Examining Vegetation Growth and Disruption Utilizing Over 30 Years of Satellite Images

Rebecca King[a] (rebeccak@udel.edu), Pinki Mondal[a,b]

[a]Department of Geography and Spatial Sciences, University of Delaware; [b]Department of Plant and Soil Sciences, University of Delaware

Problem Statement

- Vegetation growth and disruption are manifestation of continuous processes.
- Scattered field work or analysis of a handful of satellite images might not be best suited to capture this continuum.
- We utilize an algorithm 'LandTrendr' that utilizes decades of satellite image collection efforts by NASA.

Study Area

- Bandhavgarh National Park, Madhya Pradesh, India
- Established in 1981 (strictly protected; no legal anthropogenic activities)
- Area: 448.85 square kilometers

Research Questions

- Did the study area witness any major episodes of vegetation gain or disturbance since 1985?
- How does the duration and the magnitude of change vary throughout the years?

Technical Terms

- **LandTrendr**: Landsat-based Detection of Trends in Disturbance and Recovery. Module in Google Earth Engine that shows changes throughout the years since 1985.
- **NBR**: Normalized Burn Ratio. An index that focuses on burnt locations from natural or anthropogenic fire activities.
- **NDVI**: Normalized Difference Vegetation Index. An index that focuses on vegetation health. This unitless index measures chlorophyll content, i.e. greenness. Trees have higher NDVI values than grasses.

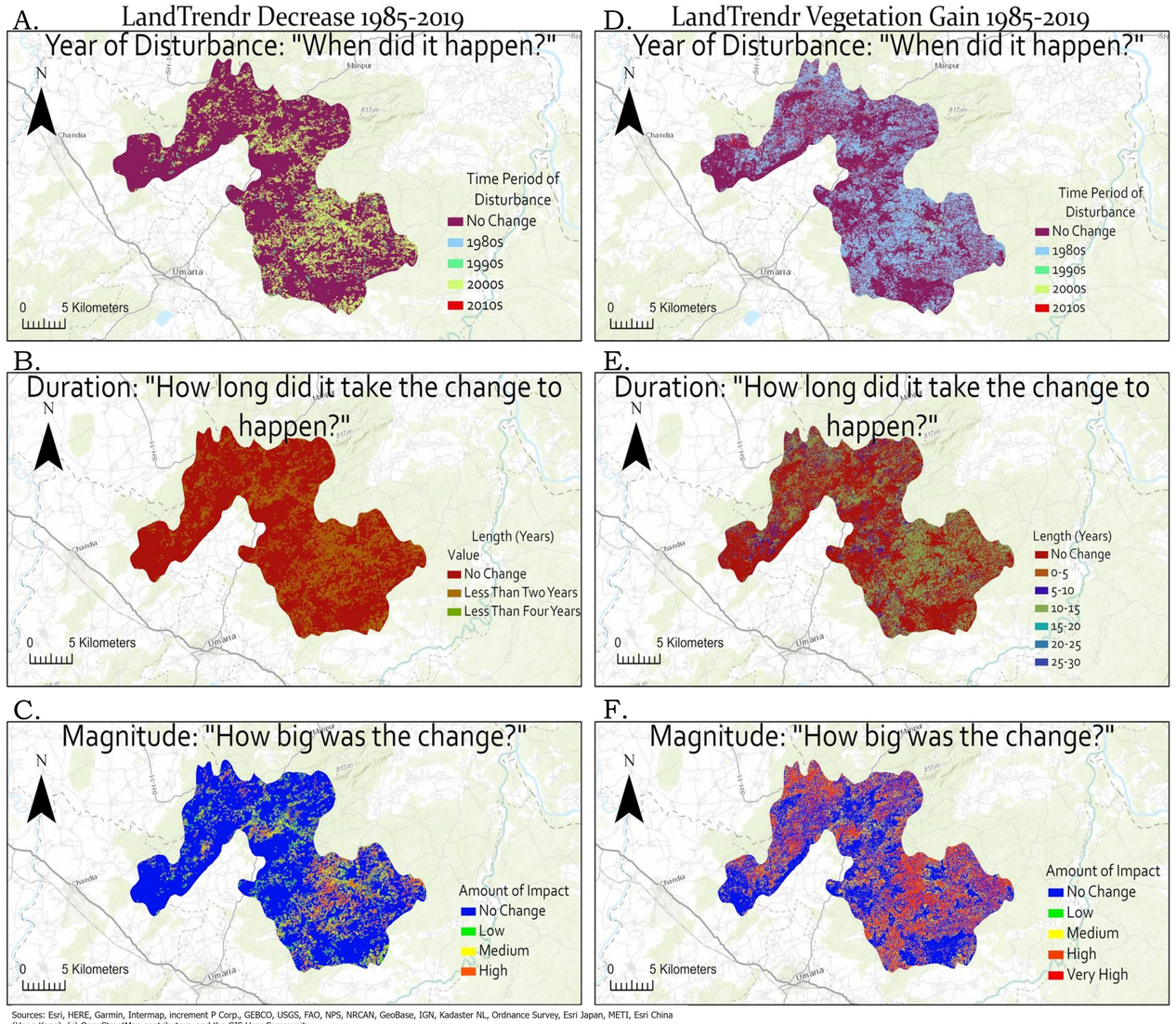

Figure 1. Disruption and vegetation growth in study area from 1985 to 2019. A. "Year of Disturbance" for disruptions. B. "Duration" of disturbances. C. "Magnitude" of disturbances. D. "Year of Disturbance" for vegetation gain. E. "Duration" of vegetation gain. F. "Magnitude" of vegetation gain.

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Method

1. For this project Bandhavgarh National Park in India was selected as a case study.
2. Platform/software used: Google Earth Engine, ArcGIS Pro.
3. Use LandTrendr to remove obstructions such as cloud, shadow, snow, and water.
4. Run LandTrendr for the time between 1985 and 2019 with NDVI and NBR selected.
   a. For this project, I used NDVI.
5. Run LandTrendr for gain and LandTrendr for disturbances.
6. Examine the files Year of Disturbance, Duration and Magnitude.
7. Spatially join and export statistics.

Results

1. There is more growth than disturbances. Since 1985, 21.07% (94.57 sq. km) of the study area has shown signs of disturbance. This is in sharp contrast to 40.91% (183.62 sq. km) of the land which has shown gain in NDVI.
2. In general, duration of disturbances were shorter-lived than the ones for vegetation gain. This shows continual growth.
3. The magnitude of change for forest disturbance is smaller and much less widespread than the magnitude of change for vegetation gain.

Conclusion

1. Over the past 34 years, the disturbances experienced by Bandhavgarh National Park are minimal and likely to be a result of ongoing natural processes.
2. Vegetation gain shows signs of recovery.

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