Dimensions of Land Change: A Spectral Index Based Observation

Vishwanatha Bhat, Mushtaq Ahmed, Girish A B

Department of Civil Engineering,

Shree Dharmasthala Manjunatheshwara Institute of Technology-Ujire

INTRODUCTION

Provision of a large synoptic view has been a prime advantage for most of the remotely sensed image. At present, remotely sensed image provides an optimum platform to analyze the features on the earth surface. Advancement in space technology has proven its leaps in providing high spatial resolution images which have used the landform analysis. Availability of images on innumerable temporal scale puts forward an edge in multi-date change analysis. These multi-date change detection programs hardly provide a quantitative survey of land features prone to slow or rapid change. One of the general and hence, the most experimented approach of change detection is using multi-dated classified imagery. This method is also known as post – classification or thematic change detection. It is also possible to simply subtract two imagery, quite directly, called pre – classification change detection [1]. But the common factor to be considered in both, or any, case of change detection is to have an atmospherically corrected multi-dated imagery.

Band rationing is a technique under the image transformation which is always used to identify the differences in the brightness values from identical surface materials caused by topographic slopes and aspect, shadows and changes in sunlight illumination angle and intensity. Band ratios involve mathematical operation for more than one band, and also provide unique, distinctive information, which further may be useful for discriminating between soil and vegetation. All-in-all band ratio images when subjected under change detection, some useful information is retrieved. The method which is the core of this communication is also based on band rationing and forms as a part of algebra-based change detection approaches. The region under consideration, for this study and a small watershed dominated by the plantation and forested vegetation patches. A more detailed description of the study region, a short reveal on the method have been presented in the subsequent sections.

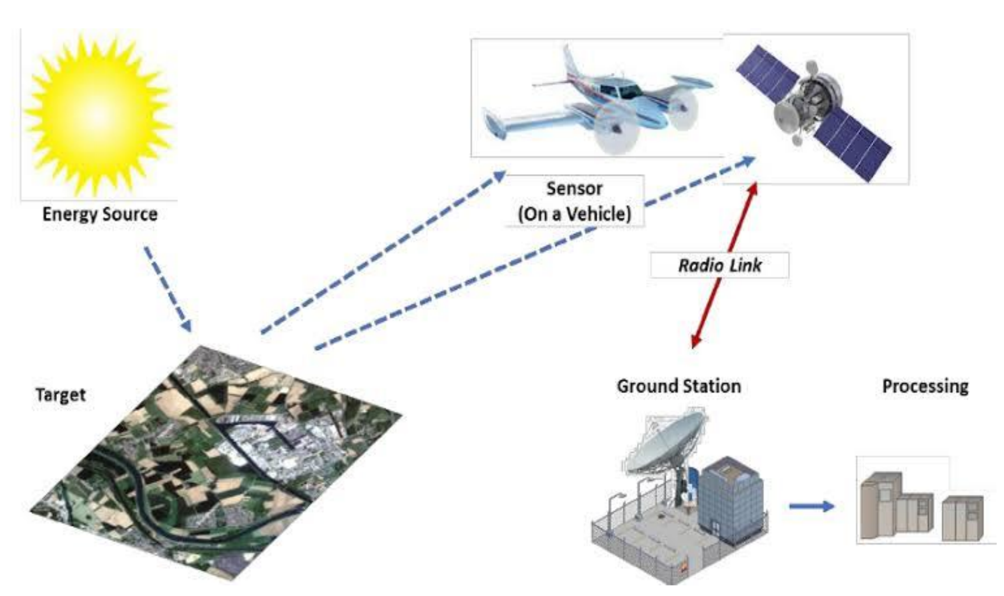


Fig. 1: Remote Sensing

THE INDABETTU WATERSHED

Indabettu, a small village, identified in the Belthangady Taluk of Dakshina Kannada district, Karnataka. Indabettu falls on the outlet of the watershed, so named and referred to as Indubetta watershed. Some other villages located within the aforementioned control volume are Bangady, Bandaje, and Didupe. This watershed, under consideration, is on the Midland and also includes major escarpments of the Sahyadri's as a drainage divider. Areas along the reach of the river are the pattern thread of urbanization and thought to be the agent of the change. A detailed map of the region is given in the following figure

