

Biomass identification of Corbett National Park, Uttarakhand using Normalized Difference Vegetation Index

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Abstract : The present study is based on analysis of normalized difference vegetation index (NDVI) and is calculated using the techniques of remote sensing and GIS. The present study uses Landsat 8 image for the purpose of study. The different band images are used to calculate NDVI. GIS gives us sense to identify the green vegetation present on our earth surface. This study helps us to explore forest vegetation, vegetation on field or any green life present on earth. The study area selected for the study is Corbett National Park, Uttarakhand.

The Corbett National Park is a protected area of tarai with one of its components having status of national park. It comprises of tiger reserve and wild life sanctuary. The tarai area comprises of pure sal forest, mixed sal forest, tall grassland, and swamps. The vegetation is mainly moist deciduous type. This study demonstrates the NDVI of Corbett National Park.

IndexTerms – NDVI, CNP, GIS.

1. INTRODUCTION

Biomass has a vital role in the life of human. It is one of the major components of terrestrial ecosystem. They are the storage of our biological variations. But human have very destructive activities which decreases the number of trees per unit area. The production rate of forest could not keep a steady rate with the exponential growth rate of human population. In 1995, there were 354 M ha of forest worldwide (FAO, 1999). In between 1990 and 1995, the area of forest declined by 56.3 M Ha, that results a loss of 65.1 M Ha in developing countries and an of 8.8 M Ha in developed countries (FAO 1999). Geographical area of India is 328 M Ha. According to an estimate India has lost 3.4 M Ha of forests land in construction of dams, roads, railways, and industries between 1951 and 1972. This leads to a conclusion that annual rate of deforestation is about 0.15 M Ha.

To collect different biophysical parameter information, combination of forest resource inventory with remote sensing techniques is two approaches for estimation of large forest areas (Kranjina et al., 2004). Either we can use optical sensor data or radar data for forest sites with relatively simple forest stand structure than the sites with complex biophysical environments. Remote sensing systems with its systematic, synoptic and repetitive coverage make potentially outstanding tools to support tropical management (Lillisand and Keifer, 1992). Remote sensing gives us a great opportunity for the process of data gathering and map making with the possibility of conducting surveys over large area rapidly in nearly very less time which enables its to save time and also it is cost effective and accurate. Such surveys can provide various levels of information to suit the desired intensity and quality of management planning requirement (Lillisand and Keifer, 1999).

First use of aerial photograph was started during seventies. However, these aerial photographs not become very popular due to its difficulty in their procurement. The National Forest Cover Mapping programme which is done by Forest Survey of India is based on visual interpretation where forests are classified into three density classes viz; dense forest (>40%), open forest (40% - 10%) and scrub forest (<10%) on 1:250,000 scale. Forest structural classification are based on canopy density classes (Roy et al. 1990). NDVI provides good information on canopy closure. It has been reported to vary with foliage activity in dry/ moist deciduous forest area (Roy & Ravan, 1994).

Landsat data have been used to report in estimation of biomass accumulation rates among secondary growths (Alves & Skole, 1996). In low biomass forest the NDVI has been used to derive LAI & biomass value can be used as a reliable predictor of landscape level patterns of productivity in woody species, especially if appropriate scales of temporal and spatial integration are employed (Kuplich et al, 2005).

Geographical information system (GIS) is combination of system of hardware, software to capture, manage, manipulate and analyse spatially referenced data for solving complex planning and management problems. (Burroughs, 1986).

2. Research objective

- ❖ To identify Corbett National Park in the Landsat 8 Image.
- ❖ To make Normalized Difference Vegetation Index of Corbett National Park and identify the biomass present in the forest.

