

Waterlogged and Saline Affected Area Mapping by GIS Techniques: Case Study of Mewat District

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Abstract

In this study waterlogged area and saline affected areas are identified by using GIS techniques. Mewat district of Haryana state is selected as study area. Two types of data used for the study, **Primary Data** Satellite data IRS-P6 LISS-III **Date of Acquisition** 15 Oct. 2005, 25 April 2006. **Secondary Data** Secondary (ancillary) and ground data constitute important baseline information in remote sensing, as they improve the interpretation accuracy and reliability of remotely sensed data. Survey of India Toposheet on 1:50,000 scale were used in the study for base map and verification purpose. Total area of study area is 163996.75 hectares, in post-monsoon year 2005, 18018.02 which is 11% of total area is waterlogged and 19429.45 (12% of total area) was affected by water logging in pre monsoon 2006. In post monsoon 2005, 10910.72 (7%) and 12992.68 (8%) hectares affected by salinity. Use of special planting procedure, sloping beds, other special land preparation procedures and tillage methods to provide a low salt environment. Various farm management practices can aid in controlling or reducing the impact of water logging and salinity.

Keywords: Waterlogged, Saline, GIS Techniques.

1. Introduction

Agriculture is a key sector in economy, contributing about 35% of the gross domestic product and employing 65% of adult population. Of the total population of over 1000 million, more than 30% live below the poverty line and about 75% live in rural areas, depending directly or indirectly on agriculture. Haryana is an agricultural state having more than seventy percent population engaged in agriculture and the economics of the state is mainly depends on agriculture. For sustainable agriculture, there is need of water and fertile land. The problems of water logging and soil salinity are threatening alarm for the sustainability of agricultural production in the state. The rise in water table is a threat to the highly productive agricultural land of the state. According to

a rough estimate, an area of about 3.50 lakh hectare is either waterlogged or salt affected. Out of this, about 50,000 hectare is under critical condition. About 65% area of the state have saline groundwater. Rohtak, Jhajjar, Sonapat, Panipat, Sirsa, Fatehabad and Mewat districts have severe problems of water logging and salinity. Bhatt, et. al. (2005) had used remote sensing and GIS techniques for assessment of water logged and salt affected area in Muktsar district of Punjab. J.C. Dagar (2005) Central Soil Salinity Research Institute, Karnal, India presents a research on title with "Salinity Research in India: An Overview". In his study he presents the Expanding problems of soil salinity and water logging have become serious issues of concern as they affect productivity and threaten the very sustainability of agriculture. Chowdary, V.M. et al. (2008) publish a research article on "Assessment of surface and sub-surface waterlogged areas in irrigation command areas of Bihar state using remote sensing and GIS". In this article they study that Satellite remote sensing coupled with Geographical Information Systems (GIS) offers an excellent alternative to conventional mapping techniques in monitoring and mapping of surface and sub-surface waterlogged areas. In the present study, pre-monsoon and post-monsoon surface waterlogged areas were delineated in all the 132 irrigation command areas of the Bihar State, India using Indian Remote Sensing (IRS-1D) Linear Imaging Self Scanning Sensor (LISS-III) data acquired during the period 2002-2003.

D.J. McFarlane, E.G. Barrett-Lennard and T.L. Setter Department of Agriculture, Albany 6330 Department of Agriculture, South Perth 6151, School of Agriculture, University of Western Australia, Nedlands 6009 presents a paper on "Water logging: a hidden constraint to crop and pasture production in southern regions of Australia". This paper reviews

what is known about water logging in southern regions of Australia, with an emphasis on Western Australia. Central Soil Salinity Research Institute, Karnal; National Geophysical Research Institute,

Hyderabad; CCS Haryana Agricultural University, Hisar have done lot of work on salinity and water logging.

