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PRELIMINARY GIS AND REMOTE SENSING ANALYSIS ON BANNI GRASSLANDS, KACHCHH

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ABSTRACT

The present study was carried out in Banni grassland (23^0 19" to 23^0 52" N; 69^0 8" to 70^0 11" E) of Kachchh district which spreads 2,617 km^2. Land use - land cover map of Banni region was prepared using Arc GIS and ERDAS Imagine. Sub-setting of the Satellite Imageries was done using Survey of India (SoI) maps 1: 50,000 scale. Five major land use classes were identified and the *Prosopis juliflora* L. distribution map was prepared and it estimated that about 45 % of the total area was under *Prosopis* cover.

Key words*: land use map, GIS and remote sensing, banni grasslands, kachchh, prosopis invasion.*

INTRODUCTION

Once Banni was considered as the largest grassland of its kind in Asia, but has fallen upon sad times in the last decades. The degradation of Banni area was linked to increasing salinity, growing human and livestock population, uncontrolled grazing and a large scale growth of invasive *Prosopis juliflora* (here after *Prosopis*). In addition to the anthropogenic pressure the existing arid conditions were adversely affected the grassland ecosystem functions.

Satellite Remote Sensing and Geographical Information System have provided very useful methods of surveying, identifying, classifying and monitoring several forms of earth resources [1]. Remote Sensing data provides accurate, timely and real time information on various aspects such as size, shape and terrain of the area of interest.

Literature survey reveals that there are a few studies existing on Banni grassland habitat mapping by using GIS and RS [4]. Jadhav et al. [2] used IRS-LISS II and TM data of the year of 88-89 and classified various habitat types. Vegetation map of Banni was prepared by GUIDE [3] using LISS III data of 1997 and 2001 and Sastry et al. [4] studied the biodiversity threat using GIS. Earlier studies predicted that *Prosopis* invasion in the grasslands will be 45% of the total area during 2010. Hence, this study was under taken to prepare a recent land use map of Banni grasslands and the *Prosopis* distribution status by using LISS III IRS – IC and 1D of June 2008.

STUDY AREA

Banni is situated on the northern border of the Bhuj Taluka (23^0 19" to 23^0 52" N; 68^0 56" to 70^0 32" E) of Kachchh district. It encompasses an area of 2,617 km^2 in the fringes of Greater Rann. The plains of Banni represent an embayment between the Kachchh mainland uplift in the south, the Pachchham uplift in the north and the Wagad and Bela uplift in the east. In the southern part of Banni there is an intervening stretch of salty waste, known as Little Rann of Banni, which separates the Banni from Kachchh mainland [5]. The Banni is falling in arid climate regime therefore; temperature is high around the year and during summer (April - June) it reaches maximum of 48^0- 49^0 C. During winter temperature goes down to 8^0-10^0 C; January and February being the coldest months. The rainfall received through southwest monsoon between June and September with an average of 317 mm per year with a coefficient of variation of 65% and droughts are a recurring phenomenon. As per 2003 Livestock census Banni grasslands support 30,000 cattle and 25,000 sheep and goat, and 48 villages mainly depended through on livestock rearing.

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MATERIALS AND METHODS

Data Used

In the present study Indian Remote Sensing satellite IRS – IC and 1D LISS III spatial resolution of 23.5 m was used. The Banni grassland falling in two scenes path (89 & 90) and row (55) and the cloud free data on April 2008 was procured from National Remote Sensing Agency, Hyderabad. The data was geo-referenced with Survey of India topographical maps of 41 E1, E5, E6, E9, E10, E14 and E15 at 1: 50,000 scale.

Ground Controlling Points (GCP) were collected from different parts of Banni area and it used as reference data for different vegetation. It also used for delineating different *Prosopis* density classes and the maximum likelihood classifier is used for processing of the satellite data.

