Assessment and Impact of Soil Moisture Index in Agricultural Drought Estimation using Remote Sensing and GIS Techniques

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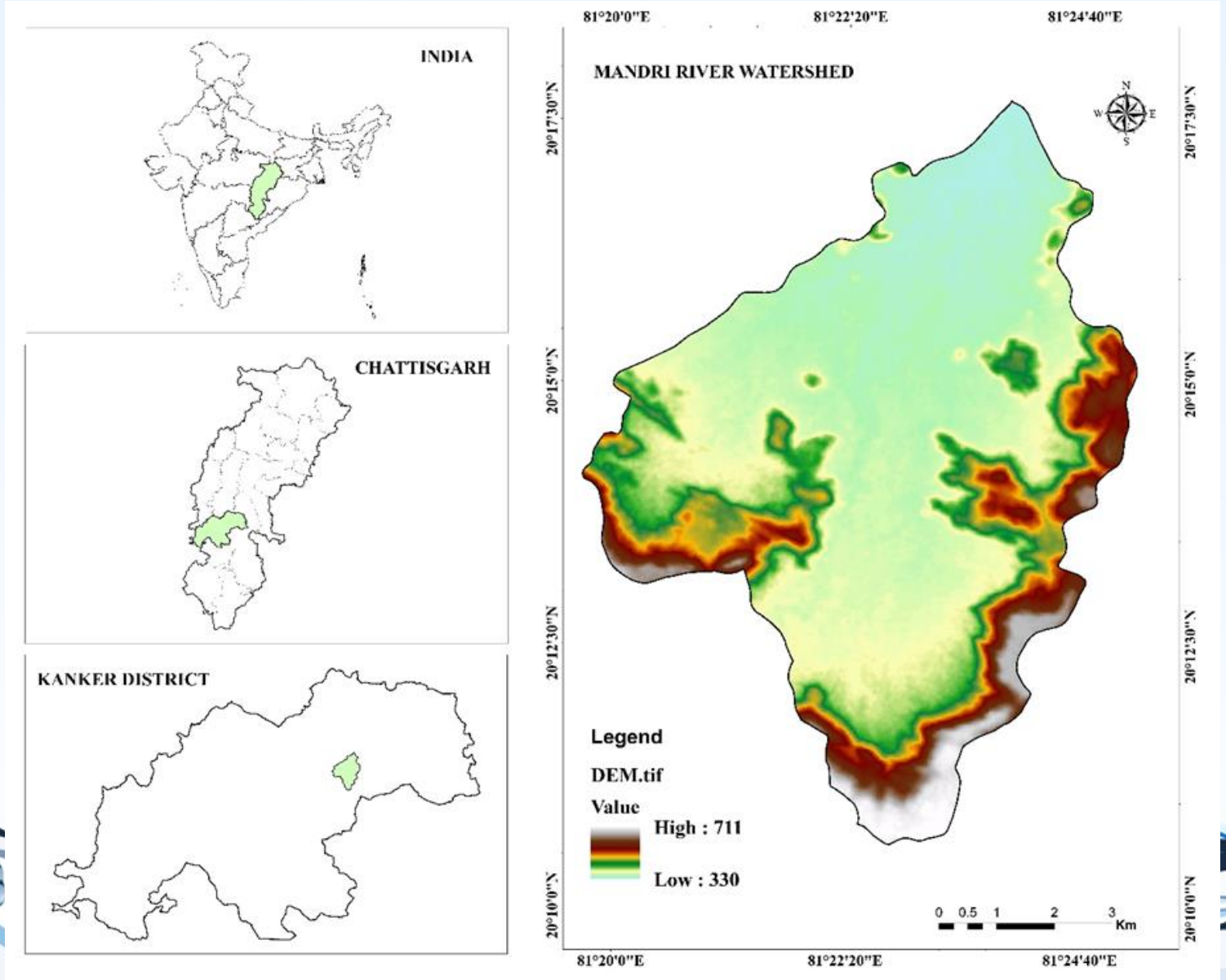
INTRODUCTION

- Soil moisture is a key parameter which directly or indirectly influence the water cycle.
- The data collected for soil moisture analysis taken below the surface over the long term as well as at higher temporal and spatial resolutions data are valuable for assessing the extent and severity of drought quite accurately (Sridhar et al., 2007).
- Various study has done to assess the soil moisture. Two methods of soil moisture measurement which is based on space borne remote sensing like microwave part of electromagnetic spectrum and thermal, infrared observation (Vicente-Serrano et al., 2004).
- The Soil Moisture Index (SMI) is defined as the proportion of the difference between the current soil moisture and the permanent wilting point to the field capacity and the residual soil moisture. The index values range from 0 to 1 with 0 indicating extreme dry condition and 1 indicating extreme wet condition (Chandrasekar et al., 2016).

