

# Integrated Management of Wastelands using GIS and Remote Sensing Tools - A Case for Some Selected Districts of State of Gujarat

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**ABSTRACT:** Excessive demand of more land, both for agriculture and non-agriculture pursuits has resulted in exploitation and reclamation of all such lands which are at present either lying unused or which have been turned unproductive, due to various reasons. Treatment and reclamation of wasteland are not only technically difficult but currently expensive as well. This paper attempts to study the various wasteland categories in 13 selected districts of Gujarat State and analyze the possible reasons after mapping the districts by grouping them under various categories, like percentage area covered by wastelands to the total district area etc. This enables us to correlate the type of wasteland with the environmental and socio-economic conditions prevailing in the concerned districts for effective planning and reclamation.

**KEYWORDS:** Wasteland, Identification, Reclamation, RS & GIS technique.

## I. INTRODUCTION

Information on Geographical location, areal extent and spatial distribution of wastelands is essential for their effective management and sustainable development. Traditionally the wasteland statistics have been compiled from village records. Now there is a greater concern for spatial validity of the map, statistical reliability of the information and timeliness of its availability. It is here, that the importance of satellite remote sensing techniques and GIS in providing such information has been well recognized (Bhatnagar, 2010). Due to increasing pressure of population, there is an excessive demand of more land both agricultural and non-agricultural pursuits. This has resulted in creation of vast stretches degraded land, soil salinity, water logging, desertification, soil erosion etc and the decrease in per capita cultivable land besides ecological imbalances (Daniel, 2010). The present paper highlights the conditions for 13 selected districts of Gujarat State which have more than 5% of its total geographical area as wasteland in order to understand the existing situation and to take necessary steps for reclamation for effective planning and management of land as a resource.

### Objectives the research study

The present study aims to address the following objectives-

- The Utility of Satellite data in identification and mapping of various categories of wastelands and updating the information contained in wasteland maps using remote sensing data.
- To study spatial disparity in levels of area under wastelands at the state level, at the district level and at each of the 13 selected districts and to identify the most vulnerable districts.
- To suggest suitable remedial measures for converting the existing wastelands into productive assets starting with the worst affected districts with top priority.

## II. STUDY AREA

Geographically, Gujarat is a land of great contrasts. It stretches from the wet, fertile rice-growing plains of the southeast (Surat and Ahwa) to the almost rainless salt deserts of Kachchh (Kutch). The northwestern region is bounded on the south by the Gulf of Kachchh, and on the north it is separated from Pakistan by the Rann of Kachchh, a huge salt marsh. The Kathiawar region south of Kutch is also arid, containing the Gir Range and the Girnar Hills. Northeastern Gujarat is mainly an area of small plains and low hills. Rainfall here is sparse, and January temperatures may drop to freezing; on the other hand, a temperature of 118° F (48° C) has been recorded in the hot season. Southward, in central Gujarat, rainfall increases and temperature ranges are less extreme. Southern Gujarat is a region of warm climate and plentiful rainfall. The State of Gujarat is divided into 25 districts out of which 13 districts are identified for the present study as they have more than 5% of the total Geographical area under wastelands (**Figure 1**).

