

COMPARATIVE EVALUATION OF AWiFS DATA FOR DESERTIFICATION STATUS MAPPING

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ABSTRACT:

The desertification process is a creeping disaster, consuming the marginal lands. It is imperative to map all the dry-land areas of the country for Desertification Status Mapping. Thus a suitable data set is required for the purpose which holds desired application potential at 1:500,000 scale for preparing large area Nationwide Desertification Status Maps. Hence the current exercise has been used to compare DSM prepared AWiFS with LISS III and WiFS data for a selected area around Sambhar lake in Rajasthan which represents marginal land, prone to desertification. The present paper gives the details of analysis and the results obtained while evaluating IRS-P6, Resourcesat-AWiFS data.

1. INTRODUCTION

Desertification is defined as the process of land degradation in Arid, Semi-arid and Dry-Subhumid areas resulting from various factors, including climatic variations and human activities (UNCED, 1992)

Desertification Status Mapping at 1:50,000 scale has been successfully attempted as pilot project for 16 selected test sites in Arid-Semi-Arid and Dry-subhumid regions of Hot and Cold areas of the country. This project is carried out under the auspices of United Nations Convention for Combating Desertification (UNCCD), through Ministry of Environment and Forest (MoEF), New Delhi.

This project aimed at developing a common methodology for preparing Desertification Status Maps (DSM) for both hot and cold regions of India. This is achieved by evolving a comprehensive classification system for Desertification Status Mapping.

Under the auspices of the Indian component of UNCCD-TPN1, a task team was constituted for this purpose, with Space Application Center as the nodal agency to co-ordinate with other agencies/institutions/centers, involved in the field of land degradation / desertification.

A comprehensive classification system, for both hot and cold areas of the country have been developed. Subsequently, 16 selected sites were picked up for pilot studies both in hot and cold areas.

Having established the methodology of DSM through successful completion of pilot projects, it has been decided to prepare desertification status map (DSM) of all the dryland areas of the entire country, both in hot and cold regions. This is attempted for the first time in the country, by any agency ever. For this purpose the AWiFS data was evaluated with respect to LISS III and WiFS.

The paper presents the details of the methodology applied and the results obtained

Sambhar lake area is chosen for the present evaluation of the AWiFS data, which is juxtaposed appropriately between the Thar desert on its west and the fertile lands on the east, between 74°30' E - 75°55' E longitudes and

26°45'N - 27°30' N latitudes This is a known 'gap' in the Aravallis, which presents an avenue for the SW-winds to blow across Aravallis from the west to the east (Dhabaria S.S, 1986)

Multi-temporal satellite data have been used for the study area. The three main data sets have been used to evaluate the application potential of AWiFS data for the purpose of desertification Status Mapping, viz. AWiFS, WiFS and LISS III (Table 1)

Table –1 Data Used

AWiFS	28Nov, 2003	15 Jan, 2004
LISS III	-----	13 Jan 1998
WiFS	18,Nov 2002	23 Jan 2003

2. METHODOLOGY:

Visual interpretation technique has been used to analyze and compare the satellite data and collateral data. Base map has been prepared using topographical map on 1: 500,000 scale. Simple light table has been used to interpret the IRS LISS III FCC transparency, AWiFS paper prints and WiFS paper prints on 1:500,000 scale,

The detailed methodology is given in Fig 1

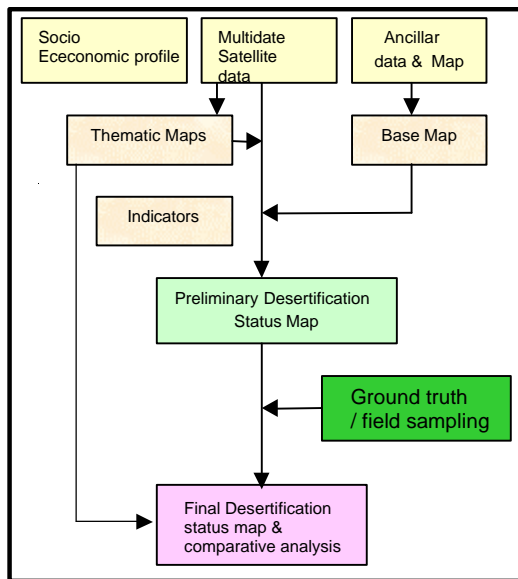


Fig. 1 Flow chart of methodology

The Desertification Status Mapping has been carried out using a standard and comprehensive, three tier classification system (Table 2) as under:

Table -2 Classification System

Level 1 – Landuse/ land cover

Agriculture – Unirrigated	(D)	
Agriculture – Irrigated	(I)	
Forest/ Plantations	(F)	
Grassland/ Grazing land	(G)	
Land with Scrub	(S)	
Barren / Rocky Area	(B/R)	B (sc) indicating scree areas in cold deserts
Dune/ Sandy Area	(E)	
Water body/ Drainage	(W)	
Others	(T)	

Level 2 – Process of desertification

Vegetation Degradation	(v)
Water Erosion	(w)
Wind Erosion	(e)
Water Logging	(l)
Salinization/ Alkalinization	(s/a)
Mass Movement	(g)
Frost Heaving	(h)
Frost Shattering	(f)
Man made	(m)

Level 3 – Severity of desertification

Slight	1
Moderate	2
Severe	3

All the classes mapped in different data sets have been tabulated and compared (Table. 3).