STUDY AREA



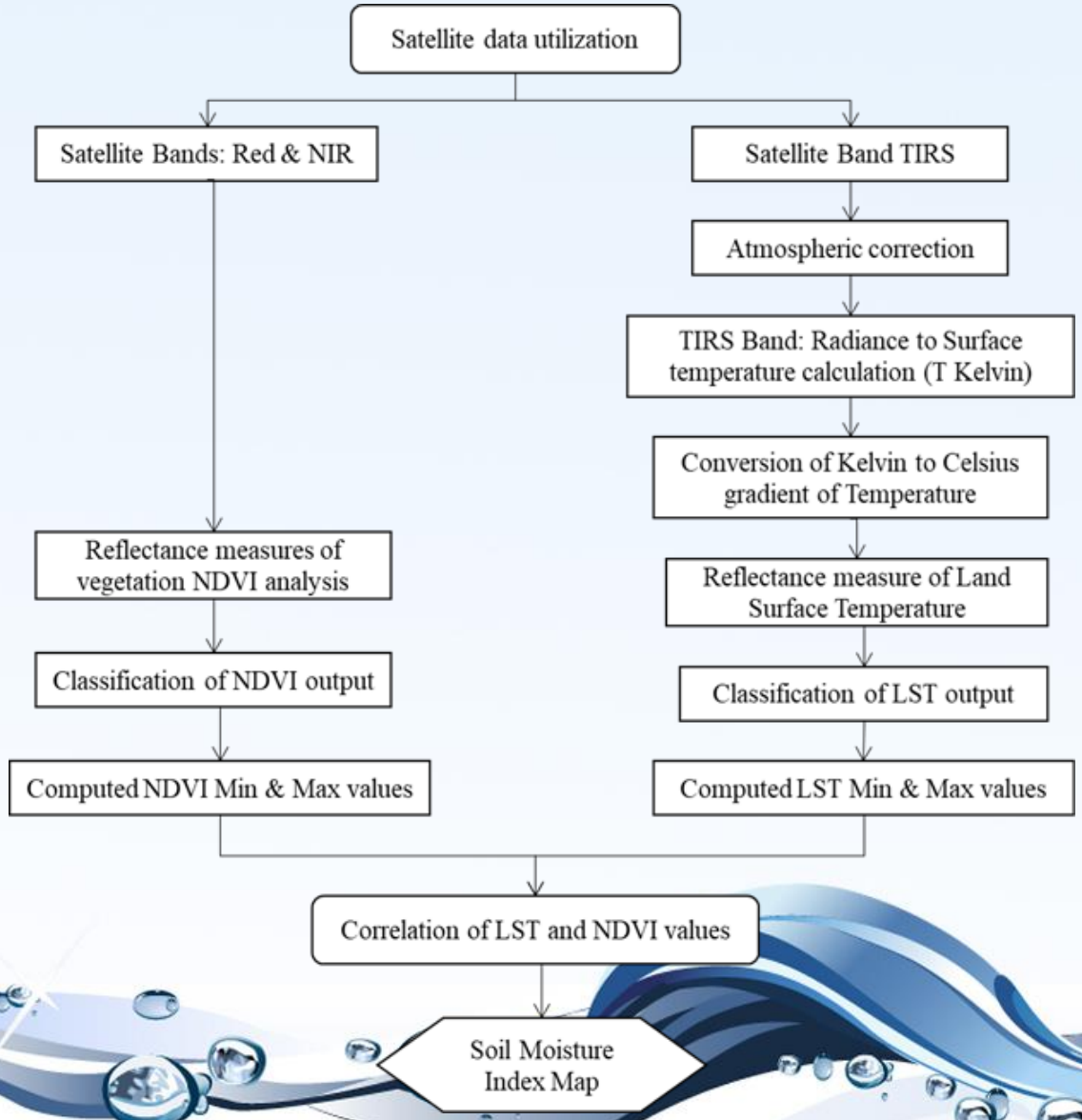
STUDY AREA

- The study area is Mandri river watershed which is falls in the Middle Mahanadi basin. This watershed lies in the district Kanker of Chattisgarh, India.
- Mandri river is the major stream flowing through the area.
- It is located between 20.1990° N latitude and 81.0755° E longitude, having a total geographical area of 6670.3 ha.

DATA USED

- Soil moisture index was mainly based on land surface temperature and vegetation indices of the study area.
- In the present work, the spatial resolution of the used band is 30m of Landsat 8 satellite imagery were downloaded using USGS Earth Explorer website.
- 6th December 2017 dated satellite imagery were downloaded.
- Essential bands from the satellite images for the calculation are Red and Near Infrared (NIR) for the NDVI calculation and Thermal Infrared (TIR) bands for the LST calculation.