3. Study Area

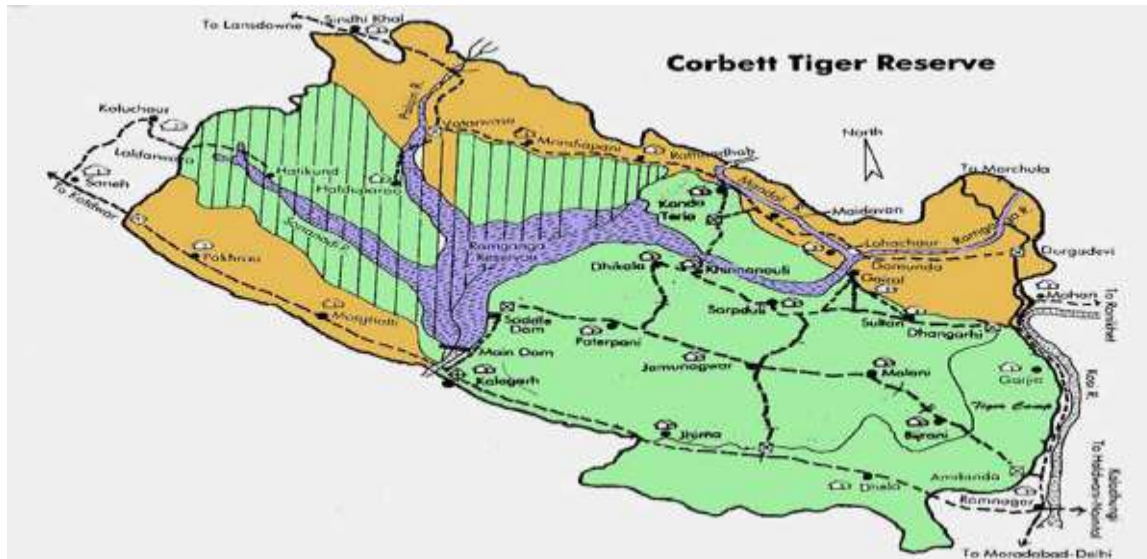


Fig. 1 Corbett National Park

Corbett National Park lies in the Nainital district of Uttarakhand. This national park known for its tiger reserve. This national park is India's oldest national park. CNP is established in 1936 as Hailey National park. CNP covering a total area of 1318.54 sq. km. in which 520 sq. km. of core area and 797.72 sq. km. of buffer zone. This national park is situated at southern part of Uttarakhand. This national park is a amazing mixture of culture of hill regions and displays amazing landscape and diverse flora and fauna. CNP extends from 78°39'40" E to 79°09'23" E longitude and 29°48' N to 29°23'32" N latitude. The altitude ranges between 360m to 1040m. this national park has an annual rainfall of about 1500mm to 1600mm mainly during monsoon though some winter rain always occur. Temperature in CNP varies between 5°C to 40°C during summer season. CNP has a rain-fed river which is popularly known as river Ramganga. It covers more than 100km before entering CNP near marchula. A dam is built on Ramganga at Kalagarh forms a reservoir of about 80 sq. km. Its backwater reaches in Dhikala range. The dam at kalagarh has hydroelectric power plant which supplies electricity within the park. The park has habitat of numerous animals, birds, and trees species. The park has around 110 tree species, 50 species of mammals, 580 bird species and 25 reptile species.

4. Data and Methodology

Methodology consist of analysis of geo spatial data which is obtained from satellite image of Landsat 8 and ancillary data. In study, computer software like QGIS, ERDAS Imagine 9.1 were used for processing and GIS analysis. It include main stages as under –

- ❖ Landsat 8 image collection from Earthexplorer website.
- ❖ Image processing and preliminary interpretation.
- ❖ GIS environment.
- ❖ Normalized difference vegetation index.

