ANALYSIS OF LAND DEGRADED IN MAITHA BLOCK OF KANPUR DEHAT DISTRICT USING REMOTE SENSING AND GIS TECHNIQUES

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ABSTRACT - *Land degradation is seen as a phenomenon or more that reduces current and/or potential soil capacity to produce goods. This means a decline from a higher to a lower state due to a decline in land capacity, productivity, and biodiversity loss. The aim of the present study is to prepare baseline data to combat land degradation and conserve land resources in an efficient manner. To assess land degradation with the help of Remote Sensing (RS) and Geographical Information System (GIS) – in Maitha Block of Kanpur Dehat district, Uttar Pradesh. Different levels of analysis were performed to estimate the extent of land. Degradation to assess saline or salt-free soils and calcareous or sodium soils and to compare this knowledge with satellite studies the spatial variability of these soil parameters was shown in soil maps created in a GIS environment. The findings showed that the soil in the study region was vulnerable to salt infiltration and water erosion that could be traced primarily to irrigation practices in the Maitha Block of Kanpur district. A temporary study of the 2013 and 2016 LISS III satellite datasets was also done to find the parameters that are responsible for land degradation, respectively.*

Key Words: Land degradation, Sodic Land, Waterlogged.

1. INTRODUCTION

Land Destruction (LD) has been one of the most serious environmental and human survival challenges in recent decades. Desertification, which is an irreversible Land Degradation process, has attracted the international community's increasing attention to its devastating potential for the natural which threatens 1,5 billion people and affects around 1,9 billion hectares of land and 250 million people worldwide (Low, 2013). The extent of deforestation is growing, covering much of the world's land area, which includes 30 percent forests, 20 percent agricultural areas and 10 environment and human society . Appropriate land management can protect and maximize these services for society. Conversely, desertification, alongside global climate change and therefore the loss of biodiversity were identified as the greatest challenges to sustainable development during the 1992 Rio Earth Summit. Land degradation is the process that makes land unsuitable for human beings as well as for soil ecosystems (Abdel Kawy & Darwish, 2019) occurs in arid, semi-arid and sub humid areas as a result of anthropogenic activities and climatic variations, and eventually subjects livelihoods and sustainable development to severe risks (Fleskens, 2014).Land use and land cover (LULC) change is a prime issue for scientists concerned with global environmental change (Easdale, 2016) Land use activities have a considerable influence on the people, posing serious consequences for social, economic and ecological aspects of human society (Burchinal, 1989). The alteration in ecological and economic functions due to the decrease in the productivity and quality of the land (Hill, 2005) can lead to decline in the biological productivity of land due to climate change and human activities. Land degradation poses a great threat to food security and damages the environmental safety of land as well as influences the sustainable development of society and economy (Zhao et al., 2013). Degradation can result in the depletion of other natural resources in both developed and developing countries and can affect arid, dry and even sub-humid areas (Omuto et al., 2014; Stringer and Harris, 2014). Land degradation is a serious problem

percent degraded grasslands (Bai et al., 2008). According to Barrett and Hollington (2006), about 10 to 20 million people live on salt-affected land with poor productivity and under alarming ecosystem destruction threats About 6 million hectares of agricultural land become unproductive

per year due to various soil degradation processes (Asio et al., 2009). The UN Convention on Combating Desertification (UNCCD) held in Brazil in 2012 set a target of zero net land degradation at RioC20, with the goal of reducing the rate of land degradation and encouraging the pace of regeneration of already degraded land (Easdale 2016). An estimated 120.40 million hectares (out of 328.73 million hectares) of land in the country was impacted by land degradation According to the Indian Council for Agricultural Research (ICAR, 2010), LULC's Change detection studies have proved to be very successful in determining possible adverse environmental impacts. Hence, it becomes essential to devise effective strategies for land management at the landscape level by analysing the extent of land degradation using model simulation studies for LULC dynamics (Gessesse et al., 2015).