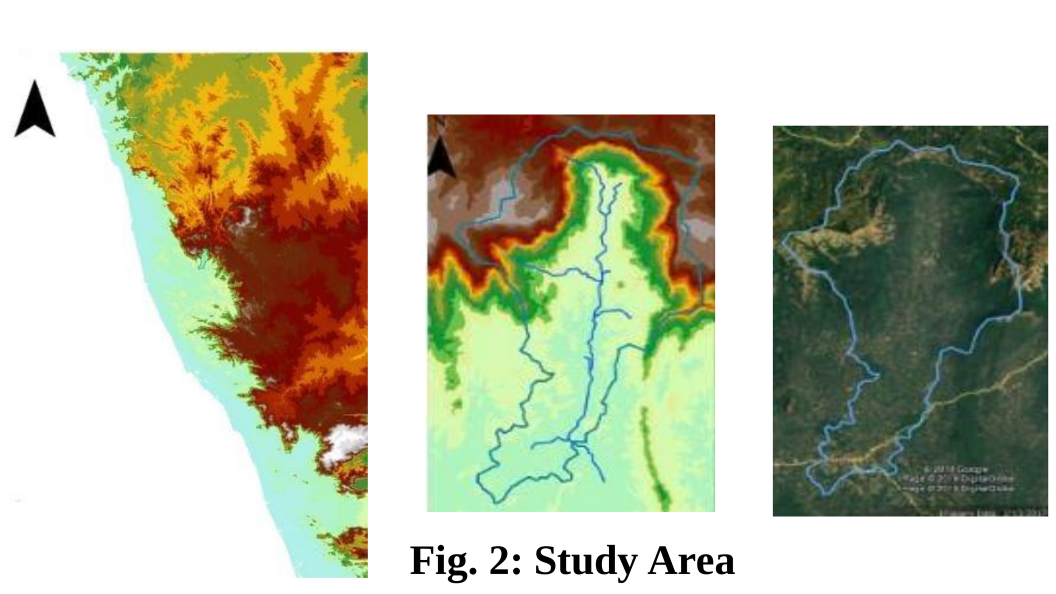


Fig. 2: Study Area

THE CHANGE DETECTION

Landsat 7 and Landsat 8 imagery of Indabettu watershed, for the year 2015 and 2019 are downloaded from the public domain of United States of geological survey (USGS). Images were processed for atmospheric corrections, including radiance – reflectance conversions. Raster map calculator, available at Quantum GIS is used as a tool for all type of processing.Further the most popular indices normalized difference vegetation index (NDVI), and normalized difference built-up area index (NDBI). Image is divided from the primary data. Hence two NVDI and NDBI Images are obtained for further change detection analysis. In both the cases, pixel values infer about the presence or absence of relevant features and the values remain from –1 to +1

