



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

VEGETATION CHANGE DETECTION USING SENTINEL- 2 DATA IN RECENT YEARS (2015-2021): A SPATIO-TEMPORAL ANALYSIS OF SHERGARH WILD LIFE SANCTUARY

POONAM* Research Scholar, Department of Geography, University of Rajasthan, Jaipur, India

Abstract: The main problem of this research concerns the environment and environmental degradation, for the assessment of the problem Land use land cover (LULC) map has been prepared to detect change in tree cover. This study focusses a moderately dense forest in the Shergarh wild life sanctuary. The Shergarh sanctuary is located in Shergarh village, about 65 km from the Baran district in Rajasthan. It is located in the Baran district and is spread across 97 sq km near the Shergarh town. The objective of this paper is to detect change in natural vegetation of the Shergarh wildlife sanctuary using sentinel-2 data with the help of LULC (Land use land cover) Map (2015-2021). For developing Land-use Land-cover map of the study area, two images of sentinel- 2 have been collected from the USGS (United States Geological Survey) earth explorer website. For image classification Band 2, 3, 4 and 8 were considered and Supervised classification technique was used with the help of semi-automatic classification plug-in (Q-GIS). The study area has been classified into three broad category – vegetation area, Bare soil area and waterbody as the area has no other major morphology. The study reveals that there is a major decline in forest cover in recent years while open area or bare soil area increased. 12.8 percent vegetation reduced in six years of time. This data suggest that Shergarh wildlife sanctuary is protected environmentally critical area and indicate that it needs some serious important policy implications.

Keywords: environment degradation; Land use land cover; Shergarh wild life sanctuary; sentinel- 2; Vegetation

1. INTRODUCTION

Monitoring land cover changes using satellite remote sensing has proven to be a good scientific technique in recent decades. Detecting changes within a remotely sensed time series and identifying their driving mechanisms can help policymakers, natural resource managers, and scientists to address many issues facing the planet, such as carbon budgets, global climate change, drought, and wildfires [1]. Vegetation cover is a very important issue in a country like India, where development is in process, and so much pressure is on natural resources. India's total forest cover (TFC) is 7,12,249 square kilometers (km²) according to the 2019 Biennial State of India Forest Report (ISFR 2019) published on December 30, 2019, Tree and forest cover together made up 24.56% (8,07,276 sq km) of India's area. In the last assessment it was 24.39%. Where open and very dense forests have increased since the latest estimate and moderately dense forests have decreased. Based on the understanding of IRS Resourcesat-2 LISS III satellite data of the period Oct to Dec 2017, the State's forest cover is 16,629.51 km², representing 4.86% of the State's geographical area. In terms of forest canopy density classes, the State has 77.81 sq km under Very Dense Forest (VDF), 4,341.90 sq km under Moderately Dense Forest (MDF) and 12,209.80 sq km under Open Forest (OF). The state's forest cover is 57.51 km² higher than the previous assessment published in ISFR 2017. Overall, forest cover has increased in recent years, but in some areas moderately dense forests have been in a decreasing position. This study also focusses a moderately dense forest in the Shergarh wild life sanctuary. The Shergarh sanctuary is located in Shergarh

village, about 65 km from the Baran district in Rajasthan. The main problem of this research concerns the environment and environment degradation, for the assessment of the problem Land use land cover (LULC) map has been prepared to detect change in tree cover. Land use and land cover are commonly used interchangeably, but each term has its own meaning. Land cover includes the surface cover on the ground such as vegetation, urban infrastructure, water, bare soil etc. Land cover identification sets out baseline information for activities such as thematic mapping and change detection analysis. Land use refers to the subject matter of land, such as recreation, wildlife habitat or agriculture. The vegetation cover and its spatial distribution have significant effects on the framework and function of the ecosystem and so vegetation plays an important role in climate change, it is also a dominating factor in maintaining the functions of the Earth's ecosystem.

2. THE STUDY AREA

One of the least known wildlife destinations in Rajasthan, Shergarh is situated about 65 km from the Baran. It is located in the Baran district and is spread across 97 sq km near the Shergarh town (latitudes 24.61 and 24.75, north and longitudes 76.44 and 76.56 degrees east). The sanctuary is known for its rich flora & fauna and amongst its major attractions are tigers, sloth bear, hyenas, deer species like chinkara (Indian gazelle), sambar, chital (spotted deer), and leopards. It was acknowledged as a protected area in 1983. The sanctuary is flanked by Fort Shergarh, an ancient fort dating back to 790 A.D. Each year, pilgrims pay homage to the fort, which houses several Jain and Brahman temples. Parban/Parvan River divides this sanctuary into two parts. The Parvan River has its source in Madhya Pradesh and runs through Rajasthan. This is an affluent of Kali Sindh. Parvan comes from the Sehore district of Madhya Pradesh and in Rajasthan It runs through the districts of Jhalawar, Kota, Baran of Rajasthan. It meets Kali Sindh in Baran district of Rajasthan.