Remote sensing data along with GIS have been useful to map India's desertification at a scale of 1:500,000 (Ajai et al., 2007, 2009). In the above national level analysis, multi season IRS- LISS III data was used. 105, 48 mha according to the inventory above. That is to say, 32% of the country's geographical area undergoes a land degradation process. As described above, it is also important to research and understand whether land degradation (area and severity intensity) increases or decreases over time. It helps to devise an effective strategy to establish action plans to stop the land loss processes. Thus the analysis was conducted to determine the changes in the desertification / land degradation status, in terms of degree and magnitude, using IRS data for the Kanpur dehat district Maitha block during a certain time.

2. STUDY AREA

Kanpur Dehat is a district of Uttar Pradesh state in northern India. The administrative headquarters of the district are at Mati - Akbarpur. Total area of Kanpur dehat district is 3021 km2. According to the 2011 census Kanpur Dehat district has a population of 17, 95,956.This gives it a ranking of 268th in India (out of a total of 640 districts).The district has a population density of 594 inhabitants per square kilometre (1,540/sq mi). Its population growth rate over the decade 2001-2011 was 14.82%. Maitha is a Block placed in Kanpur Dehat district in Uttar Pradesh. Located in rural part of Uttar Pradesh, it is one of the 10 blocks of Kanpur Dehat district. According to the administration register, the block code of Maitha is 354. The block has 116 villages and there are total 33788 homes in this Block. Maitha's population is 181591. Out of this, 98002 are males whereas the females count 83589 here. This block has 24949 children in the age group of 0-6 years. Out of this 13154 are boys and 11795 are girls. Literacy ratio in Maitha block is 66%. 121288 out of total 181591 population is educated here. Among males the literacy ratio is 73% as 71714 males out of total 98002 are literate however female literacy ratio is 59% as 49574 out of total 83589 females are literate in this Block. The dark side is that illiteracy rate of Maitha block is 33%. Here 60303 out of total 181591 people are illiterate. Male illiteracy rate here is 26% as 26288 males out of total 98002 are uneducated. In females the illiteracy ratio is 40% and 34015 out of total 83589 females are illiterate in this block. Kanpur region receives a total annual average rainfall of about 820 mm and relative humidity ranges between 69-77%.

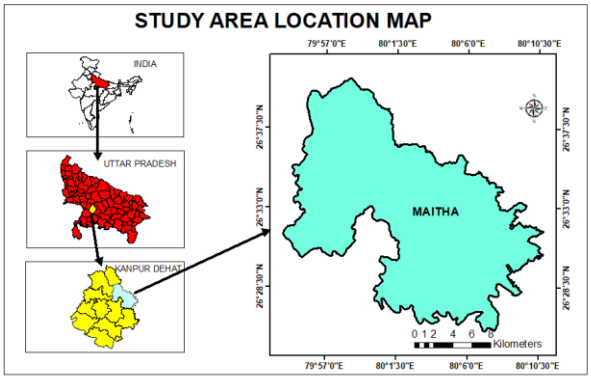

Figure 1: Study Area Map

3. DATA AND SOFTWARE USED

The change detection analysis of land degradation factors which are affecting land area is major aspect for the research. There is much knowledge is required about the land surface for change detection analysis. It needs of data sets of different years for finding the sodic land and water logged by comparative analysis.

Table 1: Description of satellite data sets used

SATELLITE	IRS-P6(INDIAN REMOTE SENSING SATELLITE-P6)
SENSOR	LISS III
RESOLUTION	23.5 m
ACQUISITION YEAR	2013-2016
SOURCE	BHUVAN
PURPOSE	FOR MAPPING AND TO FIND CHANGE DETECTIONOF LAND DEGRADATION

Satellite image processing software, Earth Resources Data Analysis System (ERDAS) version 9.1 Imagine (Hexagon Geospatial – formerly ERDAS, Inc.) and ArcGIS 10.1 (Environmental Systems Research Institute (ESRI) product) were used to process, classify, analyse, and display the satellite images.