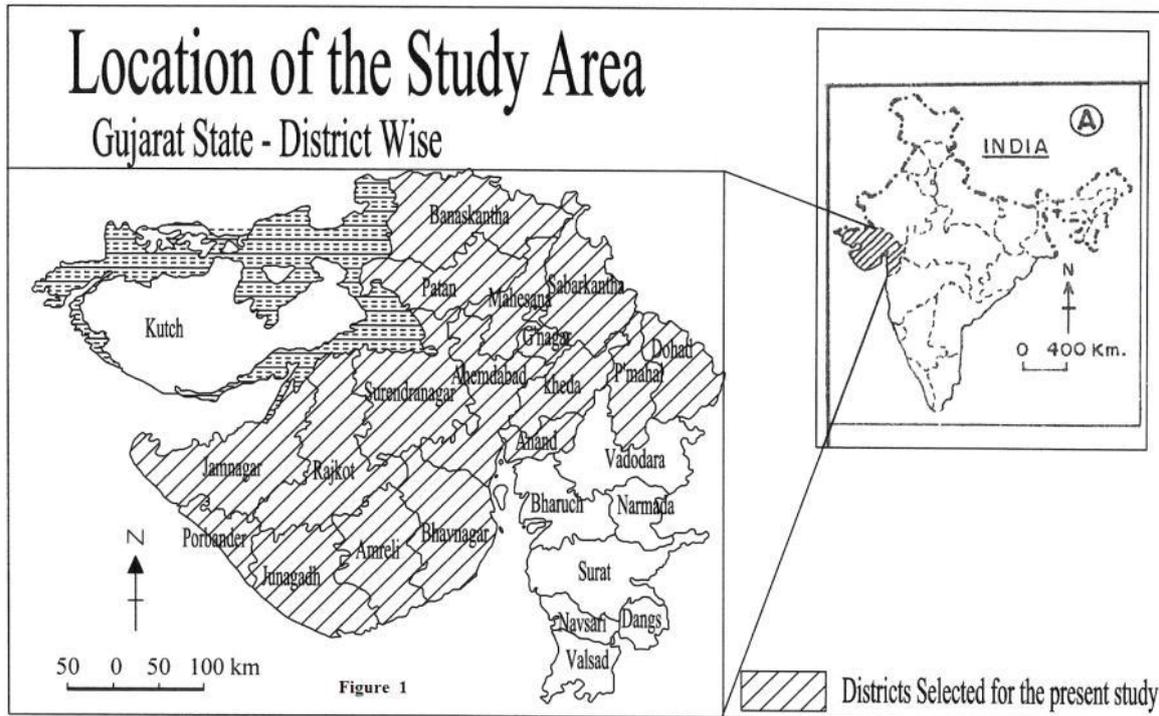


Figure 1

Figure 1: Gujarat State- Location in India

Database and methodology For the present study the data used is:

- a) Survey of India toposheets on Scale 1:50,000.
- b) IRS-1A and 1C –geo-coded FCC of bands 2,3 & 4 on 1:50,000 Scale.
- c) Secondary data in the form of Census Atlas and reports, statistical Handbooks 2001 as well as Wasteland Atlas of India 1991.

National Remote Sensing Agency, Department of Space, has prepared the wasteland catalog of all the states and Union Territories on 1:100,000,000 scale in the year 1985. About 190 Landsat false colour diapositives on 1:100,000,000 scale of 1985 available in the archives of NRSA data centre were used for the study. Data table for Gujarat state for 2001 is available in the form of secondary information in the Wasteland Atlas of India 2001. About eight wasteland categories were identified and mapped in this study. Based on this study the total area under wastelands in the respective districts of Gujarat State was estimated in terms of Square kilometers.

The methodology essentially includes visual interpretation of enlarged satellite false colour data (1:50,000 RF) based on image characteristics such as tone/colour, texture, pattern, shape, size, location and association to identify and delineate different types of wastelands for each of the selected districts of Gujarat State (Morris, 1996). The Final thematic details and the district boundaries were transferred to base map prepared using survey of India toposheets made available during the training undertaken at NRSA during the year 2004. The data sheet was prepared for wasteland categories and percentage of wasteland according to each of the wasteland category was calculated in terms of percentage to the total Geographical area of the districts. Thematic maps were generated for each category of wasteland according to their percentage area covered to the total geographical area-district wise. These thematic maps were overlapped in order to identify the most vulnerable districts which have 25% or more area under wastelands so as to correlate with the existing physical and economic conditions in that district and for effective planning and management giving top priority to such districts.

