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Deforestation: A quantitative analysis using remote sensing and GIS

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ABSTRACT

Deforestation and forest degradation are the second leading causes of greenhouse emissions and fossil fuel combustion, which is responsible for over 17% of global carbon dioxide emissions. Deforestation and forest degradation have become an important issue concerning climate change mitigation, highlighted in the Governmental Panel on Climate Change Fourth Assessment Report in 2007. About 75% of the emissions from tropical deforestation and forest degradation have been from developing countries containing large areas of tropical forest, including India. Global initiatives such as the United Nations Framework Convention on Climate Change program on Reducing Emissions. In this thesis, we are mapping about the deforestation for maintaining future of living organisms.

Keywords— *Deforestation, Remote sensing, Mapping, Forest degradation*

1. INTRODUCTION

Remote sensing is outlined because of the assortment of information regarding an associate object from a distance. Human and lots of alternative sorts of animals accomplish this task with the aid of eyes or by the sense of smell or hearing. Geographers use the technique of remote sensing to observe or live of phenomena found within the Earths layer, biosphere, layer, and atmosphere. Remote of the atmosphere by the geographers is typically through with the assistance of mechanical devices called remote sensors. These gadgets have a greatly improved ability to receive associated record data regarding an object with none physical contact. Often, these sensors square measure positioned off from the item of interest by exploitation helicopters, planes and satellites.

Most sensing devices record data regarding associate object by mensuration associate objects transmission of magnetism energy from reflective and diverging surfaces - Remote sensing is that the science of constructing inference regarding from measurements, created at a distance, without returning into physical contact with the item beneath study. That remote sensing refers to any technique, which might be wont to gather data regarding associate object while not truly returning in reality with it. A variety of ecological applications need knowledge from broad abstraction extents that can't be collected exploitation field-based ways. Remote sensing knowledge and techniques, address these desires, that embody distinctive and description the biophysical characteristics of species' habitats, predicting the distribution of species and abstraction variability in species richness, and police investigation natural and human-caused modification at scales starting from individual landscapes to the whole world.

Such measurements square measure subject to substantial errors that may be tough to beat, however, corrected knowledge square measure pronto accessible and may be of sufficiently high resolution to be integrated into traditional field-based studies. Ecologists and conservation biologists square measure finding new ways that to approach their analysis with the powerful suite of tools and knowledge from remote sensing. Here, we discuss recent ecological and conservation applications of satellite remote sensing data as well as some of the limitations inherent to measurements frequently taken from >700 km above the surface of the Earth. Remote sensing generates a remarkable array of ecologically valuable measurements, which includes the details of habitats (land cover classification) and their biophysical properties (integrated ecosystem measurements) as well as the capacity to detect natural and human-induced changes within and across landscapes (change detection). Although there is a perceived mismatch between broad-scale remote sensing and local-scale field ecological data, remote sensing is providing the impetus for an increasingly wide range of ecological and conservation biological discoveries.

The aim of this study is to produce a deforestation map of Uttar kannad that experienced a fast increase of barren land in the recent decades at different years in order to detect changes that have taken place within the forest area to predict in the same given period (2001-2010).

2. OBJECTIVES

- To map the deforestation & forest degradation in the central Western Ghats.
- To investigate the deforestation in Western Ghats for the year 2000-2010 and to view the time series change in forest land.
- To compare the barren land area vs. deforested area and to find the percentage of the deforested area.

3. STUDY AREA

The Western Ghats also are known as Sahyadri (Benevolent Mountains) is a mountain range that runs parallel to the western coast of the Indian peninsula, located entirely in India **(Fig.1)**. It is a UNESCO World Heritage Site and is one of the eight "hottest hotspots" of biological diversity in the world. It is sometimes called the Great Escarpment of India. The range runs north to south along the western edge of the Deccan Plateau and separates the plateau from a narrow coastal plain, called Konkan, along with the Arabian Sea. A total of thirty-nine properties including national parks, wildlife sanctuaries and reserve forests were designated as world heritage sites - twenty in Kerala, ten in Karnataka, five in Tamil Nadu and four in Maharashtra. It has also been observed that the coldest periods.