3. RESULT AND DISCUSSIONS

The satellite data sets used for the preparation of the desertification status maps differ mainly in their spatial, spectral and radiometric resolution. This makes the three data sets vary in their capabilities to gather various levels of information. LISS III has higher sp. resolution of 23.5 meters, while AWiFS has about 50 m and WiFS has 188 m.

This makes LISS III the better of the rest two, as regards its capabilities to collect finer ground information. Also, the WiFS data has a lesser capability of detecting finer details as compared to AWiFS.

The satellite data used for the preparation of the DSM maps are shown in Fig.2 (LISS III), Fig.3 (AWiFS) and Fig.4 (WiFS).

In view of this, the units delineated in each data sets were compared holistically. The classification system given in Table. 2 was used to prepare Desertification Status Maps using all the three data sets so as to maintain the consistency in interpretation.

Table no. 3 gives the comparative details of the units mapped using all the three different data sets viz. LISS III, AWiFS and WiFS.

The area of coverage in the three data sets is similar but not identical. The different desertification classes mapped using the three data sets show that there is similarity in the number of units mapped using AWiFS and LISS III data sets (Fig 5,6 &7).

There are 21 desertification classes each mapped using AWiFS and LISS III. All the classes, except one, that were mapped using LISS III have also been mapped using AWiFS.

However, there is also one class in AWiFS, which is not seen in the list of LISS III. These differences are mainly due to the slight difference in the area of coverage.

As compared to these two data sets, the WiFS has shown a remarkable limitation with respect to its application potential for preparing a desertification status map on 1:500,000 scale. Only 11 DSM classes could be mapped using WiFS.



Fig. 2 IRS-LISS III image (13.1.98)

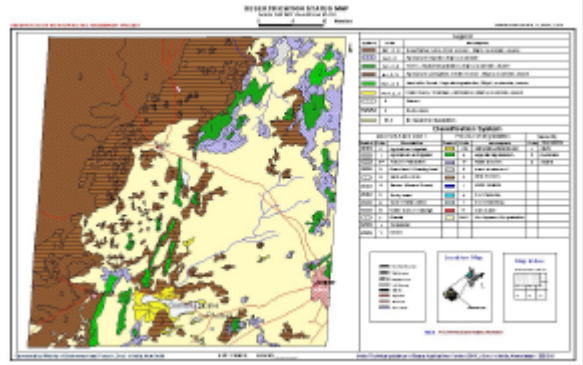


Fig 5 Desertification Status Map prepared using LISS III data.

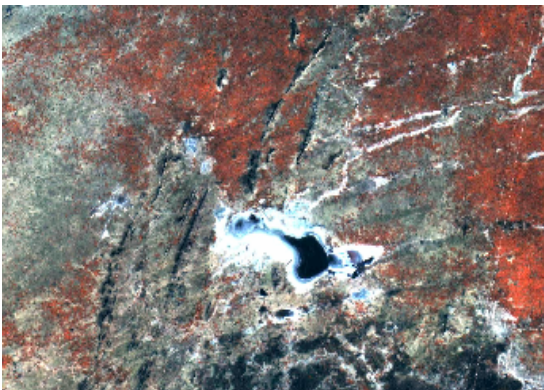


Fig. 3 AWiFS Image (13.1.1998)

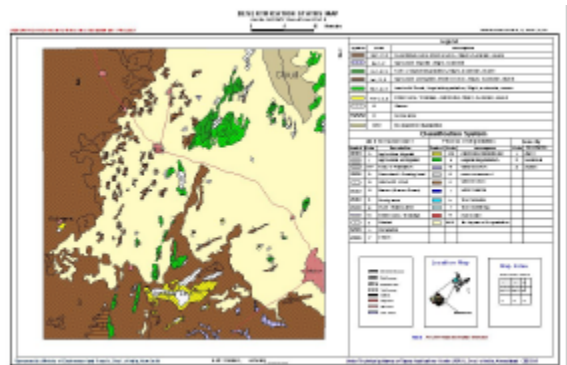


Fig 6 Desertification Status Map prepared using AWiFS data.

