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DELINEATION OF WATERLOGGING IN CANAL COMMAND AREA USING
LANDSAT TM DATA- A CASE STUDY IN SOUTH WESTERN PART OF
PUNJAB

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ABSTRACT

After the introduction of canal irrigation, large areas in South Western part of Punjab have been effected by waterlogging. An upto date knowledge of the areal extent of the waterlogged lands is essential for formulating and executing effective management strategies. Remote sensing techniques provide quick and accurate estimation of the areas effected by waterlogging menace. The present study was undertaken to operationalize the technique of delineating waterlogged areas using multirate landsat TM images and provide an upto date knowledge of areal extent of waterlogged lands to the State Irrigation Department for taking up suitable anti-waterlogging measures.

1. INTRODUCTION

In 1950s, the water table in South-Western part of Punjab ranged between 30-35 meters below ground surface. Observation of water table in this region during the last three decades has shown that the water table has been progressively rising after the construction of Sirhind Feeder in the year 1955 and Rajasthan Feeder in 1963. In the past more than a decade, waterlogging appeared in this region and has now attained quite an alarming proportion. Vast tracts in this Zone have become waterlogged thus affecting the productivity of land, bringing changes in the cropping pattern, developing cracks in buildings and badly damaging the roads. Apart from seepage from canals and their distributaries, the other factors contributing to this problem are: inadequate and inefficient drainage system, poor outfall conditions, return flow from irrigation fields and limited withdrawal of ground water due to its saline to brackish nature.

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2. DESCRIPTION OF STUDY AREA

2.1 Location:

The study area covering about 5,000 KM² is a part of South-Western portion of Punjab State falling in Ferozepur and Faridkot districts. This lies between latitude 30°13'30" N-30°59'30" N and longitude 74°8'15"- 74°54'0"E. It is bordered by Pakistan in the North West.

2.2 Geology, Physiography & Drainage:

The area forms a part of vast Indo-gangetic alluvial plain of Recent Origin. The alluvium consists of deposits of silt, loam, clay, sand and kankar and their inter-mixture in varying grades. The topography is more or less flat with minor undulations. The area is traversed by river Sutlej in the North and North-Western part. A network of canals namely Sirhind Feeder, Rajasthan Feeder, Eastern Canal, Bikaner Canal, Jalalabad Branch, Abohar Branch of Sirhind Canal and their distributaries have been constructed. A few drains have been excavated in the area for disposal of surface run-off and effluent seepage from groundwater.

3. SATELLITE DATA INTERPRETATION

Landsat Thematic Mapper (TM) images Black & White Band 3, Band 4 and False colour composites (FCC) on 1:250,000 scale of landsat 5 have been studied by visual interpretation techniques. Thematic Mapper (TM) is a very high resolution multi spectral remote sensor carried on board landsat 4 and 5, although TM data of only landsat 5 is operational. This sensor provides 30 meter resolution in six bands (0.45-0.52 micrometer, 0.52-0.60 micrometer, 0.63-0.69 micrometer, 0.76-0.90 micrometer, 1.55-1.75 micrometer and 2.08-2.35 micrometer) and 120 meter resolution in thermal IR band (10.4-12.5 micrometer). Landsat TM data is advantageous as it provides better spatial, spectral and Radiometric resolution than landsat MSS.

3.1 Observations:

Multidate landsat TM images of May 84, Nov. 84, May 85 and Nov.85 have been interpreted and a map showing water-logged area and other related land forms prepared (Fig.1).

The criterion used for the identification of waterlogged area is given in Table 1.

Besides selected field checks in the study area, ground truth comprised of toposheets by survey of India and regular water table observation data by water Resources Directorate, Punjab.

TABLE 1

FEATURES	LANDSAT TM IMAGERY		
	BAND 3	BAND 4	FCC
Presence of high soil moisture.	Medium tone	Dark tone	Bluish colour
Shallow standing water	Medium tone	Dark tone	Deep bluish colour
Perennial Vegetation	Dark tone,	Light tone	Pink and red colour
Salt encrustation	Light tone	Light tone	White and pale yellow colour

3.2 Results

Based on the interpretation of landsat TM images, it is estimated that out of 5.0 lac. ha comprising the study area, an area of about 93,000 ha (18.5%) is effected by waterlogging. The major waterlogged area lie on West of Eastern Canal extending upto Jalalabad, West of Sirhind Feeder and Rajasthan Feeder extending between Faridkot-Muktsar and downstream of Abohar branch of Sirhind canal in the east and south of Muktsar town. It is apparent that most of the waterlogged area is confined to the depressions along the canals and the distributaries.

4. REMEDIES

It is essential that appropriate measures are taken urgently to arrest the rising trend of water table. The

following remedial measures need to be undertaken to salvage the situation in this area.

- i) To reduce the recharge to the groundwater.
- ii) Provision of effective drainage system to remove the surface run-off effectively. Regular clearing the existing drains of vegetation growth, weed and silt deposits which restrict the flow of surplus water to outfall areas.
- iii) Provision of vertical drainage system by installation of shallow tubewells for increasing the draft but limiting their continuous use to avoid underlying saline water intrusion.
- iv) Provision of sub-surface drainage system after detailed investigations.
- v) Encouraging afforestation for increased evapotranspiration losses.

5. CONCLUSIONS

Satellite imagery is able to give a quick, precise and fairly reliable assessment of waterlogged areas as compared to conventional ground surveys. Some of the waterlogged areas not part of the canal command area could also be identified by Remote Sensing techniques.

It can be safely concluded that remotely sensed data when properly interpreted with ground based data is quick, economical and a vital tool for an accurate mapping of waterlogged areas and regular monitoring for change detection studies.

6. BIBLIOGRAPHY

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