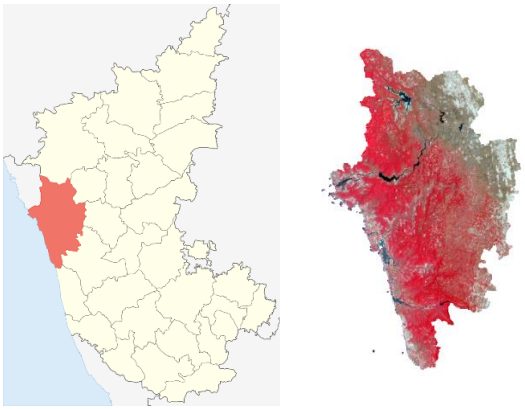


Fig. 1: Study Area

Uttara Kannada is a district in the Indian state of Karnataka. It is bordered by the state of Goa and Belagavi District to the north, Dharwad District and Haveri District to the east, Shivamogga District and Udupi District to the south, and the Arabian Sea to the west. The city of Karwar is the administrative headquarters of the district. Sirsi, Dandeli and Bhatkal are other major towns in the district. The district has 2 agroclimatic divisions, namely: The coastal plain, consisting of Karwar, Ankola, Kumta, Honnavar and Bhatkal taluks. The Malenadu, consisting of Sirsi, Siddapur, Yellapur, Dandeli, Haliyal, Joida and Mundgod taluks.

4. THE SCOPE OF THE STUDY

GIS can effectively use for the classification and analysis of forest area. Now a day's urbanization is increasing along with the depletion of agricultural lands and forest area. The advancement of the GIS makes easier to face the deforestation problem. Due to the decrease in rainfall, deforestation and land acquisition cause depletion of agricultural lands and the decrease in productions. It directly affects the economy of the state and the country.

5. MATERIALS AND METHODS

5.1 Satellite Data

The governments and business around the world operate the imaging satellites that collect the images of the Earth and other planets collectively known as satellite images. For the study, Landsat satellite images of Uttar Kannada (central part of Western Ghats), India were acquired for the year from 2001-2010 from USGS, Landsat 7 images were used (Figure 2).

In the Landsat program, the seventh satellite that was launched on April 15, 1999, is the Landsat 7. Landsat 7's principal target is to refresh the global archive of the satellite photos, providing up-to-date and cloud-free images. The Landsat program is operated by the USGS, and data from Landsat 7 is collected and distributed by USGS. It has sun-synchronous, near-polar orbital characteristics.

6.2 Image Acquisition

The physical scene or the interior structure of an object can be created as photographic images and this process is known as Digital imaging or Digital image acquisition. The term often assumed to imply or include the processing, compression, storage, printing and display of such images.

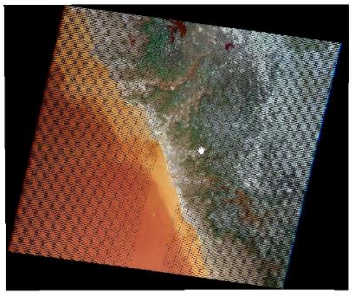


Fig. 2: Satellite Data

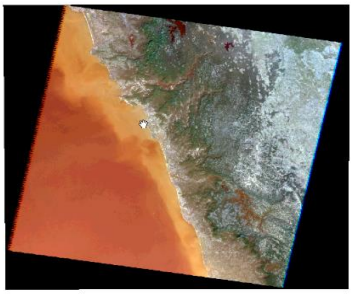


Fig. 3: After Image Rectification

6.3 Image Rectification

The transformation by projecting multiple images onto a common image surface is called image rectification. It is used for correcting a distorted image into a standard coordinate system. When the map points are not known properly or when the clearly identifiable points are lacking in images that correspond to the maps, then they seem to be as primary difficulties (Figure 3).

6.4 Image Preprocessing

The preprocessing is done prior to the main data analysis and extraction of information. (Figure 4).The radiometric correction method is an effective one to improve the data which has any sensor irregularities and atmospheric noise and to correct and convert the data so that the reflected radiation as measured by the sensor is represented accurately have also been included in the preprocessing techniques. Geometric corrections include correcting for geometric distortions due to sensor-Earth geometric variations. (Figure 5).