Wasteland categories under different districts Wasteland categories under different districts of Gujarat State as per the percentage coverage to total geographical area (Figure 2) and (Figure 3) are as described below- Gullied and Ravine: The Districts of Kheda and Anand cover 152.57 Sq.km area under this category and thus is the most critically affected district as compared to any other district of the Gujarat State. Upland with or without scrub: This category covers maximum area of the total geographical area of the 13 selected districts with the State. However, the districts of Jamnagar and Junagadh cover 2535.96 and 2328.60 Sq.km area respectively which amounts to more than 25% of the total Geographical area of the districts. Waterlogged and Marshy land: The district of Surendranagar covers the

maximum area under waterlogging and marshy land in comparison to any other districts in Gujarat State. The districts of Ahmedabad, Bhavnagar Gandhinagar, Jamnagar, Junagadh, Kheda, Mehsana and Panchmahals do not have any area under this category. Land affected by Salinity/Alkalinity (coastal/inland): The District of Ahmedabad has about 864.93 Sq.km area under this category followed by the districts of Surendranagar (710.10 Sq.km) and Bhavnagar (574.37 Sq.km). Under utilized / degraded notified forest land: The Districts of Panchmahals cover an area of 984.98 Sq.km which is the highest area under this category if compared to any of the districts under this category. The Districts of Panchmahals has over 70% of its total Wastelands under this category. Degraded Pastures / Grazing land: The District of Mahesana has 90.06 Sq.km area under this category. Degraded Land under plantation Crop: The District of Rajkot covers an area of 24.32 Sq.km under this category which is more than 8 times as compared to other districts like Kheda (3.96 Sq.km). Sands (Inland/coastal): The District of Banaskantha covers an area of 47.05 Sq.km which 5 times more than that of Kheda (9.17 Sq.km). Mining / Industrial wastelands: The Districts of Banaskantha and Panchmahals account for 3.77 & 2.55 Sq.km of wasteland area under this category. Barren rocky / stony waste / sheet rock area: The District of Junagadh and Jamnagar covers 325.16 & 311.32 Sq.km of area under this category respectively. Steep sloping area The districts of Sabarkantha and Banaskantha account for 162.59 & 159.93 Sq.km of its total wasteland area under this category which is highest as compared to any other districts selected for the present study.

