

Appraisal of deforestation in Murree using Remote Sensing and GIS techniques.

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ABSTRACT: This research was executed to delineate deforestation in Murree between 2000-2015. The main purpose of the research was to investigate the forest degradation rates using geographical information system (GIS) and remote sensing (RS) techniques. It also aimed to identify the impact assessment of deforestation on the socioeconomic life of the locals. We identified the percentage of forest degradation rates across the study area as the Landsat 8 image for the year 2000 was classified into vegetation, top soil and built up area. The area covered by vegetation was 79.97 km² (55%), top soil was 38.25 km² (26%) and the built up area 27.5 km² (19%). The Landsat 8 image for the year 2015 was classified and the classification results showed that the area covered by vegetation was 59.3 km², topsoil was 42.89 km² and the built up area 41.25 km². So it is clear that deforestation occurred in Murree region and the areas with high forest degradation rates were mapped.

Keywords: LULC (Land use and Land cover) mapping, Change detection, Spatiotemporal analysis, GIS, GPS, Remote Sensing.

1. Introduction

Earth's forests are clearing on a massive scale by the deforestation that results in the damage of quality of land. About 30 percent of world area is forest cover, but the size of global forest is degraded every year [1]. If this rate of deforestation continuous, the rain forests may be possibly disappear from the map of the world [2].

Deforestation can occur due to many reasons, but most of them are associated with money making or the people's necessity to deliver to their families [3]. Increasing trend of urbanization, and food demands may be a key factor of forest degradation. Farmers cut the forests to feed their livestock and to increase annual yield [4]. The process of cutting of forests and burning of trees is often known as "slash and burn" agriculture [5].

People cut numerous trees every year as logging operation to fulfill paper and wood demands. Auxiliary deforestation is executed by the loggers as illegal cutting by construction of roads to access the remote areas of the forest [6]. Deforestation also results in increasing urbanization trends.

All types of deforestation is not planned. Some are triggered by a group of humans and natural factors like wildfires and later overgrazing [7].

There are many harmful impacts of Deforestation on the environment. The most intense impact of deforestation on habitat of millions of animal and plant species. Deforestation destroys their homes and they can't survive, about 70 percent species of plants and animal's lives in forests [8].

Deforestation also impact on climate change. Soils are wet in the forest, but short of shield from sun-blocking tree cover they swiftly dry out. Trees also help preserve the water cycle by repaying water vapor back into the atmosphere [9].

Without this process the forest land can abruptly become barren deserts.

Removing the trees withdraws the forest of the canopy, which lump sunlight rays through the day and clutch heat at night. This distraction primes to more dangerous temperature slaps that can be unsafe for animals and plants [10].

Tress also plays an important role to absorb the greenhouse gases that firewood for global warming. Rarer forests mean more amount of greenhouse gasses entering into the atmosphere and speed up the global warming.

The speediest method to pause deforestation would be to modestly end cutting down trees. However, deforestation rates have reduced a bit in recent years, economic realities make this implausible to occur.

Its authoritative for the industrial progress of a country to have 25 percent of its whole land area beneath forest cover. It ensures the unrestricted supply of fuel wood, timber and petty forest produces and permits other land uses under the multiple use concept without threatening the ecosystem. Pakistan, although having different habitats (9 habitats) has an insufficient forest cover of 5.2%, which is not enough for meeting the national demands [11].

Objective of the research

- To delineate the areas where deforestation occurs.
- To identify the rate of deforestation.
- The impact assessment of deforestation.

2. Study Area

Murree is located at 7500 feet above the sea level with spatial extent 33.9 N latitude and 73.4 E longitude [12]. Murree is connected to Khyber Paktunkhaw on the north, Jehlum river

at the east, and district Rawalpindi in the south. Winter is very cold while summer is pleasant.

