Characterization of fire occurrences (2010-2014) in the southeast of Brazil

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ABSTRACT

The periodic occurrence of forest fire is common in some places of Brazil. Mostly in places, that has a specified dry station, these fires can damage the forestry ecosystems, and their occurrence may affect the wild life and bring economic losses, as well in CO_2 global emission. The aim of this study was define the fire season occurrence in Viçosa - Minas Gerais state Brazil, using five years data of fire and rainfall collected by the Fire Fighters. The study was made through the data from the firefighters from UFV, this data was evaluate for a period between 2010 and 2014, collecting the days and months that occurred fire in Viçosa city and outskirts, also the average precipitation data for the period. The observations showed that to Viçosa city, the occurrence of fire is mostly common in the July to October months, and August is the most susceptible month.

Keywords:
Fire, forest, dry season, precipitation.

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Introduction

Forest fires can cause damages in forestry eco-systems. The fire occurrence may affect the wild life and bring economic losses, as well in CO_2 global emission, can be compared with the fossil fuel burn (Bowman at al., 2009), Also in the Atlantic forest case, the fragmentation and deforestation The fire occurrence can prejudice seedlings which would not survive, and disappear, in this case this seedlings take more time for grow up again. (Fiedler et al., 2004).

Recently, regional-level examinations of wild-fire characteristics have drawn much attention because they have implications for hazard management, climate studies, and ecosystem research (Moritz and Stephens, 2008). Soares et al. (2006) their studies shows that the normal fire period is between August and September, their studies shows that the normal fire period is between August and September, characterized the dry occurrence in most Brazilian states, The fires can directly damage the ecological functions, such as the nutrient cycle, erosion, also human health and native vegetation, Soares and Santos (2002) shows the evolution of Brazilian fires, it started in the Brazilian Cerrado, shrub formations and fields, but nowadays it is happening in native forests too, resulting in biodiversity losses.

According to the Brazilian Environment Ministry in 2016 has 65% increasing in the fire spots, until August they had registered nearly 53 thousand of fire spots and forest fires in the country. (Brasil, 2016). The data collection and the fire occurrence s identification in some Brazilian states, is important for the fire prevention.

To develop a fire prevention plan is necessary collect the fire causes, frequency and the fire damages. Resources need to be redirected to support research the fire behavior and their occurrence (Matos, 2004, Fiedler, 2006)

The Public Agencies databases are a useful and fast method for the forest fire occurrence delimitation, and can be used in all states. Thereby, the aim of this study was define the fire seasons occurrence in Viçosa - Minas Gerais state Brazil, using five years data of fire and rainfall collected by the Fire Fighters.

Material and methods

Viçosa city is located in Minas Gerais, Brazil (20° 45'23''S and 52' 23''W), has 670 m altitude above the sea level, mountain wavy relief, the vegetation of the area is Atlantic Forest, composed by the Submontana Semidecidual Seasonal forest (Oliveira Filho et al., 1994). The climate of this region is classified as Cwa (Alvares et al., 2013), with winter (dry season), in the months from May to September, while summer (rainy season) runs from December to March, the annual rainfall reached is 1.248 mm and 80,6% of air moisture (Soares Júnior, 2000). The average annual temperature of 19°C, being the 26,1 °C the maximun and 14 °C the minimum. (Castro et al., 1973).

The collected data was provided by the Federal Viçosa University's Firefighters, the documents were read and analyzed the days and months with fire occurrence between 2010 and 2014 period.

The data were grouped according the monthly fire occurrences during the five year evaluation, then we made graphics for doing the fire occurrence caracterization, through of the Microsoft Excel 13.0 software version, corealçao de pearson. Thus, was possible delimitate the key seasons for fire prevention plan in Viçosa city.

Results

We identified 144 fire focus in the five years evaluation which were correlated with rainfall (Table 1), we could observe the most fire occurrences happened between July to October, being this months with the highly percent of fire spots (Figure 1), also August has 42% of the occurrences, characterizing this period in the dry season.