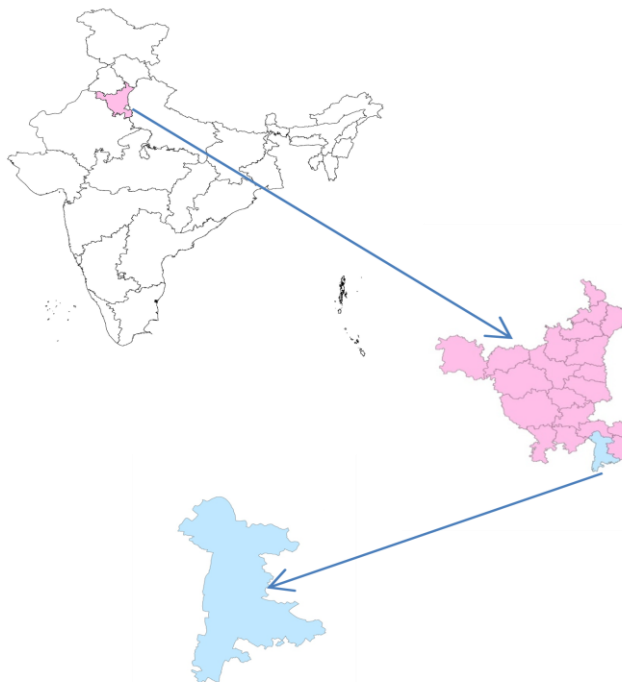


Figure 1: Location Map of Study Area (Map of Satellite Image of IRS P6, LISS III, Nov. 2010)

2. Objectives of the Study

The main objectives of the study were:

- To monitor water logging and salt affected land on 1: 50,000 scale.
- To give the remedial measure for management water logging and salt affected land.

3. Materials and Methodology

3.1 Data Description for the Study

Data Source: There are two sources of data collection technique:

Primary Data: Satellite data IRS-P6 LISS-III Date of Acquisition 15 Oct. 2005, 25 April 2006.

Secondary Data Secondary (ancillary) and ground data constitute important baseline information in remote sensing, as they improve the interpretation accuracy and reliability of remotely sensed data by enabling verification of the interpreted details and by supplementing it with the information that cannot be obtained directly from the remotely sensed data. The following secondary data were used in the study: Survey of India Toposheet on 1:50,000 scale (53D/11, 53D/15, 53D/16, 54A/13, 53A/14, 53H/3, 53H/4, 54E/1, 54E/2, 54E/1).