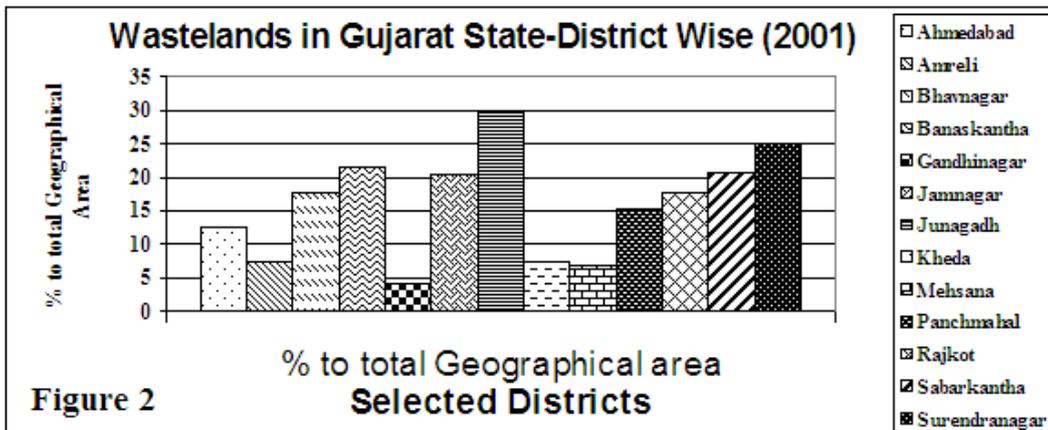


Figure 2 : Waste land in selected districts

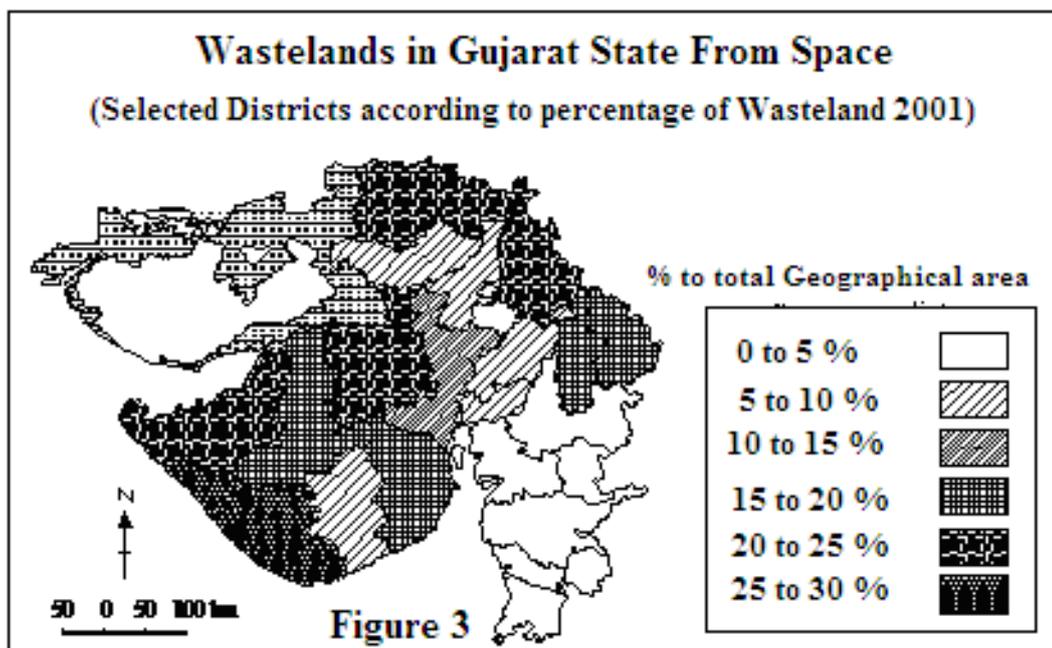


Figure 3: Space image of wastelands in Gujarat

### III. FINDINGS AND SUGGESTIONS

In the Districts of Gandhinagar (89.28%) and Kheda (28.95 %) the percentage of Gullied and Ravinous lands is higher, compared to that of other selected districts. Efforts are to be made to plant bushes or grow grasses of the fast growing varieties in order to control or stop any more erosion of the top soil.

In the Districts of Panchmahal (72.63 %) and Sabarkantha (28.36 %) where the percentage of area under degraded forests is higher, efforts are required to reclaim the degraded land by plantation crops. This can be achieved by removing the rock debris, digging out pot holes on rocky slopes where fuel wood species can also be raised to meet the local demand of villagers for fodder and fuel. This should be in compliance with other programmes like water conservation and management in the rainfall deficient areas or in those areas where surface runoff is maximum.

The areas under sheet rock or stony waste should be converted into depressions which can function as reservoirs or water bodies to meet the requirements of the livestock and human beings so that they don't have to migrate to other areas.

The North-eastern districts of Sabarkantha and the Eastern undulating tracts of Panchmahals as well as the Districts of Junagadh where sloping land needs priority among control measures to check soil erosion by bunding drainage channels, afforesting degraded areas and transforming some land into pastures for livestock.

The most worst or critical districts as per the percentage of total wasteland area out of the total geographical area is concerned are Junagadh (3141.14 Sq.km i.e. 29.61%) and Jamnagar (2883.58 Sq.km i.e. 20.41%).

Whereas almost all of the 13 selected districts have higher percentage share in the total wasteland area for the category Upland with or without Scrub. Thus this is the land which is valuable and can be fruitfully put to use by proper planning keeping in mind the future needs of the individual districts.

### IV. CONCLUSIONS

For integrated management of wastelands it is necessary to identify and delineate the wastelands at micro level, using the —Cartosat data, on 1:10000 scale. This will help us to have a precise mapping of the wastelands. The present study focuses its view to incorporate the land ethics that called on people to view themselves as a part of the environment and to discard the notion of human as conqueror of nature. The land ethic teach us to respect the land and the ecosystems, in order to make the best of the use of every land which is today categorized as wasteland, by proper conservation and restoration measures adopted scientifically and sustainably.

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