ASSESSMENT AND MONITORING OF DEGRADED LAND USING REMOTE SENSING AND GIS TECHNIQUES

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ABSTRACT

Land degradation leads to a shift in environmental and economic activities due to declining productivity and quality of land. It is seen as an act or more that reduces the current and / or potential volume of soil production. This means a decline from the highest to the lowest region due to declining global energy, productivity, and biodiversity loss. The current status of degraded land in India is found to be 147 million hectares (Mha) of land, including 94 Mha from erosion, 16 Mha from acidification, 14 MHa from flooding, 9 MHa from erosion , 6 Mha from salt, and 7 Mha from compounding. This is even worse because India supports only 2.4% of the world's land area. Apart from its limited territory in the world, India is ranked second in the world in terms of farm output. Therefore, it becomes a major test problem. The aim of the current study is to prepare basic data to combat land degradation and to conserve land resources effectively with the help of geospatial technology - Remote Sensing (RS) and Geographical Information System (GIS) - Rasulabad Block, Kanpur district. Different levels of analysis were performed to assess the magnitude of the different types of land in the study area namely Sodic land, Saline land. Degradation to assess of saline or salt-free soils and calcareous or sodium soils and comparing this information with satellite studies the spatial variability of these soil structures is shown on soil maps created in the GIS area. The results showed that the soil in the study area was at risk of salt infiltration and erosion which could be traced mainly to irrigation activities in the Rasulabad Block in the Kanpur region. A temporary study of the 2017 and 2021Sentinel satellite datasets was also done to find the parameters that are responsible for land degradation, respectively.

Keyword: - *Land degradation, Sodic land, Saline land, GIS.*

1. INTRODUCTION

Land Degradation (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). 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 and Stringer, 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. 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. 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).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 alongside GIS are helpful to map India's desertification process at a scale of 1:500,000 (Ajai et al., 2007, 2009. In the above national level analysis, multi season Sentinel data was used. As described above, it's additionally necessary to analysis and perceives whether or not land degradation (area and severity intensity) will increase or decreases over time. Thus the analysis was conducted to work out the changes in the desertification / land degradation status, in terms of degree and magnitude, using IRS data for the Rasulabad block, Kanpur district during a certain time.

1.1 LAND DEGRADATION

Degradation is a process that makes the earth unsuitable for humans and the natural systems of the soil, occurring in arid, low-lying and subterranean areas due to anthropogenic activities and climate change. Land degradation poses a serious threat to food security and harms the ecological security of the land and contributes to sustainable social and economic development. Degradation can lead to the depletion of other natural resources in both developed and developing countries and affect dry, arid and even subtropical areas. Soil degradation occurs not only because of the interaction between physio-chemical and biological elements including terrestrial structures, soil structures and climatic factors but also human factors and land use management methods. Improper land use practices have been identified as one of the major causes of land degradation by various investigators.

1.2 TYPES OF DEGRADED LAND

A. Land affected by salinity/alkalinity

Soil salinity is the salt content in the soil; the process of increasing the salt content is known as salinization. Salts occur naturally within soils and water.

B. Waterlogged/marshy land

Water logging is the lowering in land productivity through the rise in groundwater close to the soil surface. Salinization issued in its broad sense, therefore total types of soil degradation brought about by the increase of salts in the soil.

C. Scrub Land

Scrubland is plant community with scrub vegetation. "Scrub" means low shrubs, mixed with grasses, herbs, and geophytes. Scrublands are sometimes known as heath lands. Scrub lands may develop naturally or as result to human activity.

2. STUDY AREA

Rasulabad is a Block positioned in Kanpur Dehat district in Uttar Pradesh. Situated in rural area of Kanpur, Uttar Pradesh, lies between 26.6761° N latitude and 79.7778° E longitude. As per the government register, the block code of Rasulabad is 353.The block has 148 villages. As of 2001 India census, Rasulabad had a population of 7235. Males constitute 53% of the population and females 47%. Rasulabad has an average literacy rate of 41%, lower than the national average of 59.5%: male literacy is 49%, and female literacy is 31%. In Rasulabad, 19% of the population is under 6 years of age.