3.2 Methodology Flow Chart

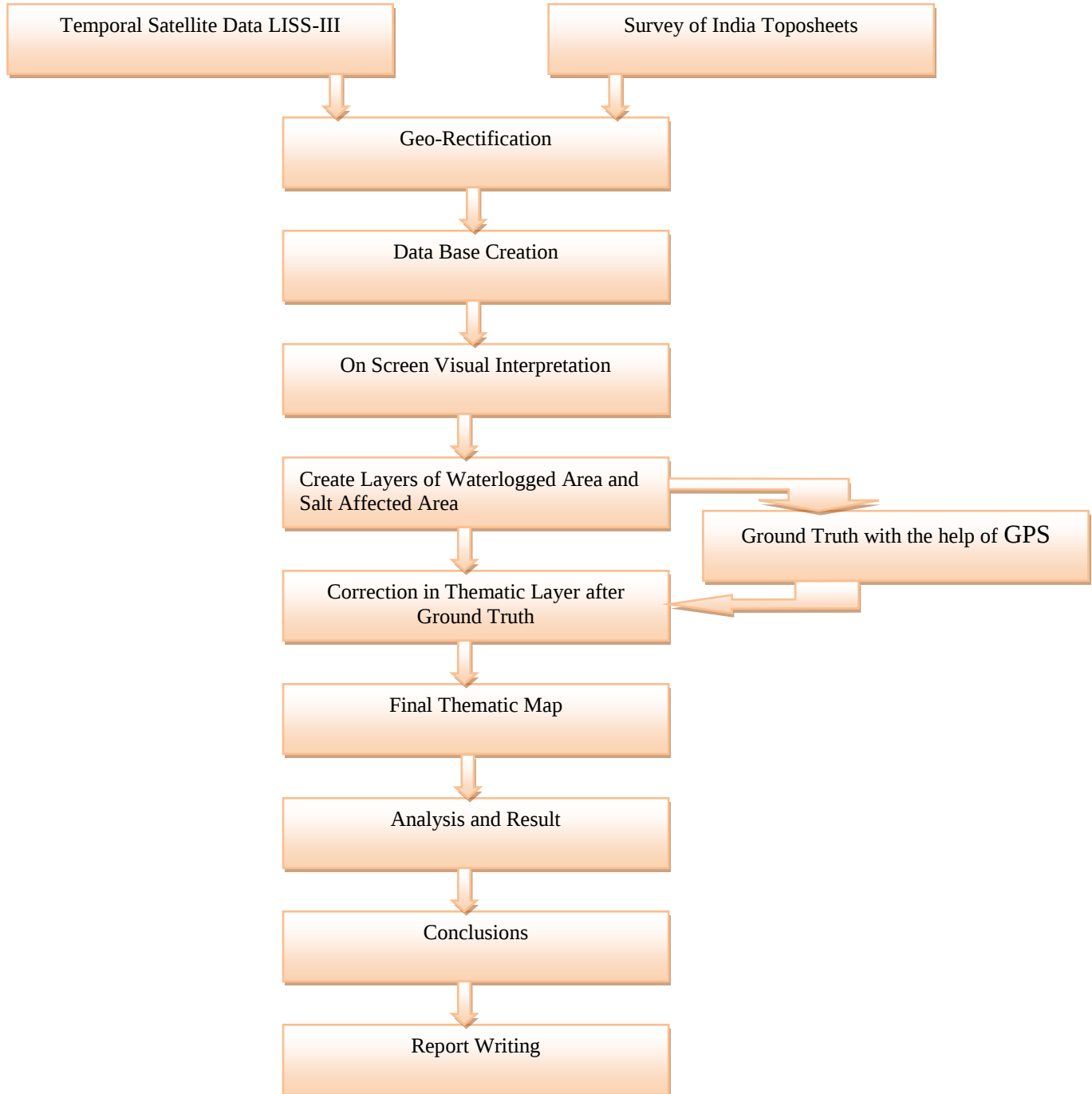


Figure 2: Flow Chart of Methodology

4. Results and Discussion

Water logging and soil salinity are the major land degradation processes operating in Mewat District. Due to improper management of soil and water resources in the command areas, the problem of water logging and soil salinity are increasing. Information on the nature, extent, spatial distribution and temporal behavior of areas under water logging and salinity is essential for proper management of irrigated lands.

The blocks which are mainly affected by water logging due to salinity are Ferozpur Jhirka, Nagina, Nuh, and Punhana. The ground water balance in Nuh, Nagina and Punhana blocks of the district continues to increase due to low rate of withdrawal. The net annual withdrawal is very less against the recharge. These natural as well as anthropogenic factors, therefore, results ponding of water in the depression areas, first on the surface and then below the surface, creating almost water logging conditions. In the areas, where water level is shallow, ground water brought upward by capillary action and the dissolved

salts due to evaporation are left at surface. Such salts affected lands are seen in parts of the areas around Nuh, Malab, Akaira and parts of Punhana block. There is urgent need to take measures to check water logging in the area. The water logging conditions are more severe during post monsoon period and have caused soil salinity resulting in decline of agriculture production.

This chapter is talk about the what, we have found in the study area and how it is applicable in the Mewat district. After finalizing the spatial database and collecting the relevant information, a detailed analysis was carried out to demarcate the water logging and soil salinity area.

The area statistics generated through spatial database created in GIS (Geographical Information System) environment reveals that out of the total geographical area (163996.75 ha) of Mewat district 11 % or 18018.02 ha of land during post monsoon 2005, 12% or 19429.45 ha of land during pre monsoon 2006 is affected by water logging and 8% or 12992.68 ha of land during pre monsoon 2006 is affected by salinity.

Table 1: Pre Monsoon and Post Monsoon Waterlogged and Salt Affected Soils Area Statistics of Mewat District

District Area in Hectares	Year	Category	Pre-monsoon Ha (%)	Post-monsoon Ha (%)
163996.75	2005	Water logging area	-	18018.02 (11)
		Salt affected area	-	10910.72 (7)
	2006	Water logging area	19429.45 (12)	
		Salt affected area	12992.68 (8)	

Map of Waterlogged and Salt affected area of Mewat District (Post-monsoon 2005)