Table 2: Specification of LISS III sensor

IGFOV	23.5m
SWATH	142 km
INTEGRATED TIME	3.32 msec
RADIOMETRIC RESOLUTION	7 bits
SPECTRAL BANDS (microns)	B2 0.52-0.59 B3 0.62-0.68 B4 0.77-0.86 B5 1.55-1.70
AVERAGE SATURATION RADIANCE ($mw/cm^2/sr/micron$)	B2 27.8 B3 28.4 B4 32.0 B5 7.64

4. METHODOLOGY

Details of the methodology used for mapping desertification and land degradation status, using satellite data is given in figure 1. Two season IRS LISS III data pertaining to the years 2013 and 2016 have been used in this study aimed at monitoring the changes in the land degradation status during the certain period. The classification system used to map various processes and their severity for the two time frames is given in Table 2. Visual analysis techniques have been employed on the multi-season satellite data to prepare desertification status maps (DSM) for both the data sets. In addition to the DSM, land use/ land cover (LU/LC) map of the study area was prepared, basically, to understand the type and the severity of degradation processes happening vis-à-vis the land use classes in which they occur.

Figure 2: Methodology for Desertification Status Mapping (DSM)

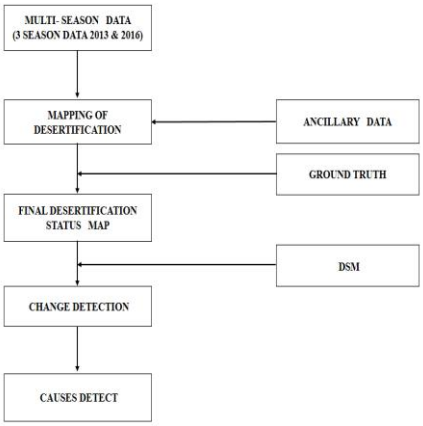

Table 3: Classification system for Desertification Status Mapping (DSM)

Vegetal degradation	**V**
Water erosion	**W**
Wind erosion	**E**
Waterlogging	**L**
Salinization \ alkalinization	**s\a**
Frost heaving	**H**
Frost shattering	**F**
Mass movement	**G**
Man made (mining \ quarrying, brick kiln, Industrial effluents, City waste, Urban Agglomeration)	**m**

Level 1: Process of degradation

Type of processes resulting in degradation:

Level 2: Severity of Degradation

This level represents the degree of severity of degradation. It is coded as 'Ds1' for slight, 'Ds2' for moderate and 'Ds3' for severe degradation.