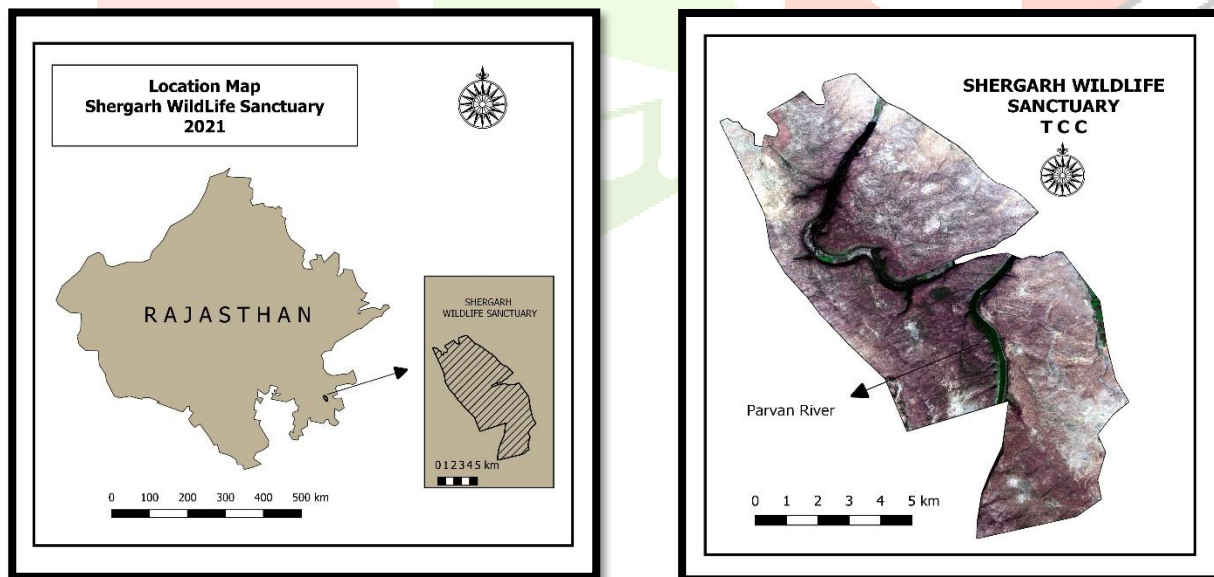


Figure 1.1 & 1.2 (Left & Right) Location map & True color composite of the study area.

3. OBJECTIVE

1. To detect change in natural vegetation of the Shergarh wildlife sanctuary using sentinel-2 data with the help of LULC (Land use land cover) Map (2015-2021).

4. DATA SOURCES AND RESEARCH METHODOLOGY

For developing Land-use Land-cover map of the study area, two images of sentinel- 2 have been collected from the USGS (United States Geological Survey) earth explorer website. Each image has a resolution of 20m, the first image is from sentinel-2a taken on 7 December 2015 with Zero percent cloud cover. Second image is from sentinel-2b taken on 11 October 2021 with Zero percent cloud cover. Both images have been captured after Monsoon period. Both images have 10, 20 and 60 m resolution for different band sets. To see the difference in vegetation cover Land use Land cover map has been prepared in Q-GIS open-source software. For image classification Band 2, 3, 4 and 8 were considered and Supervised classification technique was used with the help of semi-automatic classification plug-in (Q-GIS). The study area has been classified into three broad category – vegetation area, Bare soil area and waterbody as the area has no other major morphology. In pre-processing of the image geometric rectification or image registration, radiometric calibration and atmospheric correction have been applied. Accuracy assessment of the classification has also been done.

5. RESULT AND DISCUSSION

LULC covering three major classes: Vegetation, bare Soil and waterbodies of 2015 and 2021 are shown in figure (2.1). The spatial distribution pattern of LULC obtained from supervised classification is enumerated in Table (1.1).