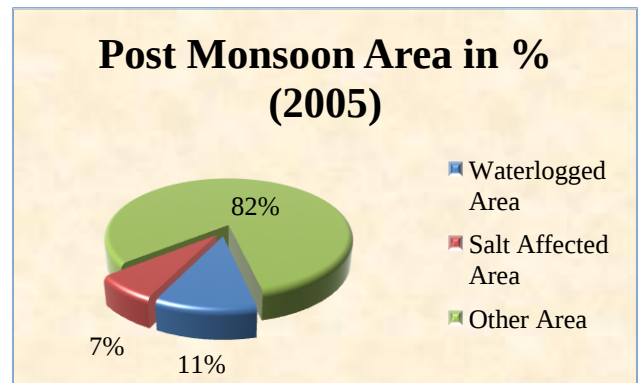
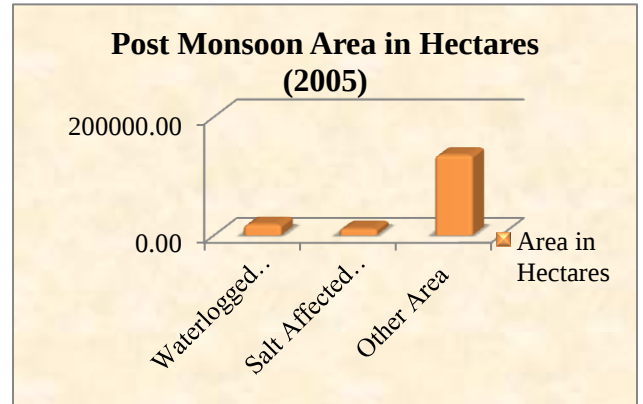
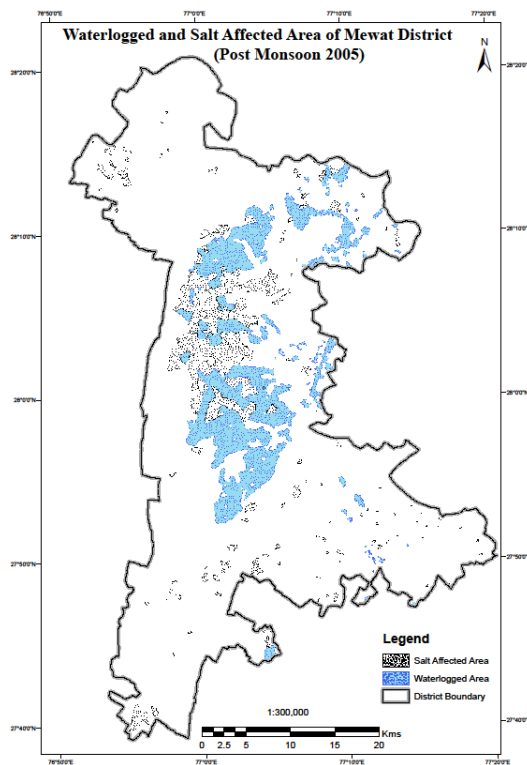


Figure 3: Post Monsoon Area of Waterlogging and Salt Affected in Hectares (2005)

Figure 4: Post Monsoon Area of Waterlogging and Salt Affected in % (2005)

During the post monsoon season in (2005) 18018.02 Hectares or 11 % area is waterlogged and 10910.72 Hectares or 7% area is salt affected and 135068.01

Hectares or 82 % have other category. Bar diagram shows the area in Hectares and pie diagram shows the area in %.