5. RESULTS AND DISCUSSION

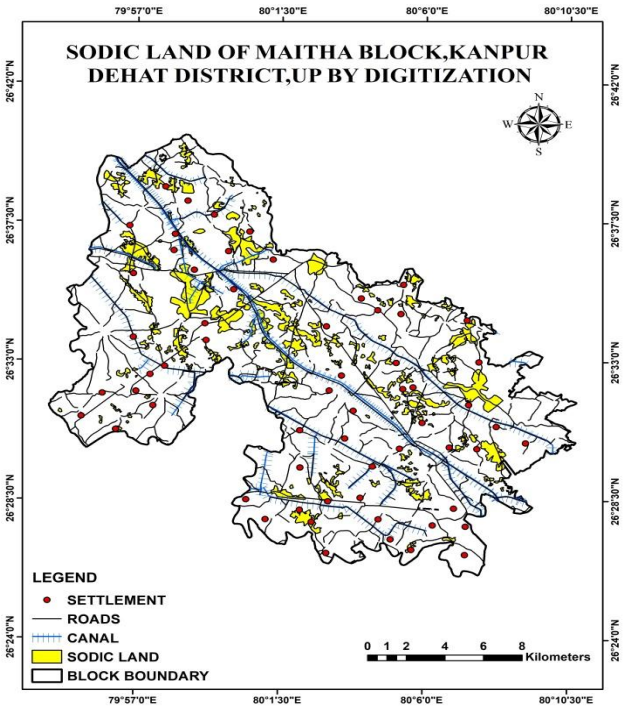

Figure 3(A): Sodic Land Map of Maitha Block Kanpur Dehat U.P 2013

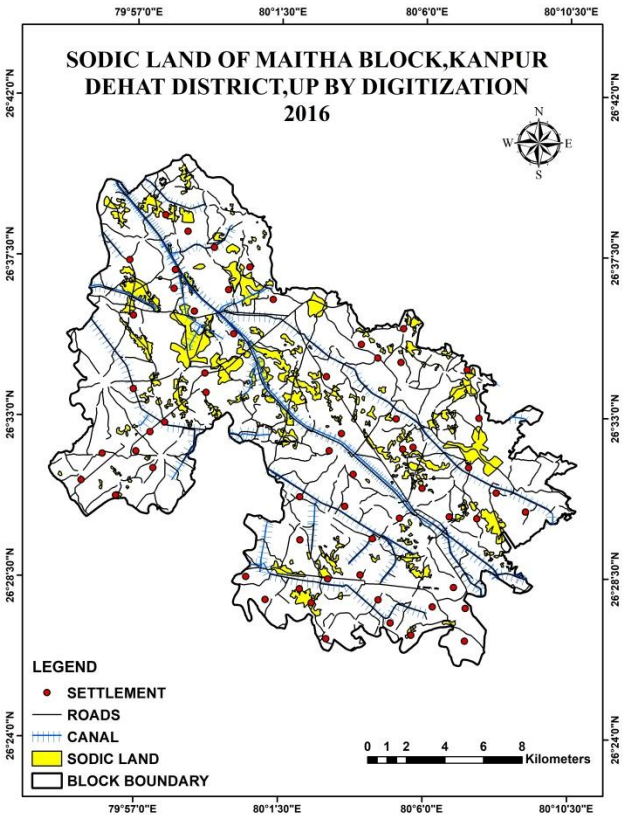

Figure 3(B): Sodic Land Map of Maitha Block Kanpur Dehat U.P 2016

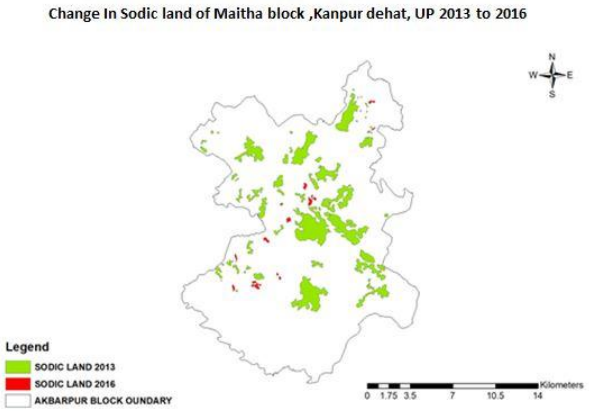

Figure 4: change in Sodic Land of Maitha Block Kanpur Dehat U.P 2013 to 2016

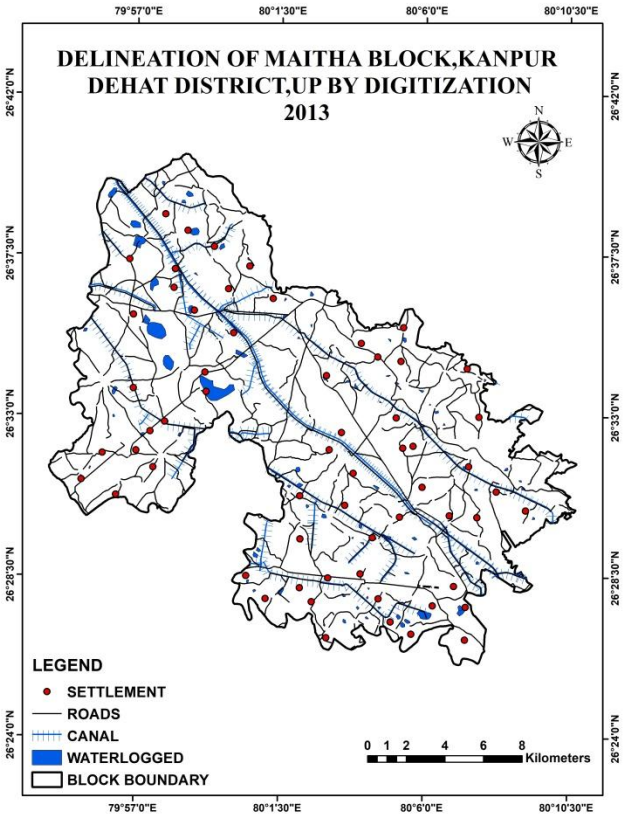

Figure 5(a): Waterlogged area in Maitha Block Kanpur Dehat U.P 2013

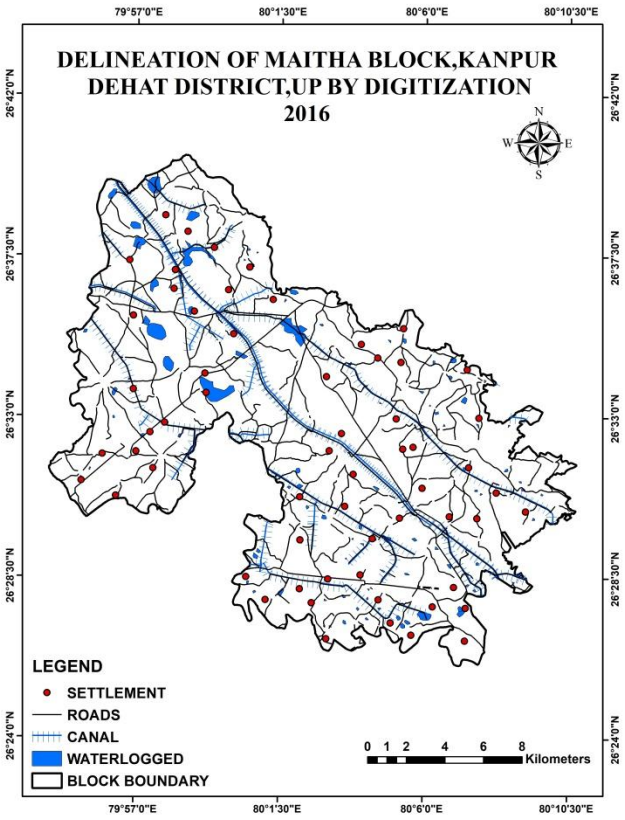

Figure 5(b): Waterlogged area in Maitha Block Kanpur Dehat U.P 2016

Maitha block of Kanpur dehat District has a geographical area of 292.65 km². Land Degradation (Sodic Land) status map of Maitha block of Kanpur dehat, prepared using the IRS LISS-III, for the years 2013 and 2016 are given in Figure 3(A) and 3(B) and Waterlogged area of the Maitha block for the year 2013 and 2016 are in figure 5(a)and 5(b) . Change in area under Land Degradation processes are presented in Fig.4. Land degradation mapping for the year 2013 reveals that salinity/alkalinity of land is the significant desertification process observed in the district which covers almost 6.61 per cent of area of the block. Salinity in the district has decreased from 20.96 km2 in 2013 to 16.32 km2 in 2016 and waterlogged area are in 2013 almost 2.9 km² and in 2016 is about 1.2 km². Total area undergoing the process of land degradation in the block was 25.96 km² in 2013 that has increased to 28.02 km² (about 9.52 % of the geographic area). Comparison of desertification status maps prepared from the satellite images of 2013 and 2016 reveals that there is an overall increase in the area under different processes of desertification. The that trend in the degree of soil degradation processes may have adverse effects on many soil surface processes linked to hydrology and soil erosion and hence it is necessary to take effective combative measures to mitigate or arrest soil degradation processes within the block.

6. CONCLUSION

Earth Observation satellite data were used to prepare the land degradation status map (DSM) for Maitha block of Kanpur Dehat district of for two timeframes 2013 and 2016. These maps have been used to monitor and assess the process of Land Degradation during the certain period. As per the DSM maps of 2013 and 2016, the area under land degradation in the Block has increased from 8.6 % to 9.52%. The main soil degradation processes active in the Maitha Block are salinity / alkaline and soil waterlogging. The results show clearly that there is an growing increase in the desertification cycle. Reasonable steps must be taken to arrest the Block and, if necessary, reverse the desertification process. Degradation of the land, livelihoods and environmental conditions are inextricably related. It is therefore recommended that action plans for land resource management and land degradation mitigation in the country as a whole be made an essential component of Panchayat-level rural development program.

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