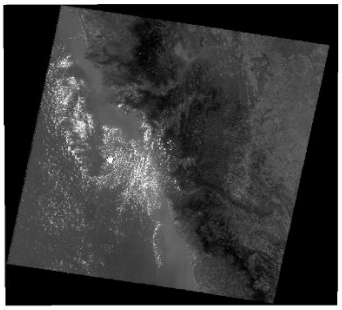


Fig. 4: Before Image Preprocessing

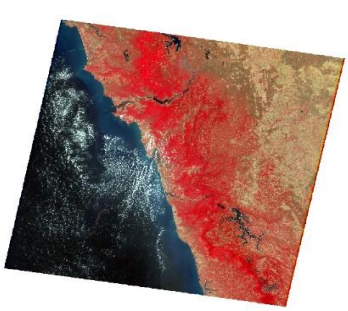


Fig. 5: After Image Preprocessing

6.5 Image Enhancement

The visual impact of an image that has on the interpreter can be altered in a fashion through which the information content can be improvised. This process is known as image enhancement. It is necessary to use the original brightness values that have been recorded by the instrument with exact geometric and radiometric corrections while conducting digital image analysis. However, to make desirable changes to the visual appearance of the imagery to improve interpretation by a human being is possible since most of the remotely sensed data is viewed on a computer display.

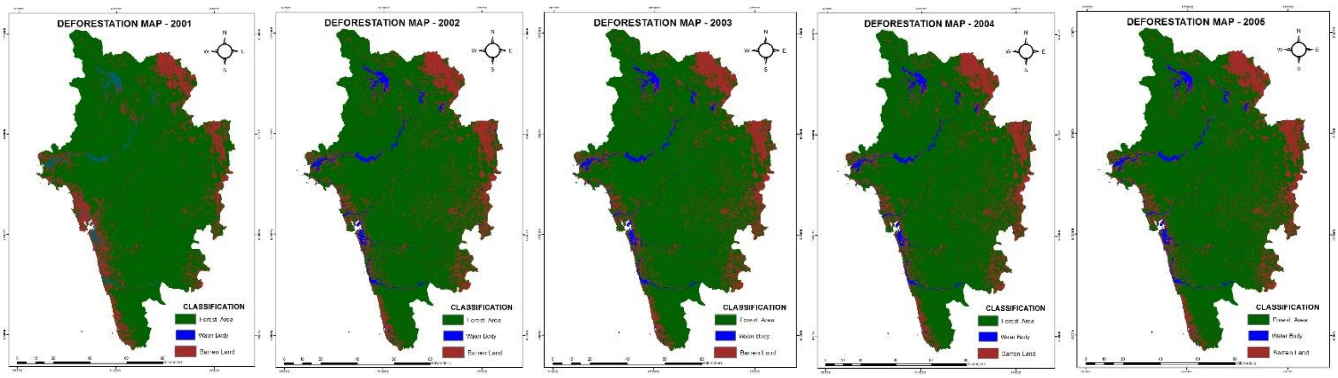
6.6 Supervised Classification

Supervised and unsupervised classification is often employed in a combination manner; classifying the image based on the user-specified land cover classes will be allowed by the remote sensing program, classification of other less common or lesser known cover types into separate groups will also be done. Maximum Likelihood classification has been employed in this project. The tool will take both the variance and covariance into account while each cell has been assigned to one of the classes as mentioned in the signature file. The class sample distribution is assumed to be normal and the mean vector and the co-variance will characterize the class.

7. RESULTS AND DISCUSSIONS

The study conducted in Uttar Kannad shows that multi-temporal satellite data are very useful to detect the changes in land use quickly and accurately. The study uncovers that the Deforested areas are the major land use in Uttar kannad. Water Bodies have increased from 2.39% to 2.67%. Barren Land has increased from 14.35% to 33.73%. Deforestation area decreases from 83.26% to 63.59 %. (Figure 6).

As India's population keeps on increasing, the deforestation rate is also increasing. Urban Sprawl has an important part in the development of urban civilization to both extents positively and negatively. For regional balance and development in a sustainable manner, the resources must be utilized effectively since urban sprawl is found to be a serious threat. As observed from the graph (Figure 7), the deforestation rate increase from 14.35 % to 33.73% within the time period of 2001 to 2010.