The rainfall average rates collected in the Climatological Station from Viçosa (A510) during the period was 1244.78 mm with a rainfall period between October to March, being December the month with 1440.7 mm, the highest level, and the lowest was in August with 16.8 mm. The value correlation between precipitation and fire occurrence accumulated was -0.85 ($p<0,021$).
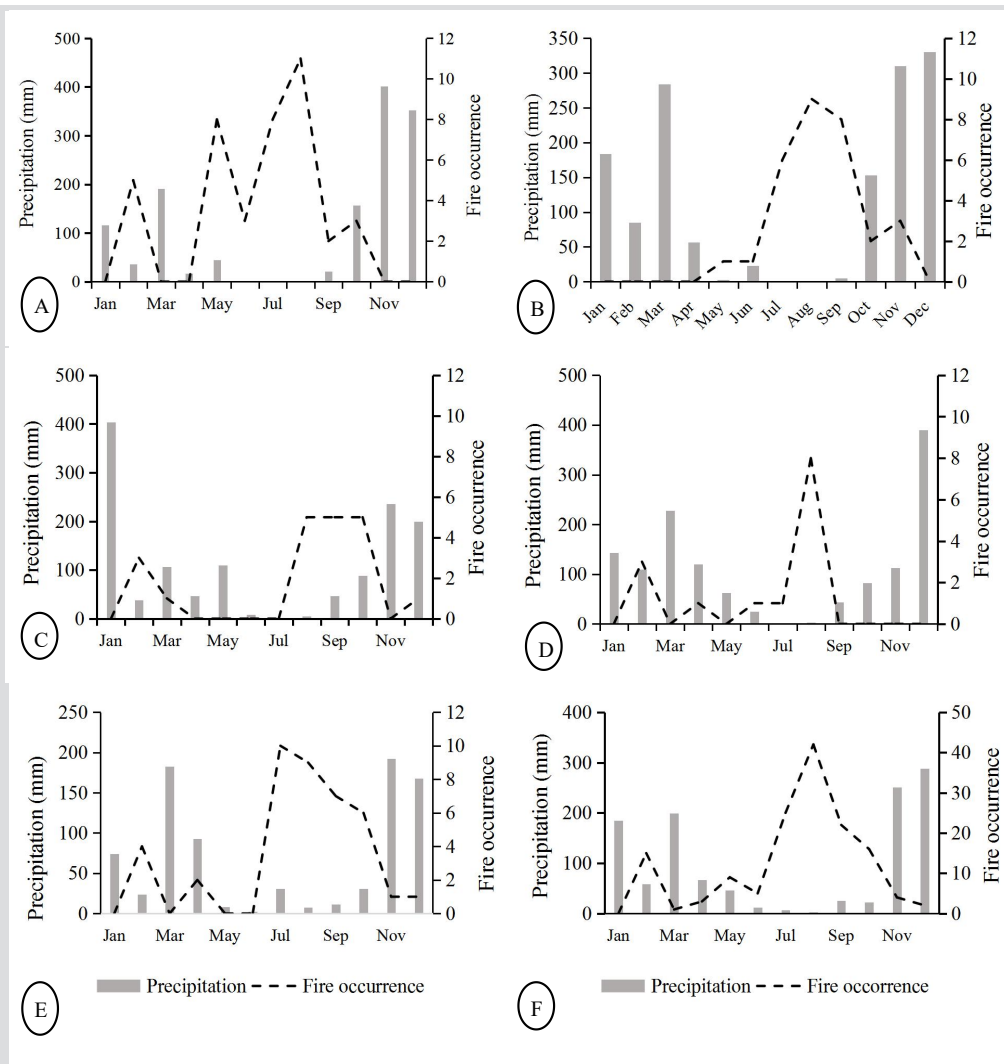
Discussion

Figure 1. Monthly distribution of the number of fires versus rainfall occurrence, between the years (A) 2010, (B) 2011, (C) 2012, (D) 2013, (E) 2014, (F) the average accumulate values of fire and rainfall in the last five years.

Table 1. Millimeters and percentage of accumulate Rainfall recorded and fire occurrences in the last five years.

Month	Precipitation (mm)	Fire occorrence	Precptation (%)	Fire occorrence (%)
January	922.5	0	14.8	0.0
February	294.1	15	4.7	10.4
March	994.3	1	16.0	0.7
April	334.7	3	5.4	2.1
May	229.3	9	3.7	6.3
June	59.8	5	1.0	3.5
July	33.8	25	0.5	17.4
August	16.8	42	0.3	29.2
September	130.0	22	2.1	15.3
October	514.1	16	8.3	11.1
November	1253.8	4	20.1	2.8
December	1440.7	2	23.1	1.4
Total	6223.9	144	100.0	100.0

The most quantity of fire occurrence was registered between July to October being related to regional climate. The September month is driest month in the Zona da Mata of Minas Gerais (Camargos et al. 2015), thus the low precipitation, associated with the low air moisture, are factors that contribute to fires occurrences, being register 70% of fires (Table 1). Corroborating with this study, many researches are developed in southeast region of Brazil, showing that the most quantity of fire occurrence is observed between July to September, correlated with the dry season. (Fiedler et al., 2006, Torres et al., 2010, Aximoff, Rodrigues 2011).

The Year of 2014 (Figure 1E), stands out among others with the most number of occurrence. The low precipitation explains it, as can be observed in the Figure 1E (68,72 mm), this period is a dry season in the study spot. According to Camargos et al. (2015), dry periods for August had occurred yet in 2004 and 2006, when the precipitation was 0,2 and 13,3 mm, respectively.

The majority of fires in the southwestern China occur in winter and spring (November to May) with dry climate (Chang et al., 2015).

In Brazil, normally, the fires are related with the hydric deficit regardless of region, however, the period is instable according to the period and the climate conditions for each place. According to Santana et al. (2010) his studies in Brazilian Caatinga region suggest that although of the irregular precipitation, the most possibility of fires is situated between May to December. In Paraná State, south Brazil, Tetto et al. (2012), highlights that occurrences of forest fire are directly associated with the pluviometric distribution, being July to September with 52, 5% of occurrences.

The cause of many fires was not described in the firefighter›s documents, this variable as well as the individual records of events and causes fundamental to the establishment of prevention policies (Soares, Batista 2007).

The high correlation between precipitation and fire occurrences (Figure 1) is an expected, since this variable is intimately related to the humidity of the combustible material. According to Torres and Ribeiro (2008), atmospheric humidity is a decisive element in fires in vegetation, with direct effect on the flammability of forest fuels, where

there is constant exchange of moisture between the atmosphere and organic matter.

Through descriptive analysis, it is observed that in Viçosa the months July to October are more likely the occurrence of fires and the month of August is the most likely, and also coincide with the dry season in the region . This study is quite important as a database for future plans and developing polices, which shed light on the reasons for the occurrence of these phenomena in the study region.

Conclusion

The highest occurrence of fires, for the city of Viçosa, is between July to October. This higher percentage is related to dry periods with irregularities in rainfall distribution.

In this sense, it is necessary to develop public policies aimed at preventing fires during the dry season.

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