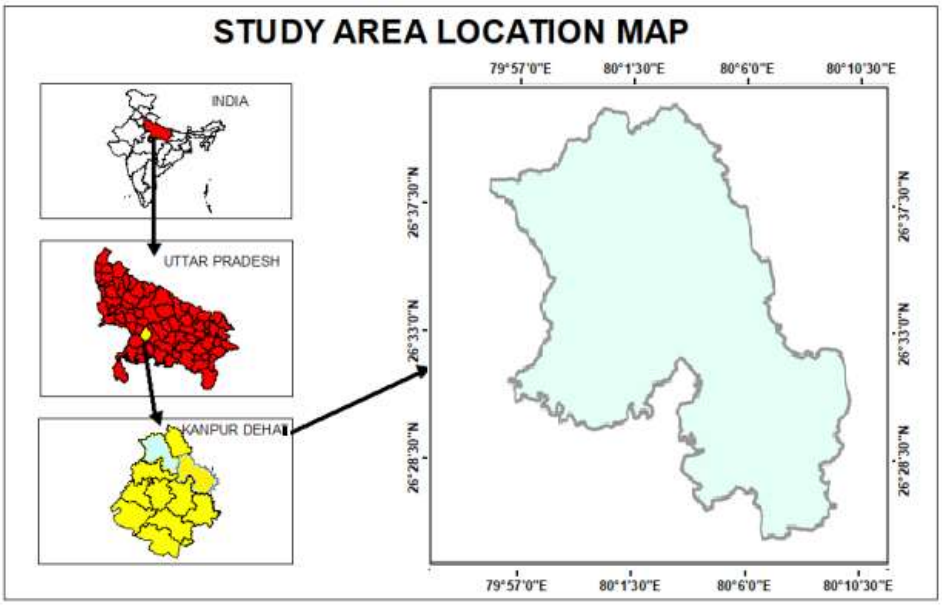

Fig -1: Study area map

2.1. 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 saline land by comparative analysis.

Table -1: Description of satellite data sets used

SATELLITE	SENTINEL (INDIAN REMOTE SENSING SATELLITE)
SENSOR	SENTINEL
RESOLUTION	10 m
ACQUISITION YEAR	2017-2021
SOURCE	USGS

3. METHODOLOGY

Details of the methodology used for mapping desertification and land degradation status, using satellite data is given in figure 2. Two season IRS SENTINEL data pertaining to the years 2017 and 2021 have been used in this study aimed at monitoring the changes in the land degradation status during the certain period. 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.

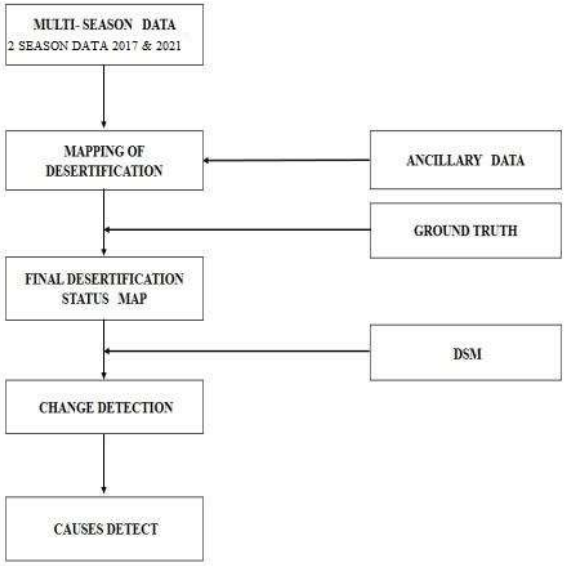

Fig-2: Methodology for Desertification Status Mapping (DSM)