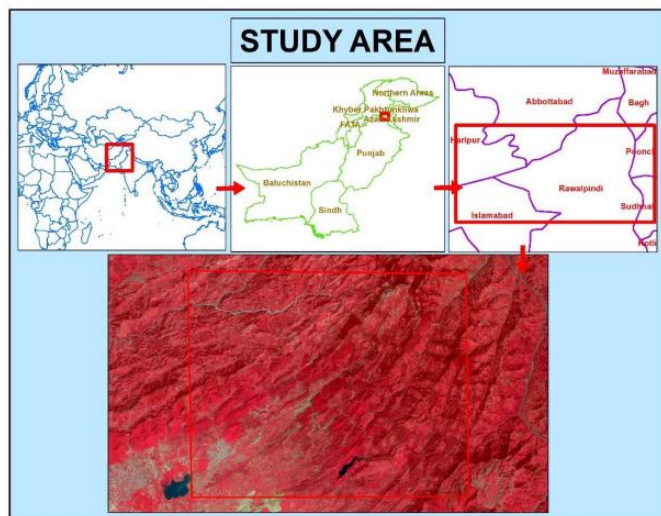


Fig. 1 Study area map.

3. Methodology

3.1 Image Acquisition

Landsat 8 satellite images for the year 2000 and 2015 were obtained from United State Geological Survey (USGS) website. These images were acquired to estimate the deforestation rates in Murree region.

3.2 Band Stacking.

The images downloaded, were a composite of 11 layers commonly known as bands. These layers were tied up using “layer stack” algorithm in Erdas Imagine 9.2. The main purpose of layer stacking was to make a composite image.

3.3 Geometric distortion.

Geometric distortions created by fluctuations in the sensor's functionality were checked and removed in Erdas Image 9.2 to process error free data.

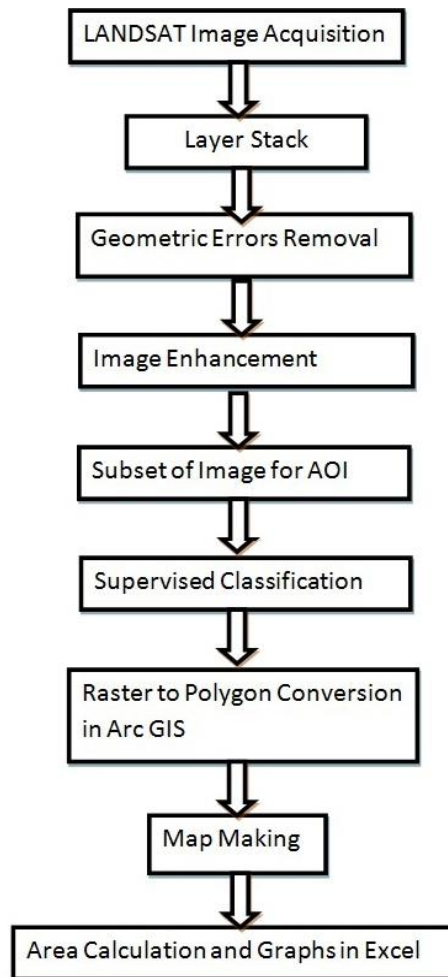


Fig. 2 Research map.

3.4 Image classification

The algorithm of supervised classification was applied to rectified satellite images to see spatial distribution of features in the images. In this step we classified the images into major classes named as vegetation, top soil and the buildup area.

3.5 Subsetting.

In this step we extracted out the area of interest from the complete dataset using “extract by mask” algorithm in Arc GIS 10.1. Sub setting is a good method of extraction of our desired area to enhance processing speed otherwise system may take longer time in processing.

3.5 Raster Analysis in Arc GIS

The classified images for the year 2000 and 2015 were imported in Arc GIS 10.1. The algorithm of “conversion into polygon” were applied to convert the images into polygons to measure the forest degradation area in km². The following results were extracted.