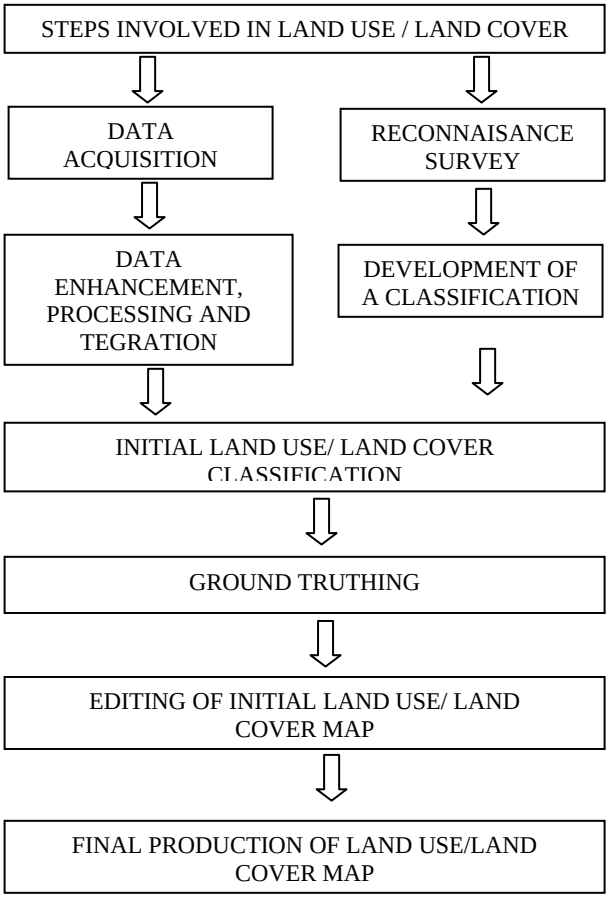
Largely two major methods were available for data analysis for extracting resources related information from data products namely digital image processing technique and visual interpretation technique and for this study digital image processing technique was used. Further this technique was divided in to 1, *Supervised classification* and 2, *Unsupervised classification* and for this study supervised classification method was used. The steps involved in land use land cover preparation are given in the flow chart.

RESULTS

Survey of India (SoI) map was taken as a reference map of study area and both satellite imageries and toposheets were coordinated according to the earth coordinated system. For delineating Banni boundary onscreen digitization was done from SoI toposheet. Information collected from SoI toposheets and personal field visit to Banni were used as reference data for land-use land-cover classification. Sub-setting was done by using the False Colour Composites (FCC) imageries. For sub-setting ERDAS IMAGINE (9.3) and Arc GIS (9.3) were used. Later the panchayat boundaries were transferred from SoI maps and DILR (District Land Records) village maps and it was super imposed to the subset map of Banni. Base map of the

Banni area was generated and the ground truthing was done with the help of Garmin GPS 12 model. In the base map 19 panchayat boundaries, road (Kachha and Pakka) network, water bodies, settlement locations were also transferred from the SoI maps and it was confirmed with the ground truthing. The final out put map of the Banni area was generated and it was given in the figure (Figure 1).

Flow Chart of Land Use / Land Cover Map



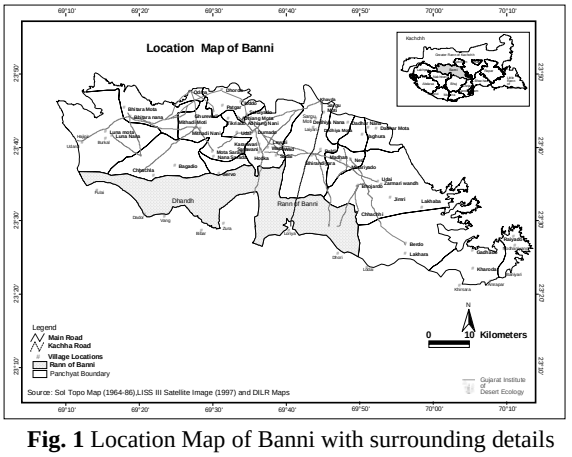


Fig. 1 Location Map of Banni with surrounding details

On the basis of field observations and differences in the tonal/colour or density variations in the imagery the land use map of the Banni region was generated. The land use pattern was classified into five major types; *Prosopis* dominant area, Suaeda scrub, *Prosopis* with other vegetation, Grassland with sparse *Prosopis* and Water bodies (Figure 2)**.** Predominant area in Banni is barren and Sueada scrub (75324.72 ha) followed by *Prosopis* dominant area (72073.48 ha) and *Prosopis* with other vegetation (55451.94 ha) (Table 1).