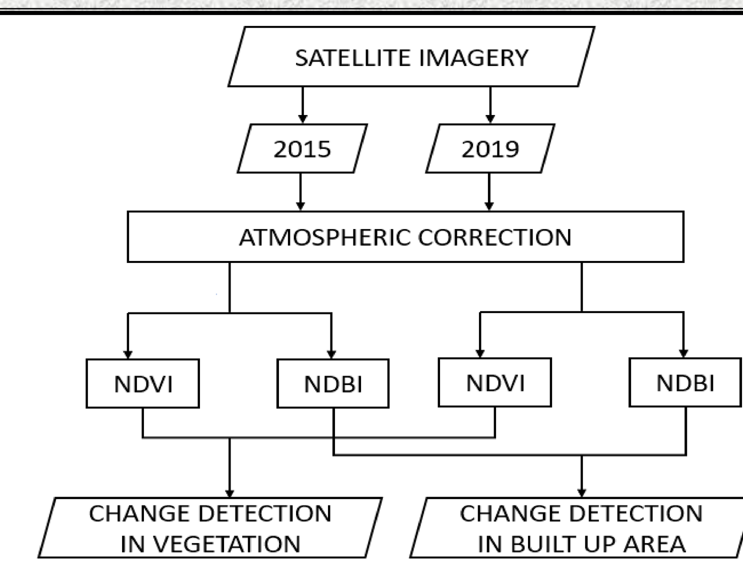
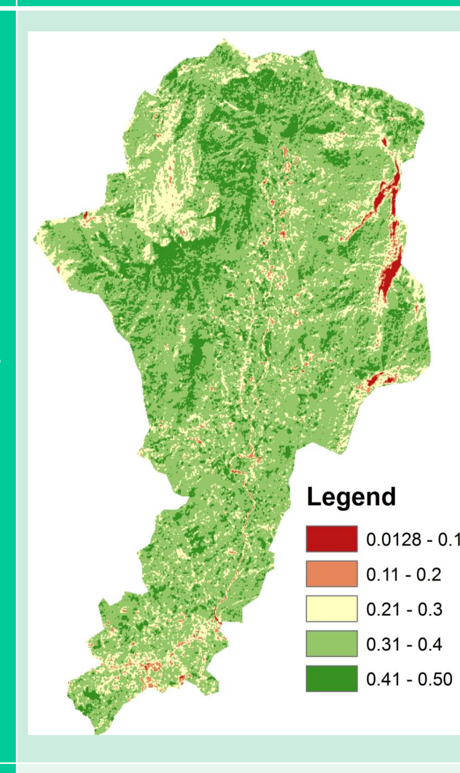
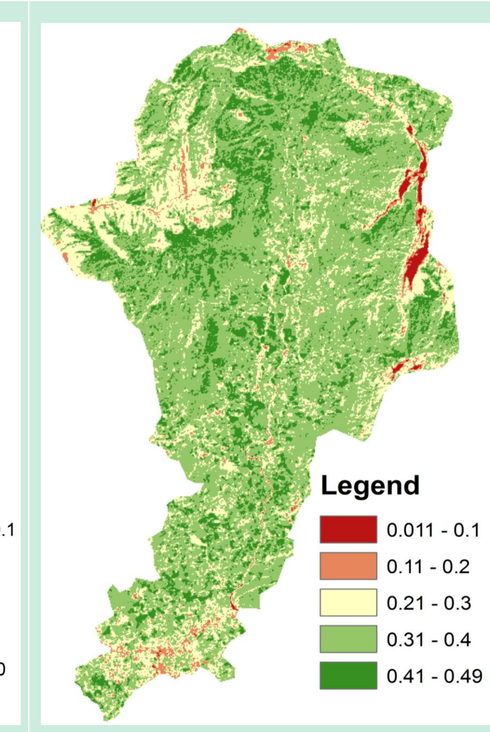
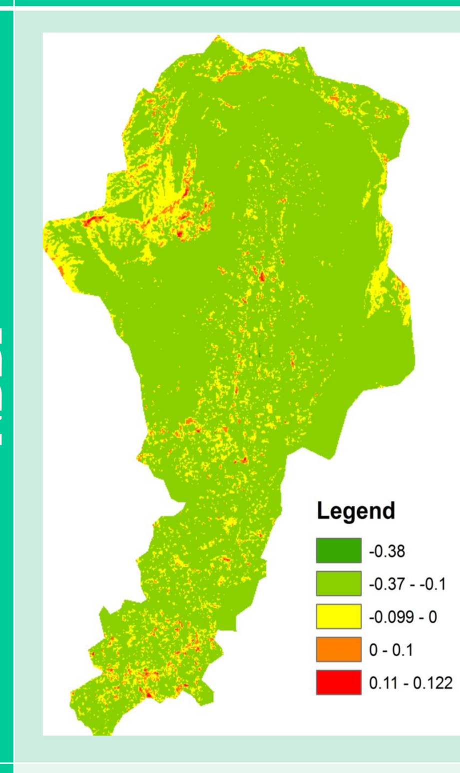
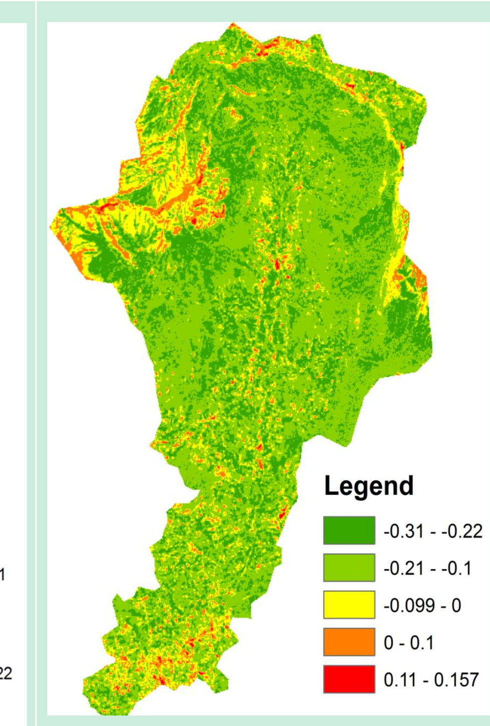