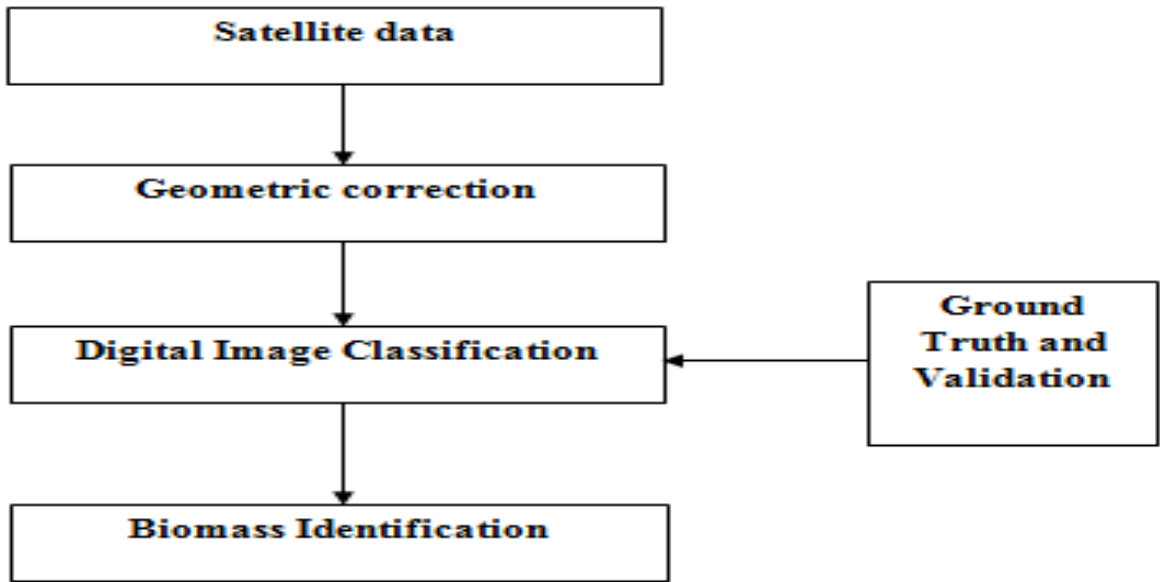


Fig. 2 Flow chart of Methodology

Satellite data of Landsat 8 dated 23rd January, 2016 of path 140 row 40 was downloaded from <http://earthexplorer.usgs.gov/>. A map with various attributes of Corbett National Park with high resolution was co registered using geometric correction techniques. This data was reprojected into Universal Transverse Mercator (UTM) World Geodetic System- 84 (WGS 84) projection for further analysis. The study area of interest is extracted using the shapefile of Corbett National Park which is driven out by the GPS coordinates taken from the ground and matched with respect to government shapefile.



Fig. 3 Ground coordinate of Corbett National Park

Then by using raster calculator we find the Normalized Difference Vegetation Index. The formula used for NDVI is-