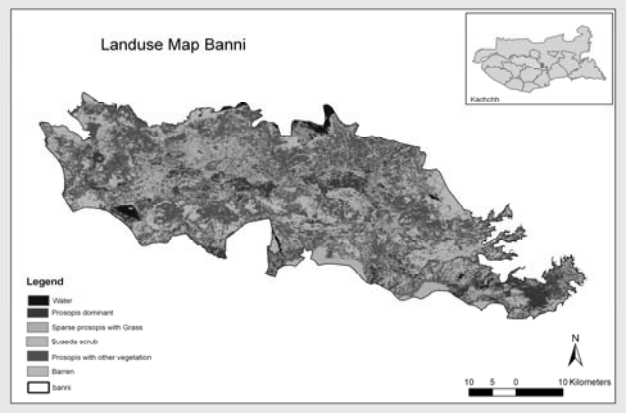


Fig. 2 Land use Map of Banni Grassland, Kachchh

Table - 1 Vegetation Classification of Banni grasslands by Satellite Imageries

Major Classes	Area in ha	% of the total area in 2008
Prosopis Dominant area	72,073.48	27.53
Water	3,839.64	1.47
Suaeda scrub (Including Barren Land)	75,324.72	28.77
Prosopis with other vegetation	55,451.94	21.18
Grass with sparse *Prosopis*	55,081.74	21.04
Total area	261,771.5	100.00

In grasslands *Cyperus* sp., *Dicanthium annulatum*, *Chloris barbata*, *Creesa cretica, Aristada* sp. and *Sporobolus helvosus* were observed. There are a few uninterrupted grass patches observed near to Dumado and Gorewali villages. During the GCP survey of these locations the rare and endemic grass *Urochondra setulosus* (Trin.) was recorded.

In Banni many seasonal water bodies was observed and its water spread area is mainly dependent on rainfall. Generally in Banni, many areas are low lying and during monsoon it gets filled by rainwater and act as a seasonal water bodies.

Based on the tonal colour the *Prosopis* density was classified into high, medium and sparse. In high density *Prosopis* areas dark red colour was observed whereas in medium density class the brownish red colour was observed and in sparse *Prosopis* area pink tone was observed. Overall above 45 % of area in Banni is falling under *Prosopis* and its density varied in different parts (Figure 3). A comparative analysis was made with the previous study by GUIDE [8] and it showed that area under *Prosopis* dominance during 1997 was about 6 % and in 2008 it increased 27.5 % of total area and this result is clearly indicating that the grass cover has reduced and the wood land habitat (*Prosopis* dominant area) increased between August 1999 and April 2008. *Prosopis* density was high in the middle of Banni area mainly in Gorevali, Mithdi, Hodko, Lakhabo, Raiyado, Bhojardo and some part of

Bhirandiyara panchayat area and it showed a gradual decrease in the fringe areas.

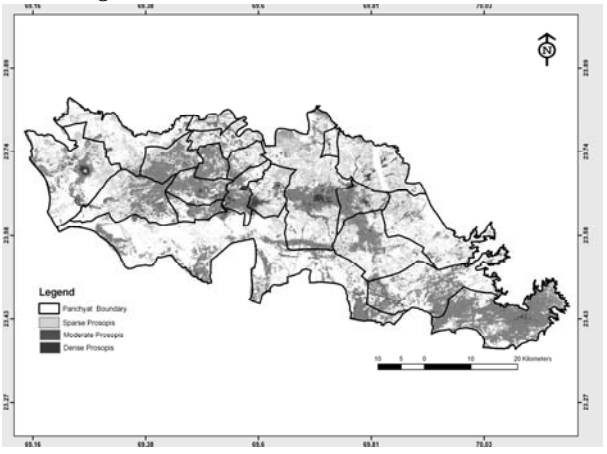


Fig. 3 *Prosopis juliflora* distribution in Banni Grasslands, Kachchh

DISCUSSION

Ever since the remote sensing data in the earth's surface is available for the analysis and attempts were made to achieve classification on earth surface [6] and in this present study the Banni grassland land use pattern was prepared and five major land use forms were identified. Nagendra [7] stated that remote sensing is the valuable tool for assigning the biodiversity in a large scale area because considering that field measurements are time-consuming and costly, remotely sensed images could be used to derive the patterns of landscape. The present study also covered 2617 km^2 area with different vegetation cover hence GIS and RS is the useful tool to prepare the land use land cover map.

