Normalised Difference Vegetation Index Based Drought Monitoring Using Remote Sensing and GIS

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Abstract. The objective of this research is to analyse vegetation’s reactions to precipitation. Three Pinups sp. combinations and water tension conditions (pine) forests and NDVI’s assessment of the capacity to identify drought and water stress in this sort of ecosystem. For the purposes of this analysis, a 30-year time series of NDVI indices, derived from SPOT-Vegetation data, is built for all three study sites and compared with field measured precipitation data for the same time span. Results indicate a good relationship between the two indices suggesting a stronger capacity for investigating the vegetation water status. In general, fluctuations in high seasonal precipitation tend to have a strong influence on both NDVI ratios, while a smoother spread of precipitation results in a poorer relationship with the two indices.

Keywords: Normalized drought vegetation index, Digital image processing, Remote Sensing, Pre-Processing, NDVI Time Series.

1. Introduction
Long-term monitoring of remote sensing observations from space provides a way to investigate temporal changes on the surface of the Earth. [1] Numerous climate change reports need this better perception of uncertainty to clarify annual and inter-annual patterns and to distinguish them from particular cases. It is also possible to use this information in budgeting and modelling for analyses of global change. This analysis uses GIS to examine [2] in the sense of Sudan, The association among precipitation as well as the vegetation indices of Normalized Variance and the NDVI value as a flood forecasting metric. By spatial analysis methods, the rainfall-to-NDVI relationship is measured, and a clear significant relationship is found. [3] Within periods of the biggest crisis, the association is strongest, suggesting that the relationship among precipitation and NDVI is not a direct structural model. It is implied, nevertheless, that the precision of the input data has undermined the consistency of the GIS performance and that the data limitations are highlighted [4]. The research illustrates the need for real-time prediction of real-time information using satellite technologies. For such systems, NDVI is a reliable initial cut predictor, even though it is difficult to measure and interpret its relationship to rainfall and has to be dependent on a thorough study of its relationship with the eco region, type of vegetation and weather.

2. Study area
The capital of the Indian state of Tamil Nadu and the gateway to South India is Chennai. Chennai is situated between 13.04 and N 80.17 and averages 6 m to 60 m above normal sea level. The field is about 42,600 ha. According to India’s 2011 census, the fourth [5] largest city in India, with a total population of 8,233,084 people, has grown in the past two centuries. Chennai is now one of India’s major manufacturing centres, with an unprecedented increase in services and redevelopment. Chennai is one
of the major tourism centres, with many [6] UN Educational, Science and Cultural Organisation (UNESCO) world heritage sites. A rare biodiversity hotspot reflects the suburban outskirts of the city. A special mangrove habitat is the marine region (Marina beach) on the east, while the thick forests to the southwest unique property struc

overpopulation, occupation, slums, unregulated wastewater treatment, increasing water shortages and degradation. [8] The US has also caused various detrimental environmental effects, such as increased oil exploitation, loss of biological diversity, increased storm surges, and destruction of biodiversity. Director- districts, namely Tiruvallur and Kanchipuram form [9] the geographical pattern of the US in Chennai. The area of 82,488.16 ha containing the city of Chennai and the 10 kilometers residential defense, that is the regions of Tiruvallur and Kanchipuram, was then chosen by humans.

3. Research Objective
The main objective of the study is to track the drought-prone region by monitoring the Normalized Difference Vegetation Index (NDVI) series.

3.1 NDVI
The green vegetation measure in a region is determined by the normalized vegetation differences index (NDVI). NDVI is focused on the rule that, although radiation is unequivocally conveyed in a close infrarroad setting, it is securely held in the visible range of the 'photo-synthetically complex radiation' spectrum for the efficient processing of green plants [10]. A tool for studying and advising crops, the Green-Seeker Handheld Optical Sensor System provides accurate NDVI calculation and recording of information. In order to define a well-being of plants there, in comparison to regular ones with NDVI formula counts, can be employed an important area of preservation and printing of the artificially complex photographic exposure over a suitable duration.

\[
NDVI = \frac{(NIR - Red)}{(NIR + Red)}
\]

Although scenery calculation indices. Originally, a mixture of observable and close to infrared wave distances was determined using the boundary condition for various quantities and standardized indices as suggested by NDVI scientists; NIR standing for near-infrared emission and VISr for the visible red spectrum is determined while NDVI is the uniform differential vegetation index. NDVI vary values between −1 and +1 (normally water). The optical characteristics of the leaf tissue specify the wavelength density in the NIR range (700-1300 nm) and the VISr scale (550-700 nm) [11].