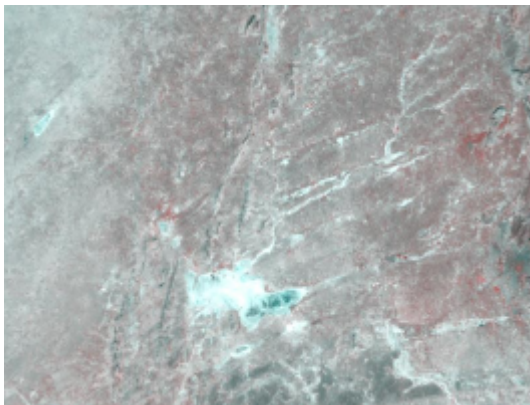


Fig.4 WiFS Image (23.1.2003)

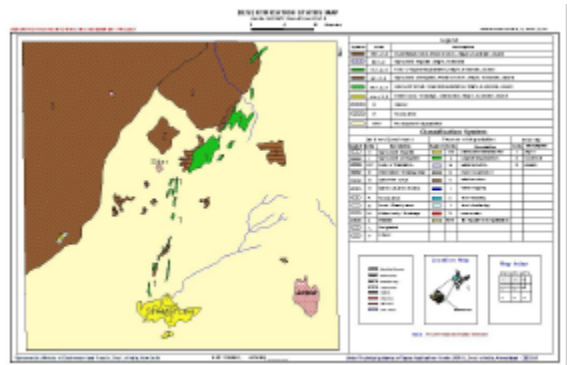


Fig 7 Desertification Status Map prepared using WiFS data.

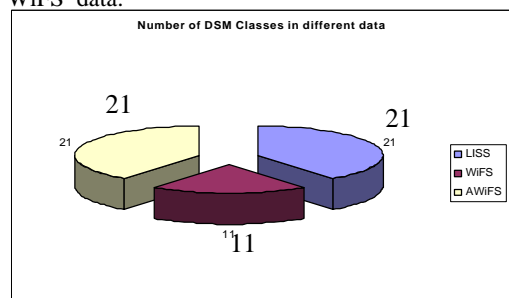


Fig 8 : Fig. 8 Pie-chart showing the number of classes mapped in each data set.

The list of the DSM classes mapped using the three different data sets is given in table –3 as follows :

Table-3

DSM Classes	Full Form	LISS III	WiFS	AWiFS
B	Barren (Barren Scree)	√	×	√
Dw1	Agriculture irrigated, water erosion, slight	√	×	√
Dw2	Agriculture irrigated, water erosion, moderate	√	×	√
Ee1	Dune / Sandy area, Wind erosion, slight	×	×	√
Ee2	Dune / Sandy area, Wind erosion, moderate	√	√	√
Ee3	Dune / Sandy area, Wind erosion, severe	√	√	√
Fv1	Forest / Plantation, vegetal degradation, slight	√	√	√
Fv2	Forest / Plantation, vegetal degradation, moderate	√	√	√
le1	Agriculture unirrigated, wind erosion, slight	√	×	√
le2	Agriculture unirrigated, wind erosion, moderate	√	√	√
le3	Agriculture unirrigated, wind erosion, severe	√	√	√
NAD	No Apparent Degradation	√	√	√
R	Rocky area	√	√	√
Sv1	Land with scrub, vegetal degradation, slight	√	×	√
Sv2	Land with scrub, vegetal degradation, moderate	√	×	√
Sv3	Land with scrub, vegetal degradation, severe	√	×	√
Sw2	Land with scrub, water erosion, moderate	√	×	√
Sw3	Land with scrub, water erosion, severe	√	×	×
W	Water body / Drainage	√	√	√
Ws1	Water body / Drainage, salinization, slight	√	×	√
Ws2	Water body / Drainage, salinization, moderate	√	√	√
Ws3	Water body / Drainage, salinization, severe	√	√	√

4. CONCLUSIONS:

- 1) AWiFS data could be successfully used to prepare Desertification Status Map (DSM) on 1:500,000 scale
- 2) The Desertification Status Map (DSM) on 1:500,000 scale prepared using AWiFS data has been compared with DSM prepared using LISS III and WiFS data
- 3) All the DSM classes that were mapped using LISS III data could be mapped successfully using AWiFS data, except one class, which is due to the minor difference in the coverage area
- 4) Thus AWiFS data has been evaluated and found suitable to substitute LISS III data, which was earlier proposed to be used for this purpose in the project. This has led to saving of enormous amount of money, time and effort that would have gone in procuring and handling the LISS III data.
- 5) WiFS has been found unsuitable for the purpose and scope of the project i.e. to prepare Desertification Status Map at 1:500,000 scale map.
- 6) AWiFS is highly suitable for large area mapping and offers excellent quality of data, even at 50 mts spatial resolution due to 10 bits radiometric resolution

5. REFERENCES:

Dhabaria S.S (1986), Desert Spread and Desertification, Environmental Research Publication – 1, published by Environmentalist, Malviya Nagar, Jaipur – 302 017, India. 54p

UNCED (1992) Earth Summit Agenda 21: Programme of Action for Sustainable Development. New York: UN Department of Public quoted in WMO-UNEP, 1996.

6. ACKNOWLEDGEMENT

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