INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY
HYDERABAD

R&D SHOWCASE 2021
Technology, Social Impact

Mapping Forest Burnt Severity across Spatial Scales and determining impact of fire severity on Vegetation Regrowth Using Burnt Severity Metrics and Deep Learning Techniques

ABSTRACT

Wildfires in forests occur across countries. One such incident took place in the Bandipur Tiger Reserve, India on 22nd February 2019 and set ablaze 66% of the total area. This site was used as sample and the main objective of this study was to map burnt severity and to assess its effects on the vegetation growth of Bandipur Tiger Reserve using Landsat(30 m) time-series data and its available products. Two popular spectral indices, differenced Normalized Burn ratio(dNBR) and Relative differenced Normalized Burn Ratio(RdNBR) were used to determine burnt severity. In order to compare the severity across different scales with regard to vegetation dynamics and vegetation loss after the fires, the time-series analysis was carried out on the aforesaid forest area using Remote Sensing and Deep Learning techniques.

STUDY REGION

Figure 1: Bandipur Tiger Reserve(Karnataka)

Figure 2: 2019 Bandipur Tiger Reserve wildfires

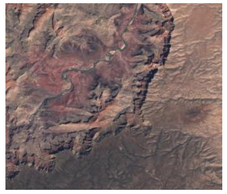


Figure 3: Atmospherically corrected Landsat 8 Image

The Bandipur National Park situated in the Western Ghats of Karnataka State, is one of the biodiversity hotspots of the world. On 22nd February 2019, news articles reported fire spreading in the Bandipur Tiger Reserve across the Himavad Gopalaswamy Betta range and estimated the extent of burnt area to be about 10, 920 acres.

OBJECTIVE

The main objective of this study was to map burnt severity and to assess its effects on the vegetation growth of Indian Forests using Landsat(30 m) time-series data and its available products with Remote Sensing and Deep Learning techniques.

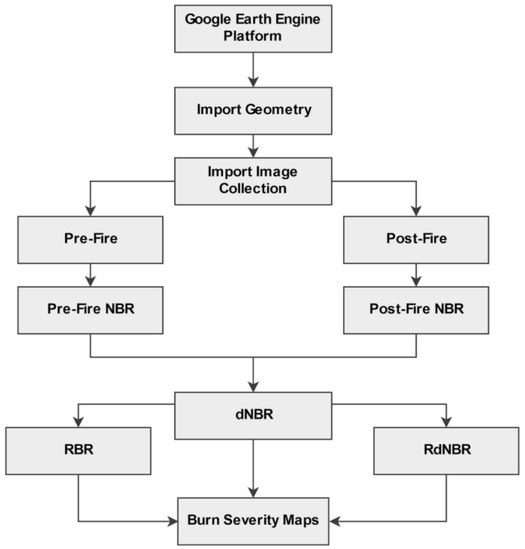
NORMALIZED BURN RATIO – BURN SEVERITY METRICS

$$NBR = \frac{NIR\text{-}SWIR}{NIR+SWIR} \qquad dNBR = \left(NBR_{prefire} - NBR_{postfire}\right) \times 1000$$

$$RdNBR = \begin{cases} \frac{dNBR}{|NBR_{prefire}|^{0.5}}, & |NBR_{prefire}| \geq 0.001 \\ \frac{dNBR}{|0.001|^{0.5}}, & |NBR_{prefire}| < 0.001 \end{cases}$$

Severity Level	dNBR Range (scaled by 10^3)	dNBR Range (not scaled)
Enhanced Regrowth, high (post-fire)	-500 to -251	-0.500 to -0.251
Enhanced Regrowth, low (post-fire)	-250 to -101	-0.250 to -0.101
Unburned	-100 to +99	-0.100 to +0.99
Low Severity	+100 to +269	+0.100 to +0.269
Moderate-low Severity	+270 to +439	+0.270 to +0.439
Miderate-high Severity	+440 to +659	+0.440 to +0.659
High Severity	+660 to +1300	+0.660 to +1.300

METHOD



RESULTS

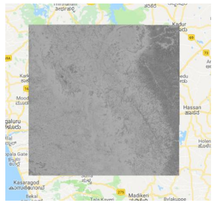


Figure 4: Pre-Fire NBR Image

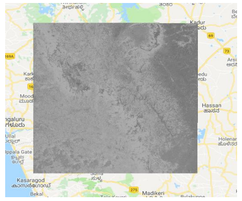


Figure 5: Post-Fire NBR Image

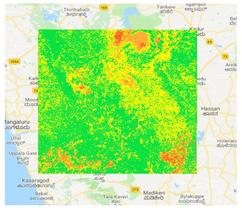


Figure 6: dNBR Classified Image

Authors:----M. Srinivas, Dr. Rama Chandra Prasad P.----------

Research Center Name:--Lab For Spatial Informatics----