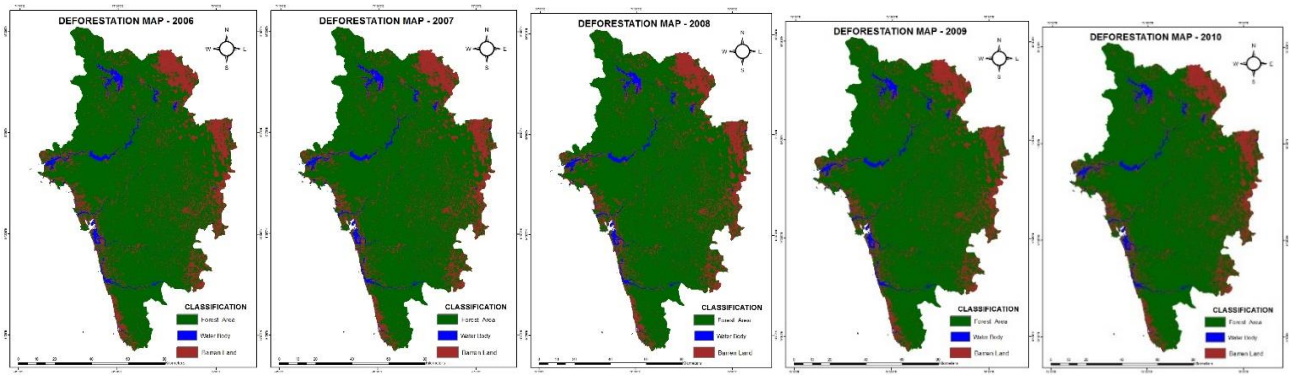


Fig. 6: Deforestation map for Uttar kannad 2001-2010

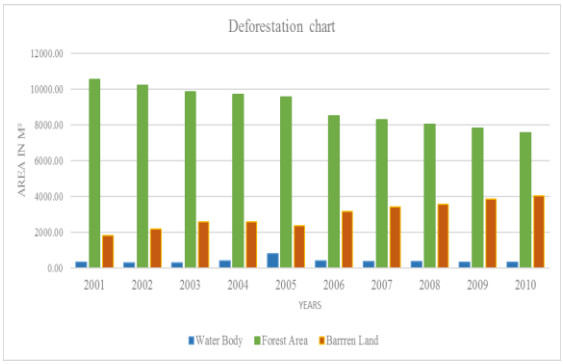


Fig. 7: Change of deforestation in Uttar kannad from 2001-2010

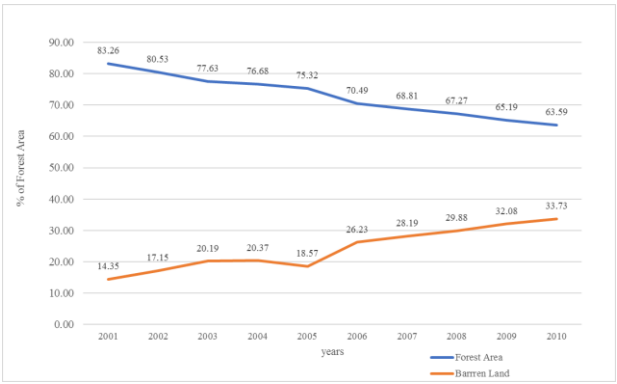


Fig. 8: Barren land &forest area detection in Uttar kannad from 2001-2010

The percentage of barren land is also gradually increased as well as the forest area is decreased simultaneously. The percentage of barren land is decreased from 14.35% to 33.73. All these changes were happened due to the deforestation and urbanisation in that area. The water body level has been gradually changing due to the rainfall and evaporation of the water level due to the temperature changes. (Figure 8).The water level in 2001 is 2.39% and in 2010 it is 2.69%. It may be due to the changes in the monsoon and rainfall changes. The area of the water bodies reached its peak in 2005. And the water level is touched its lowest level in the year of 2003.

8. CONCLUSION

This paper is about the deforestation Changes in Uttar kannad, using remote sensing data and GIS techniques. From the results, it is evident that deforestation was so prominent during the time period from 2001 to 2010. There is a major expansion of barren land areas and on the other hand, there is a drastic decrease in vegetation, water bodies. This study precisely indicates the significant impact of population and urbanization. This was made possible by the integration of remote sensing and GIS technologies. This can be of great use for policymakers and also for the public to better understand the surroundings.

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