Madagascar_Forest_Fires

This repository contains data and scripts to analyze forest loss and fire activity in Madagascar from 2000-2018

Summary

The purpose of this repository is to contain data, code, and analyses for a project examining the impact of agricultural activity on deforestation and fire activity in Madagascar during the years 2000-2018. This repository contains a csv file of forest loss by year, fire activity by year, and agricultural productivity for Madagascar's main crops (cassava, maize, beans, sweet potatoes, rice, and vanilla) as well as scripts for data management, exploratory data analysis, and modeling. The goal of this analysis is to examine the relationship between forest loss and fire activity and identify the impact of agricultural productivity on land clearing practices. I am also interested in seeing if land clearing rates have changed over time through a time series analysis.

Investigators

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Keywords

Madagascar, agriculture, forest loss, fire activity, slash and burn agriculture, remote sensing

Database Information

<describe the origin of all data in the repository, including data collected from outside sources and new data generated by the investigator(s). If data was accessed from an outside database, the date(s) of data access should also be included.> Forest Loss Data To measure deforestation in Madagascar, I used the Global Forest Change (2000-2018) dataset produced by Hansen et al (2013) (accessed in January 2019). This dataset was generated using multispectral satellite imagery from the Landsat 5 thematic mapper, Landsat 7 thematic mapper plus, and Landsat 8 Operational Land Imager remote sensors. In this dataset, tree cover is defined as all vegetation 5 meters or greater in height. The dataset does not discriminate between natural forest and plantations. The Global Forest Change data consist of 10x10 degree tiles (approximately 30m spatial resolution at the equator) of forest canopy change. Forest loss, the indicator used in my analysis, is defined as change from forest to non-forest state between the year 2000 and any year in the 2001-2018 interval, resulting in a forest-loss-per-year spatial dataset. To prepare this dataset for my analysis, I used ArcPro (ESRI) to mosaic 4 tiles covering my study area of the island of Madagascar. I then extracted the forest loss data using a mask of the island to get forest loss by year for all of Madagascar.

Fire Data As a measure of slash-and-burn agriculture, I used the MODIS Thermal Anomalies/Fire dataset produced by Giglio et al (2015) (accessed in January 2019). This dataset is derived from MODIS 4- and 11-micrometer radiances recorded by the Terra and Aqua remote sensors. The Thermal Anomalies/Fire dataset consists of daily records of fire presence around the globe in 1km resolution. Each daily record is an aggregation of 4 daily measurements, resulting in a comprehensive daily fire presence dataset for the interval 2000-2018. I used Google Earth Engine to filter this dataset by location, time, and confidence level, resulting in total fire area for each year.

Agricultural Data To gather information on agricultural productivity and its relationship to deforestation and slash-and-burn agriculture, I included total crop production for cassava, maize, beans, sweet potatoes, rice, and vanilla. These data were downloaded from the FAOSTAT Statistical Database operated by the Food and Agriculture Organization of the United Nations (accessed in April 2020).

Folder structure, file formats, and naming conventions

The Code folder includes various scripts for data management, exploratory data analysis, and modeling. The Output folder includes plots and figures. The ProcessedData folder contains the final, cleaned and rearranged csv file. The RawData folder contains the original forest loss, fire activity, and agricultural datasets.

The files in this repository consist of data in the form of csv files and RMD files in the Code folder.

The file naming convention is "object_file_iteration"", ie. mixedmodel_forest_1

Metadata

Forest Data The columns in this data file are DistrictName (class: factor), ForestLoss (class: number), ForestLossByDistrict (class: number), and Year (class: Date).

Fire data The columns in this data file are DistrictName (class: factor), Fire/BurnedArea (class: number), FireByDistrict (class: number), and Year (class: Date).

Agricultural Data The columns in this data file are CassavaCultivation (class: number), MaizeCultivation (class: number), BeanCultivation (class: number), SweetPotatoeCultivation (class: number), RiceCultivation (class: number), VanillaCultivation (class: number), and Year (class: Date).

Scripts and code

<list any software scripts/code contained in the repository and a description of their purpose.> The only software used in the repository is R. The various code files in the Code folder were created to conduct analysis on the 1) relationship between agricultural production and land management practices like deforestaion and slash-and-burn agriculture, 2) the relationship between deforestation and slash-and-burn agriculture, and 3) a time series analysis of deforestation and slash-and-burn agriculture.

Quality assurance/quality control

The Global Forest Change, MODIS, and FAOSTAT data are prescreened by their corresponding agencies. To account for any outliers, I examined the data in an exploratory data analysis. I did not find any outliers or erroneous data points.