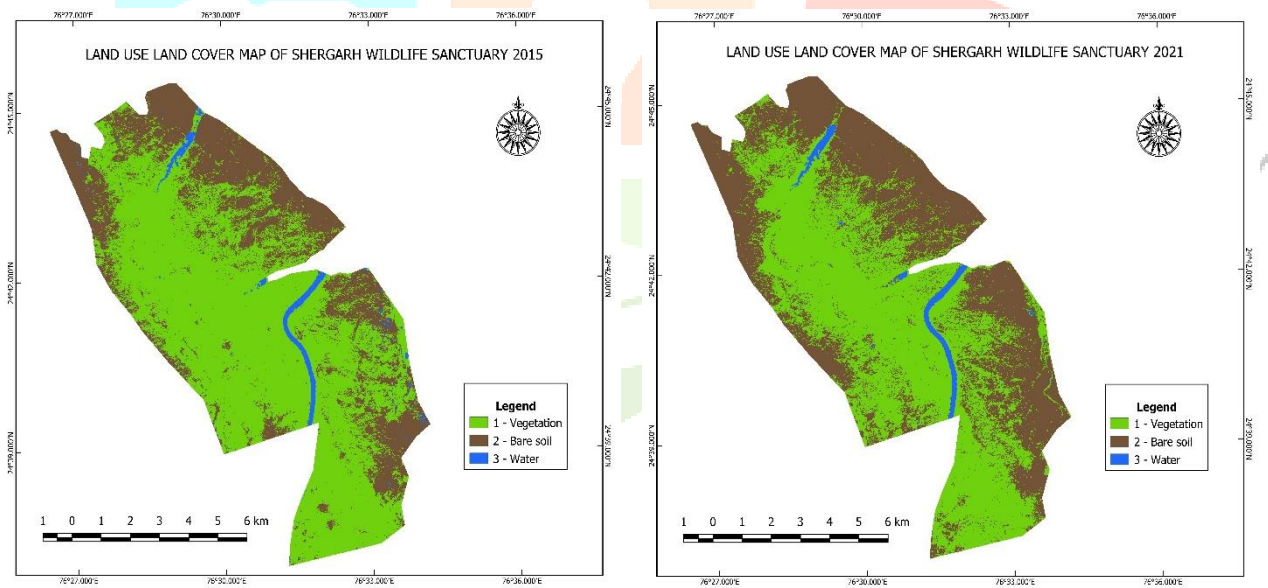


Figure 2.1 (Vegetation cover change in LULC Map during years 2015-2021 in Shergarh wildlife sanctuary)

LULC class	2015		2021	
	Area (km ²)	Area (%)	Area (km ²)	Area (%)
Vegetation	64.5	67.0	52.1	54.2
Bare soil	30.0	31.2	42.5	44.2
Water body	1.8	1.9	1.6	1.7

Results show that, In classified LULC map Vegetation has decreased drastically as the area under vegetation reduced to 52.1 km²(2021) from 64.5 km² in 2015. While the bare soil area has been increased as 12.4 km² area under vegetation converted to bare soil land. The difference can be seen clearly in figure 2.1, where in 2015 image green area is very much higher compare to 2021 image. Water body has no major affect as total area under water body remain almost similar. Lapse of vegetation in Protected forest is very critical situation. Only in 6 years of time, 12.8 percent vegetation shrink in the study area. Total area calculated under both the images was 96.22 km². Kappa accuracy assessment of both images has been also done, in which overall accuracy was found 99.39 percent in 2015 image classification and for 2021 image classification overall accuracy was found 97.21 percent. User accuracy and individual producer accuracy of both the images were also above 95 percent in vegetation class and bare soil class. Multiple studies also show a decrease in the amount of forest in India, contrary to what the government claims. The Forest Survey of India (FSI) estimates India's forest cover to be 7.08,273 km² in 2017, up from 7.01,673 km² in 2015. This apparent growth in forest cover has been debated, with some experts indicated that the government estimates comprise plantations cover which are different from natural forests. Using MODIS satellite data a study has been done by National Remote Sensing Agency (NRSA), Hyderabad which confirms declining in the core forest areas and recognized hotspots of forest loss in protected forest areas between the years of 2001-2014. They highlighted “substantial negative changes” in the seasonal green cover. In another report of October 2017 by Centre for Earth and Space Sciences, University of Hyderabad; Centre for Climate Change Research, Indian Institute of Tropical Meteorology, Pune; and School of Environmental Sciences, Jawaharlal Nehru University, New Delhi found that 15.83 percent reduction in overall forest covers during the last 95 years and conversion of agricultural land into scrubland, largely driven by mining, agricultural activities and urbanisation in the Eastern Ghats. This study also supports the fact that natural forests in India are slowly vanishing, with some serious decline in the core forest area and protected forests.

6. CONCLUSION

This study assessed the change in vegetation during 2015-2021 in the Shergarh wildlife Sanctuary using sentinel-2 data. The study reveals that there is a major decline in forest cover in recent years while open area or bare soil area increased. 12.8 percent vegetation reduced in six years of time. This data suggest that Shergarh wildlife sanctuary is protected environmentally critical area and indicate that it needs some serious important policy implications.

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