

Using Earth Observations to Analyze Vegetation Phenology and Climatology in Bhutan to Identify Forest Disturbances

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ABSTRACT

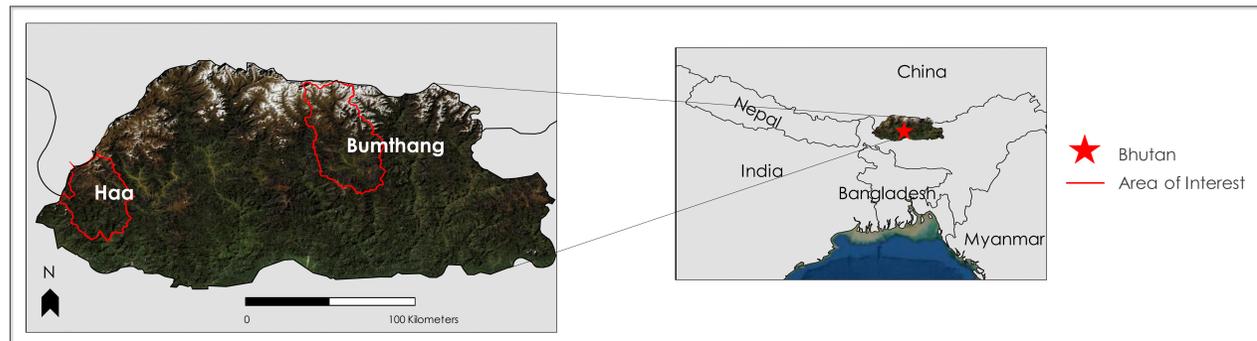
Changes in climate in the Himalayan region cause variability in temperature, precipitation, and phenology. It can also impact the health of coniferous forest ecosystems including increased damage due to aggressive forest pests. Forest disturbance from bark beetle is a major concern in Bhutan, sometimes causing extensive tree mortality to pine and spruce forests. Climatological trends and changes in vegetation phenology were analyzed and incorporated into a tool in Google Earth Engine that identified patches of forest disturbance in Bhutan. Preprocessed phenology and meteorological data from the Advanced Very High-Resolution Radiometer (AVHRR) and Terra and Aqua Moderate Resolution Imaging Spectroradiometer (MODIS), along with Climate Hazards Center Infrared Precipitation with Station (CHIRPS), Famine Early Warning System Network Land Data Assimilation System (FLDAS), Sentinel-2 Multispectral Instrument (MSI), and Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper (ETM+), and Landsat 8 Operational Land Imager (OLI) were used within the tool. Changes in temperature, precipitation, and phenology were analyzed throughout Bhutan, and forest disturbance caused by bark beetle was investigated in two districts of the country.

PROJECT PARTNERS

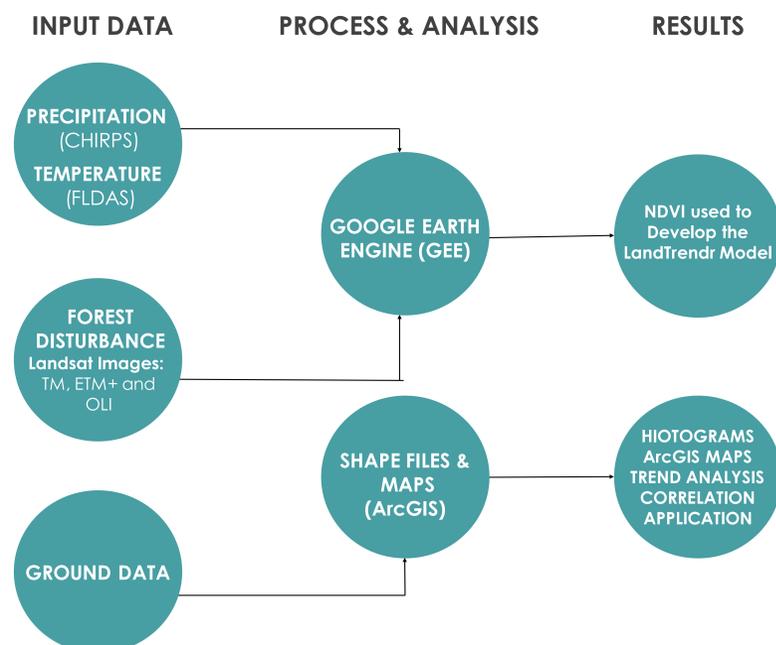
- Ugyen Wangchuk Institute of Conservation and Environmental Research (UWICER)
- Bhutan Foundation
- Karuna Foundation

STUDY AREA

- Country: Bhutan
- Areas of Interest: Bumthang and Haa
- Study Period: 2000-2018 (18 years)

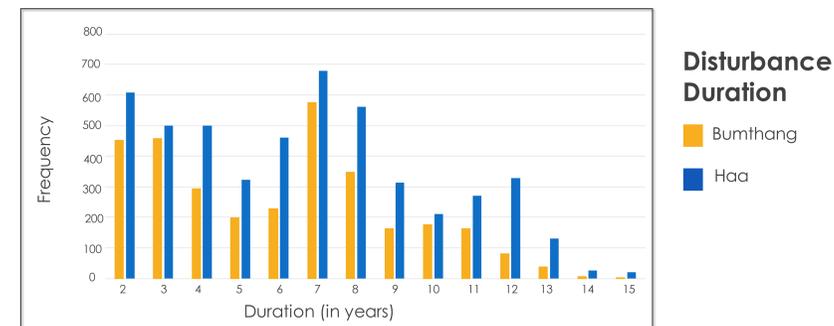


METHODOLOGY



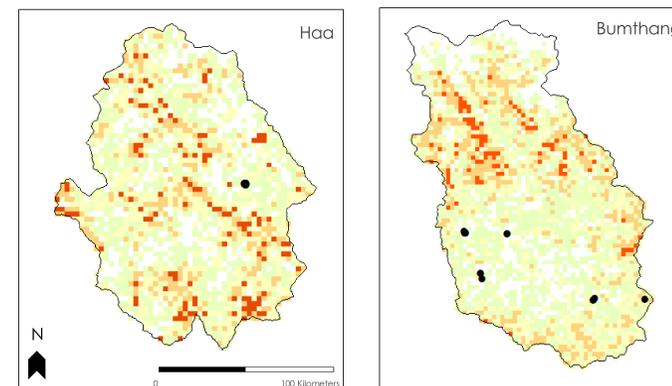
FOREST DISTURBANCES DETECTION TOOLBOX (FDDT)

RESULTS



Disturbance Magnitude

- Magnitude (2000 - 2018)
- Low (1)
- Medium Low
- Medium High
- High (378)
- Ground Data
- No Data



CONCLUSIONS

- Using the GEE LandTrendr code using Landsat data, the Forest Disturbances Detection Toolbox (FDDT) was used to assess forest changes from 2000 – 2018. With LandTrendr, it required a minimum of 10 years to observe any significant changes.
- There were rare observed instances of high magnitude events. The modeled output showed a longer duration of disturbance in Haa as compared to Bumthang. Overall, disturbance was mainly detected in 2000.
- The project's FDDT will be provided to project partners to aid forest management efforts in Bhutan.
- Additional work, including quantitative validation, is needed to further test and refine the FDDT.