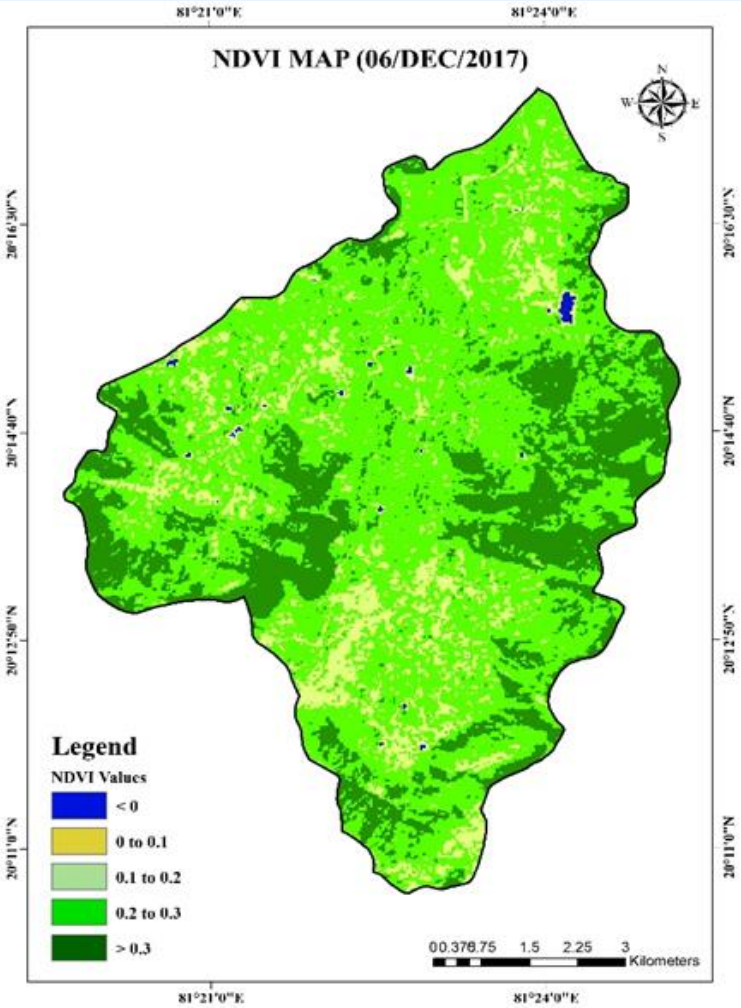
METHODOLOGY

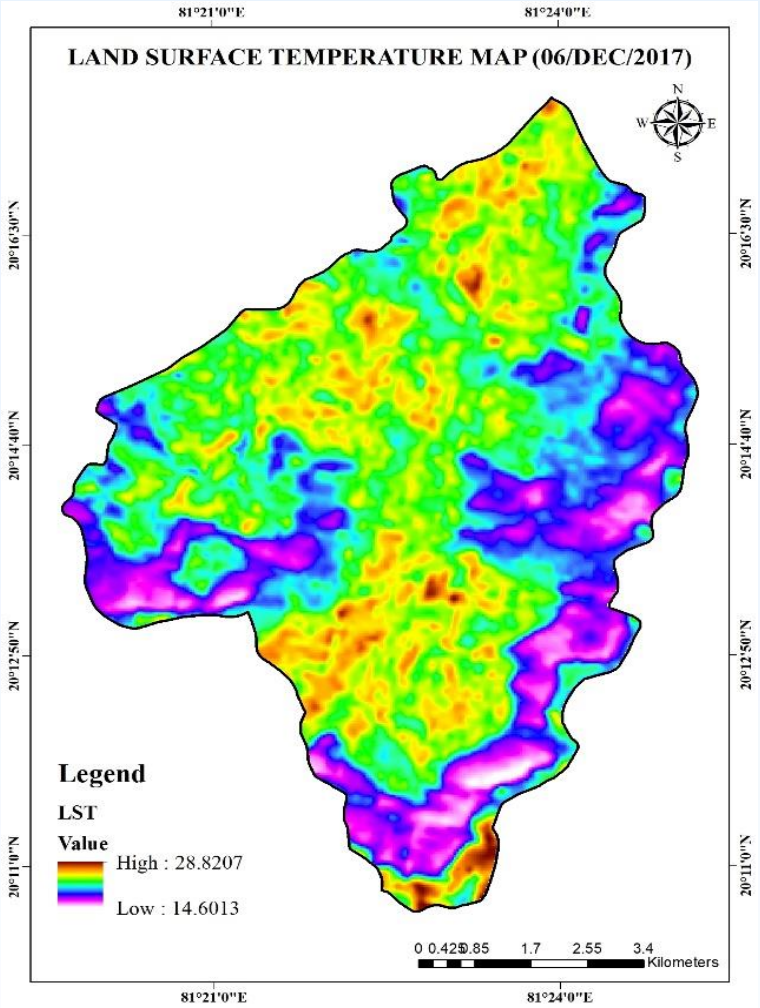


RESULTS

- LST and NDVI are calculated based on essential data to obtain SMI calculation.
- NDVI values varies in range of -1 to 1 where negative values existent absence of vegetation or poor vegetative cover, while positive values shows the dense and good vegetative cover.
- LST values are the temperature of surface which is measured in °C. The result is accessible with the values range within 0 to 1, where values close to 1 are the regions with a less amount of vegetation and surface temperature which indicated that surface have low infiltration and present a higher amount of soil moisture.
- The values close to 0 are the areas with a major amount of vegetation and surface temperature and present the low level of soil moisture and increases the infiltration capacity of the to soil surface.