Previous studies in Kachchh grasslands highlighted the invasion of *Prosopis* in the grasslands as a major problem and in the present study also found that about 49 % area is under *Prosopis*. Sastry et al. [4] has estimated the *Prosopis* spreading speed in Banni grassland was 1.15 % of the total area and it estimated that during 2010, 45% of the total Banni area is under *Prosopis* and in the present study also found that the situation in true in Banni area and it shows very alarming situation for Banni grasslands. The earlier recommendations like phase wise removal of *Prosopis* will give a better conservation measure for the grassland restoration in Banni grasslands [8] and [9]. The present study revealed that moderate *Prosopis* cover was occupied about half of the Banni grassland area and this area will likely to be denser in near feature. The invasion of P*rosopis* woodland in the grasslands is changing the grassland ecosystem function of the area and it will have a serious impact on grassland biodiversity. As human and natural forces modify the landscape, it increasingly important to monitor and assess the alterations. As Banni grassland like pastoral land management is getting high priority in terms of grassland biodiversity as well as pastoralists. The vegetation cover changes influence management and policy decisions for the stake holders but monitoring the changes from intensive field sampling will be very difficult [10, 11].

Hence this study is more useful for conservation and management purpose of the stake holders.

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REFERENCES

[1] Suresh, M., Sudhakar, S., Tiwari, K.N. and Chowdary, M. (2004) Prioritization of watershades using morphometric parameters and assessment of surface water potential using remote sensing. *J. Indian Soci. Remote Sensing*, **32 (3)**: 249 - 259.

[2] Jadhav, R. N., Kimothi, M. M. and Kandya, A.K. (1992) An approach for assessment of grassland using satellite remote sensing – A case study for semi arid region (Banni), Gujarat. In *Proc. Nat. Symp. on Remote sensing for Sustainable development*, pp. 37- 42.

[3] GUIDE, 2004. *Vegetation cover mapping of Banni grassland using remote sensing*. Gujarat Institute of Desert Ecology, Bhuj. pp. 24.

[4] Sastry, K. L. N., Thakker, P. S. and Jadhav, R. (2003) Biodiversity threat through exotic species monitoring and management using remotely sensed data and GIS techniques. In 6th annual international conference on MAP INDIA 2003 during 28-31 January 2003 at New Delhi.

[5] GUIDE and GEER, (1998) *An ecological overview of Narayan Sarovar Sanctuary and adjoining de-notified areas*. Gujarat Institute of Desert Ecology, Bhuj and Gujarat Ecological Education and Research Foundation, Gandhinagar. pp. 61.

[6] Kandya, A. K., Kimothi, M. M. and Jadhav, R. (1992) Image Texture processing for classification of forest types using IRS LISS II data. *In Proc. Nat. Symp. on Remote Sensing for Sustainable Development*, pp. 43-46.

[7] Nagendra, H. (2001) Using remote sensing to assess biodiversity. *Int. J. Remote Sensing*, **22:** 2377 - 2400.

[8] GUIDE (1999) *Ecorestoration of Banni grassland.* Gujarat Institute of Desert Ecology, Bhuj. pp.79.

[9] SAC (2002) *Grassland mapping in Gujarat using Remote Sensing and GIS techniques: Kachchh District*, Space Application Centre, Ahmedabad. pp. 36.

[10] Busby, J. R. (2002) Biodiversity mapping and modeling. In Skidmore, A. (ed.), *Environmental Modeling with GIS and Remote Sensing*. Taylor and Francis: London, UK, 145–165.

[11] Kerr, J. T. and Ostrovsky, M. (2003) From space to species: Ecological applications for remote sensing. *Trends in Ecology and Evolution* **18**, 299–305.

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Books

[16] Stebbins, G. L. (1974) *Flowering plants: Evolution above the species level*, Arnold Press, London, pp. 1 – 399.

Chapters from a book

[19] Schafer, H. and Muyzer, G. (2001) Denaturing gradient gel electrophoresis in marine microbial ecology. In *Methods in Microbiology* (Ed. Paul, J. H.), Academic Press, London, Vol. 30, pp. 425 – 468.

Thesis or other diplomas

[21] Nayaka, S. (2004) *The visionary studies on the lichen genus Lecanora sensu lato in India.* Ph. D. Thesis, Dr. R. M. L. Avadh University, Faizabad, India.

Conference proceedings

[4] Mohapatra, G. C. (1981) Environment and culture of early man in the valley of rivers Chenab and Ravi, western sub-Himalayas. In *Proceedings X Congress of IUPPS*, Mexico, pp. 90 – 123.

Online documentation

[9] Koning, R. E. (1994). Home Page for Ross Koning. Retrieved 26-6-2009 from *Plant Physiology Information Website*: http://plantphys.info/index.html.

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