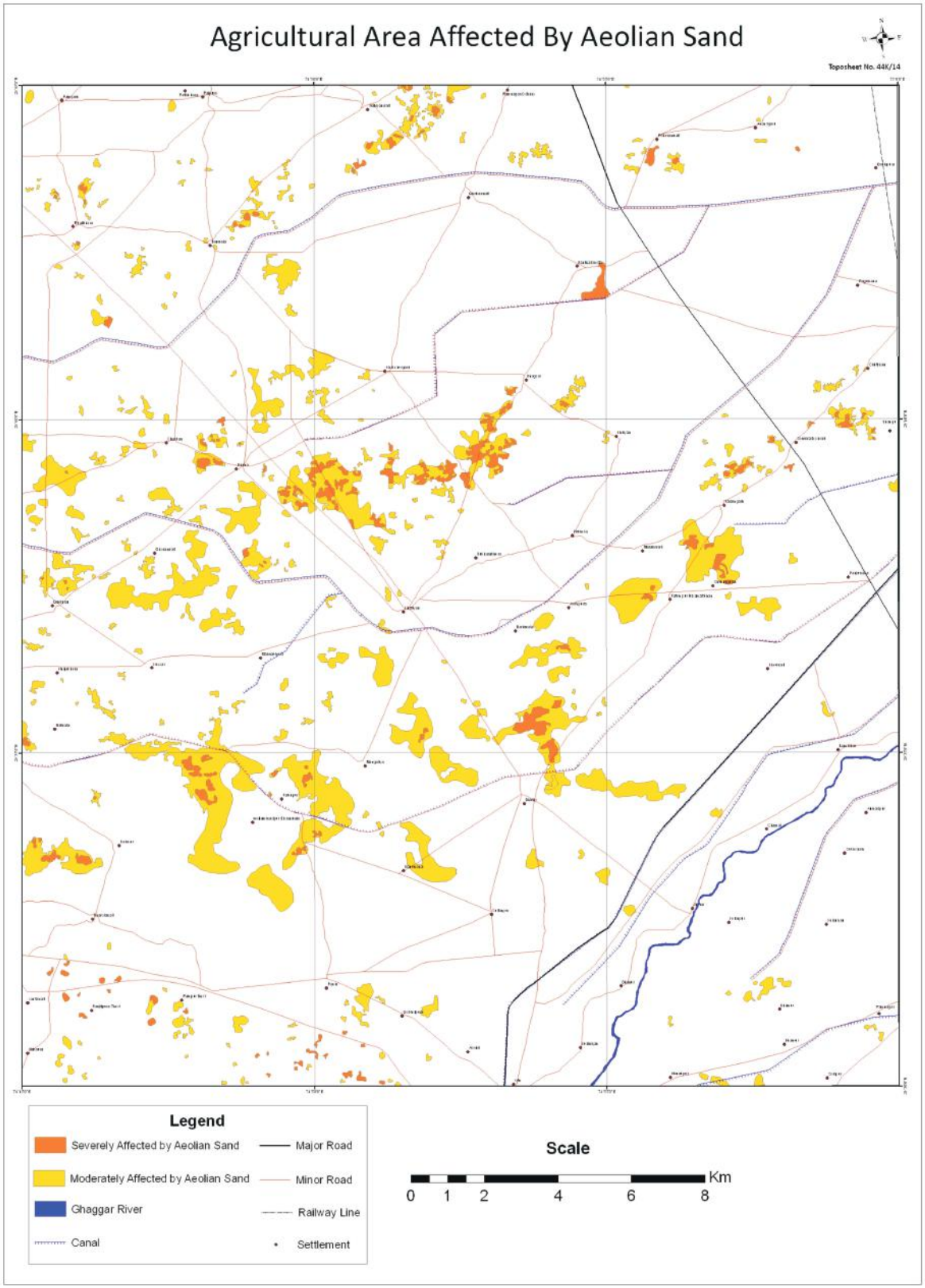

Fig. 2. Map showing area affected by aeolian sand

Table 1. Area under different wasteland categories in the study area

S.N.	Category	Area (ha)	Area (%)
1	Ghaggar River	74.03	0.11
2	Moderately affected by Aeolian sand	3881.77	5.96
3	Severely affected by Aeolian sand	545.79	0.84
4	Other	60675.33	93.09
5	Total	65176.93	100.00

phenomenon in these areas. The most part of the study area consists of sandy soil with low soil moisture content and organic matter content and therefore loss of soil in form of sand dune and sand transportation is a very common process by wind erosion. The Ghaggar, an important seasonal river in the district is a major drainage of the area and covers nearly 0.11% of the study area. In study area, two main categories of Aeolian sand have been identified, which are as follow:

(1) Moderately Affected by Aeolian sand: Area under this category is 3881.77 ha which is 5.96% of the study area (Table 1). This category is higher than another because of good soil characteristics such as- good organic matter content with soil moisture retention. Agricultural activities in this region are intensive because of good soil condition but it need to be managed scientific agricultural practices. In condition of extreme utilization without proper management, these may gradually turn in critically. These types of soil can be converted by adopting recommended agricultural practices and can be optimized for better agriculture.

(2) Severely Affected by Aeolian sand: This area covers 545.787 ha which is 0.84% of the study area (Table 1). Although this category is less than the first category and is very small part of total geographic area, but it is not useful for agricultural practices. Vegetation in this area is very sparse because soils are sandy and deficient in plant nutrients and moisture. These categories of soil are very difficult to ameliorate because of its bad physical and biological condition, although they can be used for plantation and for subsistence agriculture to some extent.

The study demonstrated the potentiality of satellite remote sensing technique for preparation of more consistent and accurate baseline information on wastelands. Interpretation of Landsat ETM+ data supported by ground truth information revealed that there are two types of wastelands in the study area. It could be concluded that most of the area of district is covered by aeolian sand, of which 5.96% is moderately affected by aeolion sand while 0.84% is severely affected by Aeolian sand.

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