RESULTS

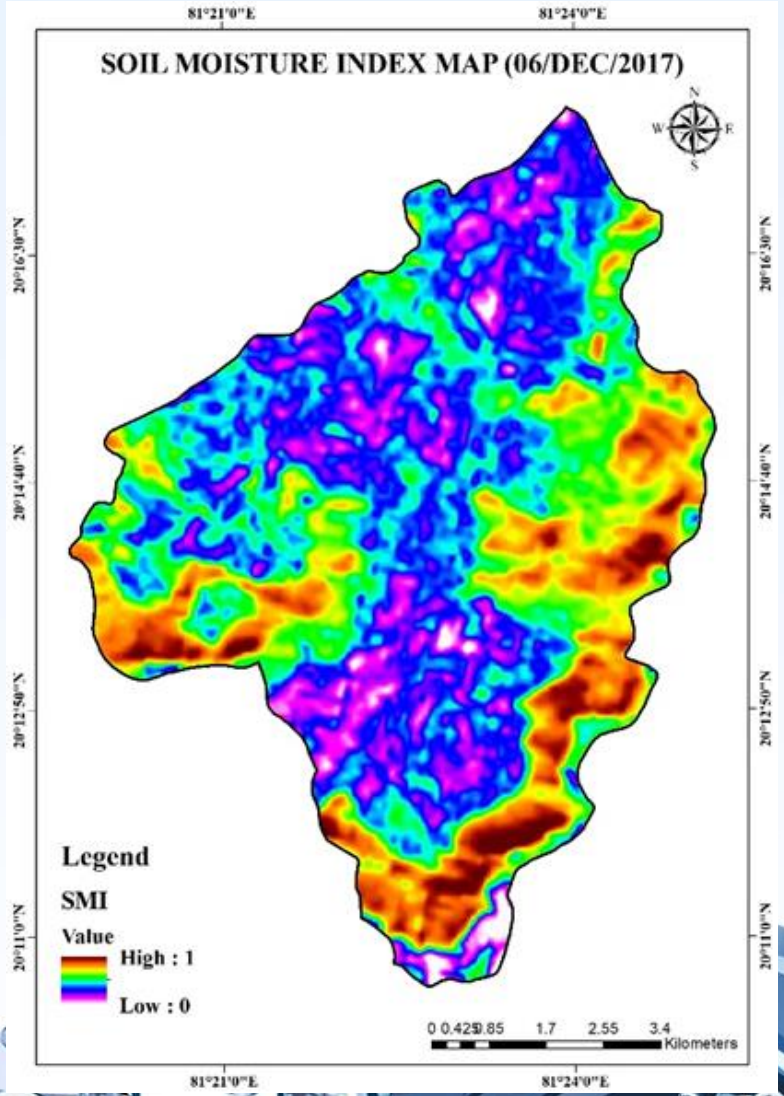




RESULTS

- NDVI value is showing within the range of -1 to +1 and its divided in between five classes as mention. LST value is varies at minimum of 14.60°C to maximum of 28.82°C.
- The scatter plotted between the pixels with NDVI values with corresponding LST values.
- Soil moisture index map of December 2017 is represent in results which indicated soil moisture index in rage of 0 to 1 as classified in four colour ramp.
- Most of the study area as shows in figure (violet and blue colour) have in the value closed to zero, which were highly affected by water deficit.
- The values near by 1 (red and yellow) are forest cover which have moisture as compare to rest of the land cover.
- The result concluded that more than 50 percent area showing closed to zero, that purely indicate moisture deficit in off season throughout the study area.
- As per the index 1 represent the higher amount of water or moisture presence and zero shows minimum moisture content such as dry areas.

RESULTS



CONCLUTIONS

- Soil moisture have important in agricultural watershed for crop production. The study is done in Mandri river watershed of Kanker district in Chhattisgarh, which is highly dominated to agriculture land which have around 39% of total area.

- The number of irrigation depends on soil moisture. Results concluded that around 50% area have sever drought condition and rest of the forest cover have normal moisture condition. To increase the agriculture productivity we have to main focus on forest plantation to increase precipitation as well as moisture condition.

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