4 Results and discussion

Fig 3 describes that Landsat 8 image for the year 2000 was classified into vegetation, top soil and built up area. The area covered by vegetation was 79.97 km²(55%), top soil was 38.25 km²(26%) and the built up area 27.5 km²(19%).

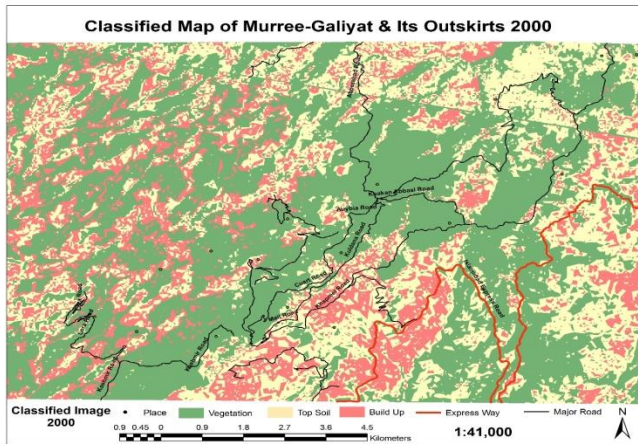


Fig. 3 Classified map of study area in 2000.

Fig. 4 describes that Landsat 8 image for the year 2015 was classified in the same classification as in fig 3. The area covered by vegetation was 59.3 km², topsoil was 42.89 km² and the built up area 41.25 km².

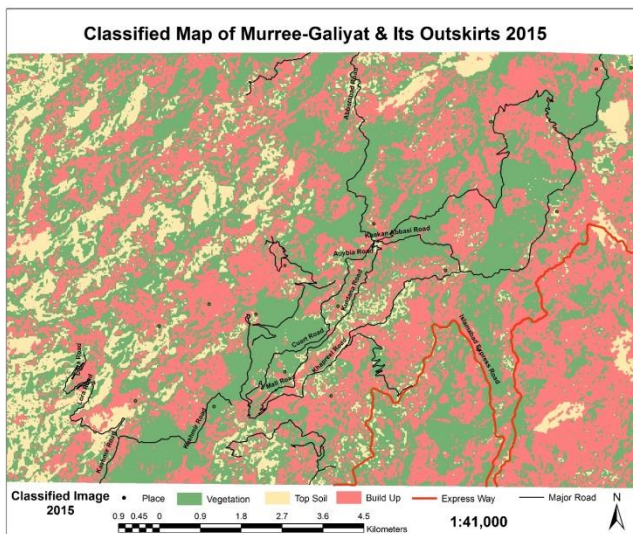


Fig 4. Classified map of study area in 2015.

Fig is describing that built up area is increased along Muree express way in the Fig 4. vegetation is decreased due to many factors, including activity of timber mafia along with forest officials.

4.2.1 Economic Impact of Flood

Forest reserves in Murree are a source of wood having a cost of billion of rupees. This wood might be stolen or removed in the last 15 years to establish new settlements. This activity may cause a degradation in national economy.

Environmental impacts

Murree forests are a source of fresh oxygen that play a vital role in maintaining the ecosystem of a region. Deforestation may cause a polluted environment and hence a diseased future.

Strategic role.

Murree forests help the Pakistani army to hide ammunition and tanks behind the tree for a better strategic attack on Indian army in a safe environment. Removal of the trees will actually reduce our strategic planning.

Aesthetical role.

The beauty of Murree forests attracts the visitors for fun and other activities of enjoyment that actually boosts the regional and national economy. Removal of trees may lead the area toward high erosion rates and landscaping. This phenomenon of landscaping will reduce the natural beauty which is actually a loss to the economy.

5. Conclusion

Remote sensing (RS) and GIS techniques proved very useful to identify the rate of deforestation in Murree. It became very easy to demarcate deforestation and to estimate the cost of stolen wood. RS and GIS techniques enabled us to analyze the areas where we were not approachable physically. These techniques increased the spatial and temporal resolution.

6. References

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