Fig. 3: Methodology

RESULTS

The following results were observed from change detection analysis.

YEAR	2015	2019
NDVI		
FEATURES	NDVI=(NIR-RED)/(NIR+RED) NDVI > 0: vegetation: NDVI < 0: non-vegetation	

YEAR	2015	2019
NDBI		
FEATURES	NDBI=(SWIR-RED)/(SWIR+RED) NDBI > 0, built-up area; NDBI < 0, non-built-up area	

DISCUSSION

This communication deals with the analysis of two sets of satellite imagery of the same region, from two different timelines chosen over a temporal scale to study the changes in the morphological and built-up regions near the Indabettu watershed. After the images were processed for atmospheric corrections and radiance – reflectance conversions, NDVI and NDBI images for change detection in vegetation and built-up area, were obtained to give a variety of change detection observations. A pattern of change in nearby roads, river, and the built-up area has been observed to be quite high over such a short temporal period. Vegetated lands have been transformed into built-up regions directly or through a process of converting itself from barren land. Comparing both NDVI images, a variety of shades among the vegetation can be sensed. The Shola grasslands can be seen to change itself under the group of barren lands or fallow lands. A high value of NDVI indicates that the region is covered with natural vegetation whereas low value in NDVI indicates barren lands or water bodies. Comparing both NDBI images, rapid development in the builtup area is observed near the watershed as the value in the latter image is greater than 0. A considerable region has been converted into a built-up area indicating some deforestation activities.

CLOSURE

The spectral index method evolved over the years, to be considered as a strong way of measuring thematic changes when used in change detection analysis. This process is rapid, lucid and requires no further human intervention to supervise, unlike in the classification method.

BIBLIOGRAPHY

[1] Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman "Remote Sensing and Image Interpretation" WILEY Publications, 2015.

[2] Vishwanatha Bhat, "Analysis of land use/land cover from Space: Spectral Index Approach", I International Conference on Recent Trends in Technology ICRTT- paper proceeding, 2018.

[3] Mushtaq Ahmed, Abhishek Shanbhag, Vishwanatha Bhat, "Morphometric Analysis of Nethravathi Watersheds". International Conference on Recent Trends in Technology ICRTT- paper proceeding, 2018.

[4] United States of Geological Survey - https://www.usgs.gov/

Vishwanatha Bhat

Assistant Professor, Department of Civil Engineering

Shree Dharmasthala Manjunatheshwara Institute Of Technology-Ujire