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Short contribution – Decision Support Systems and Tools

Fire and land use in recent years in the Atlantic Forest in Brazil

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Abstract

The biome Atlantic Forest in Brazil covers a substantial portion of the country, where a large population and major cities are located. In spite of the substantial influence from human activities, the region is one of the most diverse tropical ecosystems with a large number of endemic species, and it is one of the world's biodiversity hotspot. In this region, fire is an important disturbance, due to its strong effects on nutrient cycling, vegetation succession, and atmospheric emissions of gases and aerosols, and therefore must be considered when planning on the sustainability of the region. This study presents a set of initial analyses of fire occurrence in respect to different types of land cover and use as classified by the recent Brazilian MapBiomias Project (<http://mapbiomas.org>). Information on fire occurrence are from remote-sensing with the Moderate Resolution Imaging Spectroradiometer (MODIS) Collection 6 Active Fire Product. The data on fires data are for years 2001-2017. The selected data on land cover and use are for year 2010, nearly at the middle of the fire data time span. For analyses, both datasets were aligned in space and aggregated at 0.5-deg spatial resolution. It was found that in average, most of fires happened during months with less precipitation, as expected. In comparison with other major biomes in Brazil, the density of fire detections in the Atlantic Forest was lower, but still a substantial number of fires are detected yearly in the region. Perhaps, more important is the fact that despite of most of fires detected with MODIS occurred in areas dominated by agriculture and pasture (as expected by the general relations between fire and land use in Brazil), a relatively high number of fires were detected in areas dominated by natural forests. That has important consequences for the high interest in conservation of the study region, based on its marked biodiversity and potential for providing relevant ecosystem services to society.

Keywords: Fire, land use, Atlantic Forest, Brazil

1. Introduction

The biome Atlantic Forest in Brazil covers a substantial portion of the country, where a large population and major cities are located. Most of its primary forests have already been converted to agricultural and pasture areas, but important forest and other natural vegetation formations still remain (Ribeiro *et al.* 2011). Despite substantial influence from human activities (Joly *et al.* 2014), the region is one of the most diverse tropical ecosystems with a large number of endemic species, and it is one of the world's biodiversity hotspot (Myers *et al.* 2000).

In this region, fire is one of the important disturbances, with implications for maintenance of its natural resources (Joly *et al.* 2014, Clemente *et al.* 2017). Fires have several important effects on nutrient cycling, vegetation succession, and atmospheric emissions of gases and aerosols and must be considered in plans of the sustainability of the region. In this study, it is presented a set of initial analyses of fire occurrence for years 2001-2017 in respect to different classes of land cover and use based on recent information from the Brazilian MapBiomias Project (<http://mapbiomas.org>).

2. Methods

Given the large extent of the study region (Fig. 1a), the majority of information on fire activity comes from satellites, because of their ability to cover large regions in relatively short periods of time. In this study, the data on fire occurrence are from remote-sensing with the Moderate Resolution

Imaging Spectroradiometer (MODIS) Collection 6 Active Fire Product (Giglio *et al.* 2016), for years 2001-2017.

The information on land use were recently produced by the Brazilian MapBiomas Project, which is a multi-institutional initiative to generate annual land cover and use maps using automatic classification processes applied to satellite images (complete description at <http://mapbiomas.org>). From the most recent version of the dataset (2.3), it was selected data for year 2010, nearly at the middle of the fire data time span. For analyses, all datasets were aligned in space and aggregated at 0.5-deg spatial resolution.

3. Results

As shown in Figs 1a and 1b, several active fires were detected in the Atlantic Forest region in the years from 2001 and 2017. The spatial distribution of the fire detections in the study region (Fig. 1a) shows that generally coastal areas had relatively lower fire activity, and interior portions of the states of São Paulo, Bahia, Paraná and Santa Catarina had relatively more fires. In time (Fig.1b), most of fires were detected between the months of July to October, when precipitation is lower in most of the region. In comparison with the country as a whole, and other major biomes in Brazil, the Atlantic Forest presented lower fire activity density.

