

A High-Resolution Model for the Assessment and Forecasting of Wildfire Susceptibility

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Introduction

Aburrá Valley is a narrow andean valley, located in Colombia. It has almost 4M inhabitants. Annually, in the dry season, wildfires produce ecological losses and health issues. We present the development and implementation of a Bayesian distributed model that forecast wildfire susceptibility.

Data and methodology

Static

MS

Land use classification from unsupervised labeling and distance to urban perimeter, as human interaction index.

Moisture

MM

Calculated as the sum of capilar storage and gravitational storage (first soil layer) of the WMF model.

Rainfall

MR

Antecedent accumulated rainfall (AR) and the amount of days without exceeding a minimum threshold of AR.

Temperature

MT

WRF AT resampled with altitude. ST estimated by a fit between weather stations and LANDSAT imagery.

History

MH

More than 3000 events. Grouped as density per km².

Weather variability

Wildfire occurrence exhibits a bimodal behaviour at yearly scale consistent with the rainfall and insolation.

Susceptibility estimation

- For each physic variable multiple pdf are obtained by different aggregation rules to assess which one represents "wildfire conditions".
- Chosen distribution used to transform each physic variable to probability
- Montecarlo calibration
- Susceptibility estimation
- Temperature filtering

$$M_i(x) = \begin{cases} p_1 & x \in [a_1, b_1] \\ \vdots & \\ p_n & x \in [a_n, b_n] \end{cases} \quad i = \{S, M, R, H\}$$

$$W_S - W_M - W_R - W_H$$

$$f(temp) = \begin{cases} 0 & temp < t_{umb} \\ 1 & temp \geq t_{umb} \end{cases}$$

Human activities

Urban growth dynamics has increased human interactions with nearby forest areas and grasslands.

Results

Validation is performed over cells within a radius around the coordinate of each report as there is uncertainty about exact fire location.

Consistent susceptibility and fire report annual cycles.

At least 81% of cells with fires were labeled as susceptible to wildfires (Medium + High). However, at some cells, the model hardly ever suggest values below medium susceptibility.

Health issues

February 8th, 2017: wildfire at "Quitasol" Burned biomass aerosols were captured by the air quality network scientific citizens.

Scientific citizens is a local project held by SIATA to let people measure air quality in their homes by using low cost sensors.

Human activities, along with weather variability, modulate the occurrence of forest fires during the dry seasons.

Monitoring & divulgation

Camera Network

Fire departments assistance

Pre and post event drone mapping

Fire and smoke columns reports, meteorological conditions, drone assistance.

Model results delivered to fire captains daily.

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