3.2 Data processing
We used the thematic mapper and the improved themed mapper images of 30 m space resolution from 2010 to 2019 to cover temporary scenes from 2010. The data have been easily obtained from a Geological Survey site in Geo TIFF format and geo-referenced using a coordinate measuring unit from the World Geodetic System [12]. The object pre process was carried out using the application kit for the Framework for remembering Object. On firstly we have to select the year and date which is required for the work. And we also need to adjust the cloud percentage less than 10%, cause of the cloud percentage adjusting we are able to get efficient data of the cloud cover. And then the pre-processing of the images has been done [13]. The pre-processing of the images has been carried through two process called Layer stacking and Landsat gap fill. Whereas Layer stacking is the process of combining three spectral bands of the image and to combine them as a single layer [15]. On other hand Gap fill helps to fill the gaps that will miss in the Landsat ETM Images. Then the pre-processing of the images has been carried out for the study region.
4. Methodology

- Image interpretation (Landsat TM scenes).
- Beginning the pre-processing with layer stacking and gap filling.
- NDVI calculation.
- In this study, output vegetation indexes were performed using quantitative channel estimation.
- The formula is as follows: (NIR-VIS)/(NIR+VIS), or the channel ration: (Band4-Band3)/(Band4+Band3)
- NDVI values are in the 0-1 range and never become negative or expand beyond 1, since NDVI is a linear algebraic characteristic of these bands.

4.1 Layer Stacking

As shown in Figure 1, Layer stacking is the process which is used to combine different layers that satellite Imaginary contains. It actually combines the Layers in which we only give the output. It contains the combination of the different spectral Bands NIR, RED Bands.

![Figure 1: Layer stacking](image1)

4.2 Gap Filling

As shown in Figure 2, Gap Filling is used to fill the pixels that have been missed while processing the layer stacking of the image [14]. This is very important tool after the layer stacked image because the will have been missing pixels so it is necessary to perform gap filling to get the required fine values from the satellite imaginary.

![Figure 2: Gap filling](image2)
5. Results And Discussions

5.1 NDVI Analysis

The NDVI output shown in figure 3 is generated by using software called ENVI from the source of LANDSAT imaginary which we have downloaded from the UGSC. This type of output has been generated for the required time to calculate the NDVI of the required Region.

5.2 NDVI Statistics

| YEAR | MINIMUM | MAXIMUM | MEAN      | STD.DEV  |
|------|---------|---------|-----------|----------|
| 2010 | -1      | 1       | -0.086216 | 0.134286 |
| 2011 | -1      | 1       | -0.020146 | 0.096965 |
| 2012 | -1      | 1       | -0.0719   | 0.136617 |
| 2013 | -1      | 1       | 0.030834  | 0.094172 |
| 2014 | -1      | 1       | 0.046912  | 0.099376 |
| 2015 | -1      | 1       | -0.06816  | 0.138939 |
| 2016 | -1      | 1       | 0.049344  | 0.128501 |
| 2017 | -1      | 1       | 0.059896  | 0.138549 |
| 2018 | -1      | 1       | 0.115633  | 0.40906  |
| 2019 | -1      | 1       | 0.025975  | 0.12057  |

The Table 1 is the derived NDVI output values from ETM images, and the NDVI for the span of the ten has been gradually increasing and decreasing in between the years. The present derived value has been reflecting the circumstance which drought can be monitoring. The graphical representation is shown in Figure 4.
6. Conclusion and Future works
In this study, a set of ETM scenes has been used to monitor the Drought. The technique proposed was adopted to assess the viability of the Namakkal district in Tamil Nadu. GIS-based data analysis (Landsat ETM) enhances landscape research and surveillance technologies. Results of this study show that the relationship between satellite and soil moisture vegetation types is highly affected by the soil cover variability as well as its shape. In this analysis, the NDVI was widely used to examine the changes in the rate of vegetation growth. In addition, it is beneficial to assess the development of green vegetation only as vegetation shifts are recognised. The effects are correlated with the various highlights which the satellite image missed. The outcome is contrasting with the image of Google Earth, which shows the transition. The key is to carry on agricultural farming in the less vegetative values which we have got from the NDVI output. The remote distinguishing advancement which is in the derived image is commonly used for checking crops and agrarian dry season appraisal. Distinctive vegetation records which are derived; a few documents are more qualified than others for explicit vocations. In view of its critical check, NDVI is, in an area, similarly used as an overall level for vegetation. In order to have proof of improvement outcomes, it is often prudent to consolidate NDVI nearby. Hence from these results it is learned that from various band widths we are able to study the vegetative propagation of the Namakkal district by deriving Normalized Vegetative Index. Furthermore, the ability to increase and decrease seed tolerance can be accomplished using different fertilizers and advanced nanotechnology as well as composites in the stress management of crops linked to drought.

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