4. RESULTS AND DISCUSSION

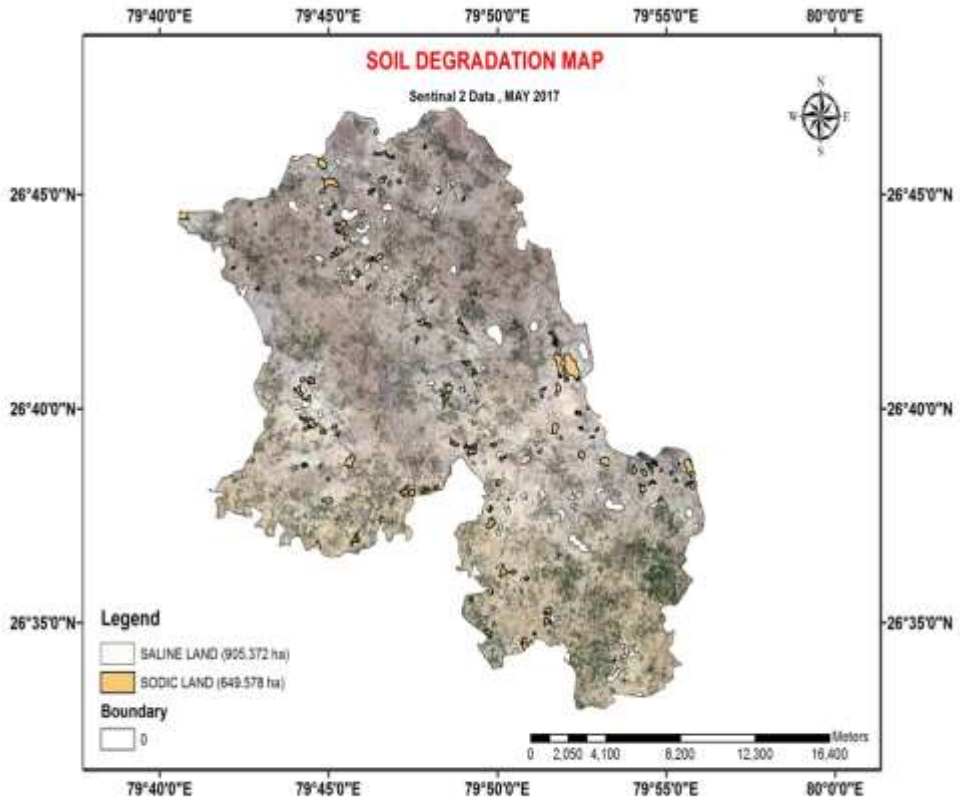

Figure-3(A): Sodic Land and Saline Land Map of Rasulabad Block Kanpur Dehat U.P 2017