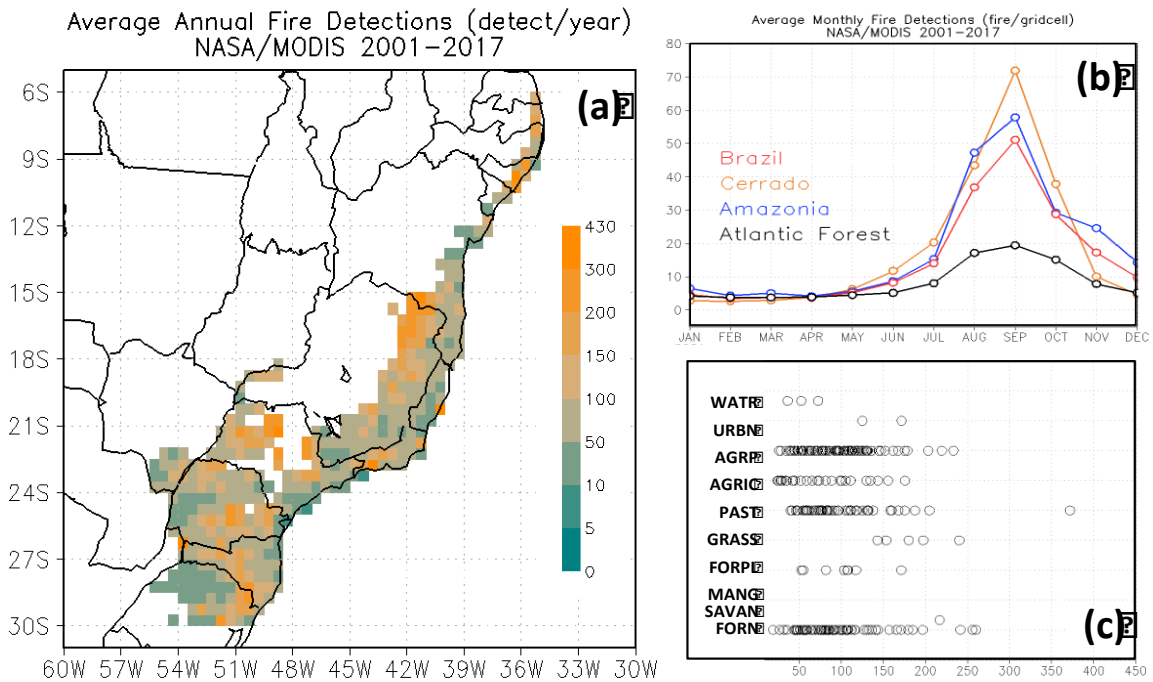


Figure 1 - Characteristics of fire occurrence and land use in recent years in the Brazilian Atlantic Forest. In (a), the spatial distribution of MODIS average fire detection density in the Atlantic Forest in Brazil from 2001 to 2010, in units of detections per year within each 0.5-deg gridcell of the study region. In (b), the average monthly fire detection density in the Atlantic Forest (black), in the whole Brazil (red), and in the biomes Cerrado (orange) and Amazonia (blue). In (c), the distribution of average annual fire detections per type of the land cover and use in the Atlantic Forest, where the classes correspond to the dominant land cover and use within each gridcell: WATR are grid cells dominated by water bodies, URBN are gridcells mostly covered by urban surfaces, and AGRP corresponding to agriculture or pasture, AGRIC corresponds to agriculture, PAST corresponds to pastures, GRASS to grasslands, FORPL planted forests, MANG mangroves, SAVAN natural savannas, and FORN to natural forests.

Figure 1c shows the distribution of the average annual fire detections per type of the land use in the studied region. As shown, the majority of fires were detected in areas related to agriculture and pastures

(classes AGRP, AGRIC, and PAST), but a substantial number of detections were in areas of natural forests (FORN).

4. Conclusions

In this study, it is presented an initial set of analyses of fire occurrence for years 2001-2017 in the Atlantic Forest in Brazil, in respect to different classes of land cover and use as described by the Brazilian MapBiomas Project (<http://mapbiomas.org>). It was found that in average, most of fires happened during months with less precipitation, as expected. In comparison with other major biomes in Brazil, the density of fire detections in the Atlantic Forest was lower, but still a substantial number of fires are detected yearly in the region. Perhaps, more important is the fact that despite of most of fires being detected with MODIS occurred in areas dominated by agriculture and pasture (as expected by the general relations between fire and land use in Brazil) a relatively high number of fires were detected in areas dominated by natural forests. That has important consequences for the high interest in conservation of the study region, based on its marked biodiversity and potential for providing relevant ecosystem services to society.

5. References

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