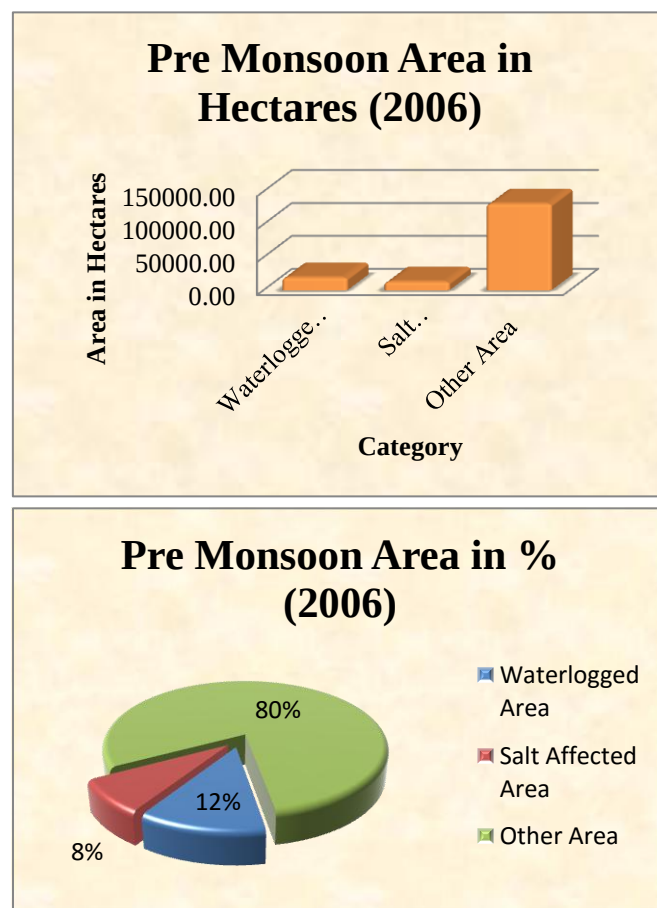
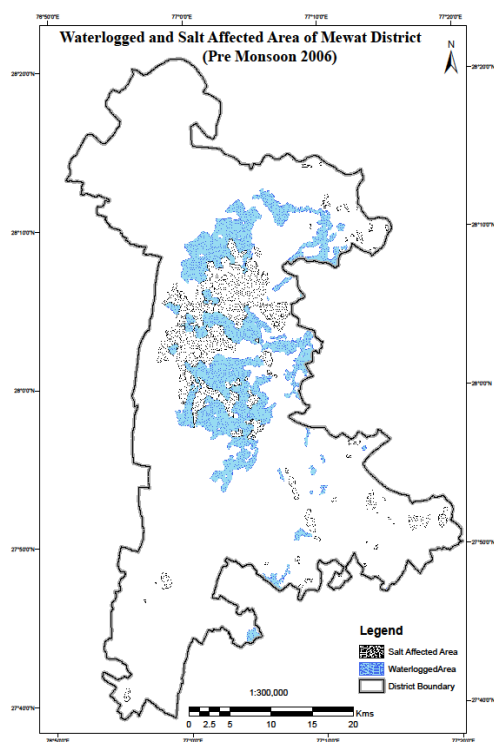


Figure 5: Pre Monsoon Area of Waterlogged and Salt affected in Hectares (2006)

Figure 6: Pre Monsoon Area of Waterlogged and Salt affected in % (2006)

During the pre monsoon season in (2006) 19429.45 Hectares or 12 % area is waterlogged and 12992.68 Hectares or 8% area is salt affected and 131574.62 Hectares or 80 % have other category. Bar diagram shows the area in hectares and pie diagram as shown in the area in %.

5. Recommendations for Salinity Control

The multifaceted deleterious impact of salinity on the economic and social development of region calls for devising a sustainable strategy, which can ameliorate the salinity and facilitate the

optimum use of ground water and soil. To achieve this objective following remedial measures are suggested: Excessive surface runoff should be drained out of the area, Shallow bore wells to be installed so that the withdrawals of ground water at least equal the annual recharge. This will control the rise of water table and reduce the scope of evaporation. Salt tolerant crops like barley, wheat, cotton, and sunflower, water melon, tomato, olive, grapes etc. may be grown in the area.

Plantation of eucalyptus trees should be encouraged where water table is less than 5 m

deep. This will serve a dual purpose, first by lowering the water table through rapid transpiration and secondly by providing economic support to local farmers.

6. Conclusions

Water logging and soil salinization are the major land degradation processes operating in irrigation commands of the semi-arid regions. The significant occurrence of salt affected soil lies in arid and semi-arid regions reducing considerably the productive capacity of the land surface. Due to improper management of soil and water resources in the command areas, the problem of water logging and soil salinity are increasing.

Water logged and salt affected are most frequently studied in the present time, which affect the agriculture cultivation in Mewat area.

Space borne satellite data have become valuable tools in studying for monitoring and management of water logging and salt affected soils because of their rapid and accurate assessment.

The steps that area needed to be taken up immediately and in long term for the management of waterlogged and salt affected area are plantation of eucalyptus species, salt tolerant crops like barley, wheat, cotton, and sunflower, water melon, tomato, olive, grapes etc. may be grown in the area. Various farm management practices can aid in controlling or reducing the impact of water logging and salinity. Use of special planting procedure, sloping beds, other special land preparation procedures and tillage methods to provide a low salt environment. Selection of crop varieties that have higher tolerances for salt or sodium.

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