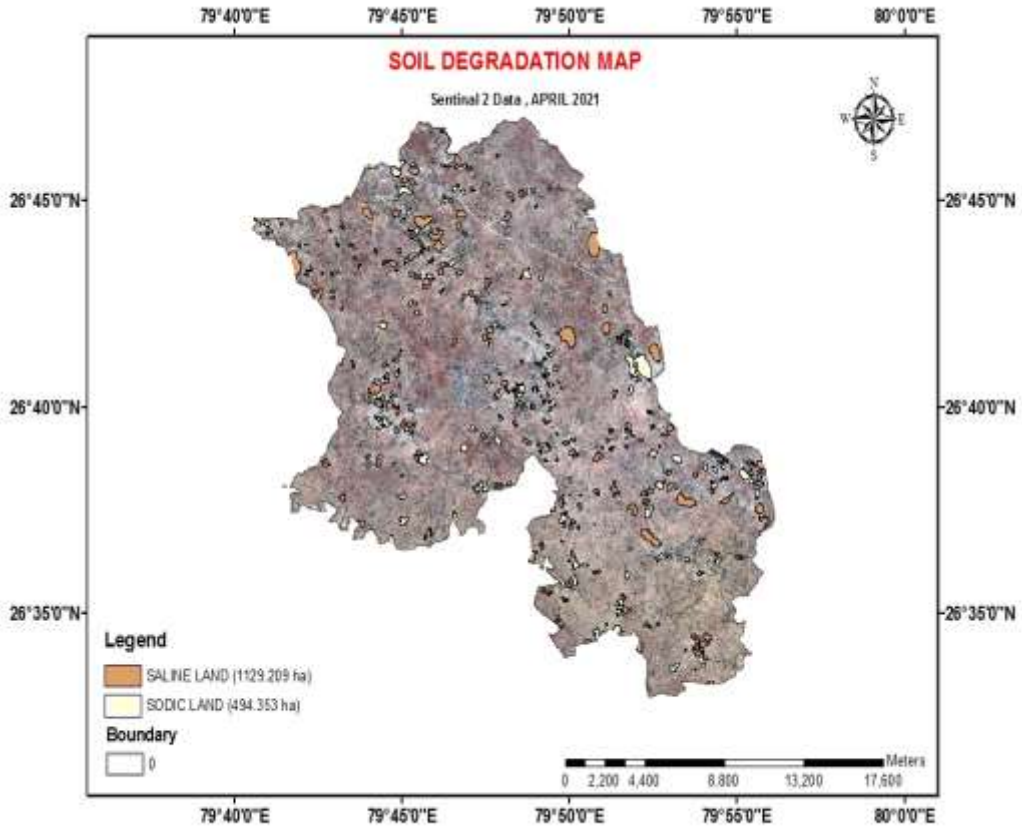

Figure-3(B): Sodic Land and Saline Land Map of Rasulabad Block Kanpur Dehat U.P 2021

Rasulabad block of Kanpur Dehat District has a geographical area of 27.75 km^2. Land Degradation (Sodic Land and saline land) status map of Rasulabad block of Kanpur Dehat, prepared using the IRS Sentinel data, for the years 2017 and 2021 are given in Fig. 3(A) and 3(B). Change in area under Land Degradation processes can be access from the given maps. Land degradation mapping for the year 2017 reveals that salinity/alkalinity of land is the significant desertification process observed in the district which covers almost 32.61 per cent of area of the block. Salinity in the district has increased from 9.0537 km^2 in 2017 to 11.292 km^2 in 2021and sodicity area has decreased from 6.495 km^2 in 2017 to 4.943 km^2 in 2021. Total area undergoing the process of land degradation in the block was 15.549 km^2 in 2017 that has increased to 16.235 km^2 in 2021(about 58.50 % of the geographic area). Comparison of geological process standing maps are prepared from the satellite images of 2017 and 2021 reveals that there's an overall increase within the space below totally different processes of geological process. The that trend within the degree of soil degradation processes might have adverse effects on several soil surface processes connected to geophysical science and erosion and thence it's necessary to require effective combative measures to mitigate or arrest soil degradation processes among the block.

5. CONCLUSIONS

Earth Observation satellite information were accustomed prepare the land degradation standing map (DSM) for Rasulabad block of Kanpur Dehat district of for 2 timeframes 2017 and 2021. These maps are accustomed monitor and assess the method of Land Degradation throughout the bound amount. As per the DSM maps of 2017 and 2021, the area beneath land degradation within the Block has accumulated from 15.549 % to 16.235 %. The main soil degradation processes active within the Rasulabad Block area are salinity / base-forming and soil sodicity. The results show clearly that there is growing increase within the desertification cycle. Cheap steps should be taken

to arrest the Block and, if necessary, reverse the geological process. Degradation of the land, livelihoods and environmental conditions area unit inextricably connected. It's thus suggested that action plans for land resource management and land degradation mitigation within the country as an entire be created a vital element of Panchayat-level rural development program.

6. REFERENCES

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