$$NDVI = (IR-RED) / (IR+ RED)$$

Where,

IR = Infrared band

RED = Red / Visible Band

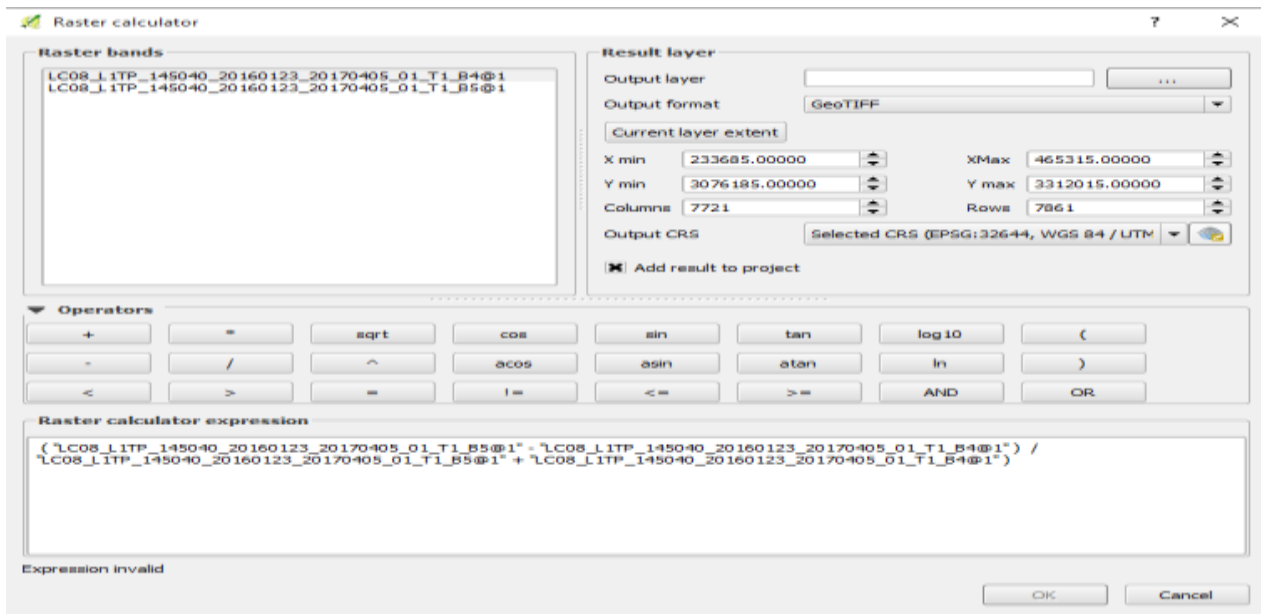


Fig. 4 Raster Calculator

5. RESULT:

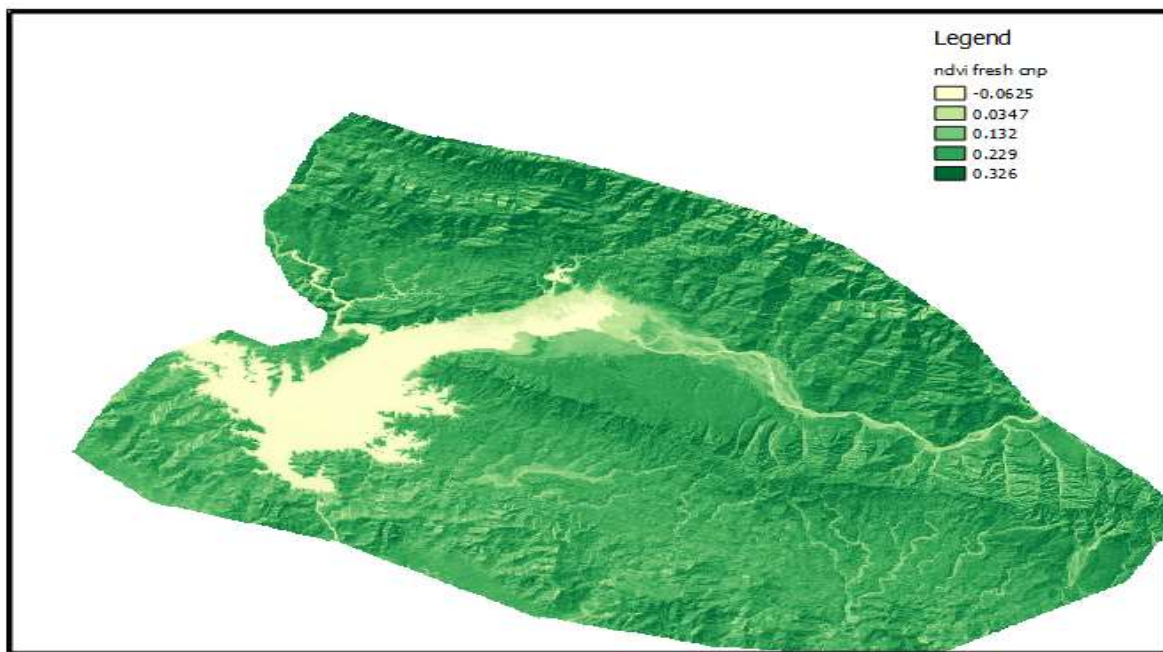


Fig 5 NDVI of Corbett National Park

The Normalized difference vegetation index were grouped into four canopy density classes viz; <10% (non forest), 10% - 40% (open) , 40% - 70% (medium) and >70% (dense). For evaluation purpose image element like tone, texture, shadow were evaluated. These data was now validated using ground truth and expert field experience. With the help of NDVI we can measure and map the density of vegetation. NDVI gives us ratio number which lies between -1 to +1 . NDVI value zero means grass , scrubs etc, 0.6 to 0.9 means dense vegetation, negative value represent water, ice etc

6. Acknowledgement :

I wish to express my sincere gratitude and regards to my supervisor, Dr. R.K. SHUKLA, Associate Professor, Department of Civil Engineering, Madan Mohan Malaviya University of Technology. His guidance and support throughout the work has been a major factor in the successful completion of the present work. This work would not have culminated into the present form without his invaluable suggestions and generous help.

I also feel very much obliged to all the faculty members of Department of Civil Engineering, for providing me with an excellent education during my M.Tech. Program and for their encouragement and inspiration for execution of this work. I am thankful to all my friends and colleagues who provided valuable suggestions and constant help during my work. Above all, I am forever thankful to my parents and family for their love and encouragement. Thanks

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