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

E. Zapata (1, 2), N. Velásquez (1), S. Ospina (1, 2), C. D. Hoyos (1, 2), A. Ochoa (1, 2), G. Guzmán (1, 2), J. Sepúlveda (1, 2), M. Zapata (1, 2)

2. Sistema de Alerta Temprana de Medellín y el Valle de Aburrá - SIATA 1. Universidad Nacional de Colombia, sede Medellín

Introduction almost 4M inhabitants. 0.2 1.2 2.2 3.2

Aburrá Valley is a narrow andean valley, located in Colombia. It has

> 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.





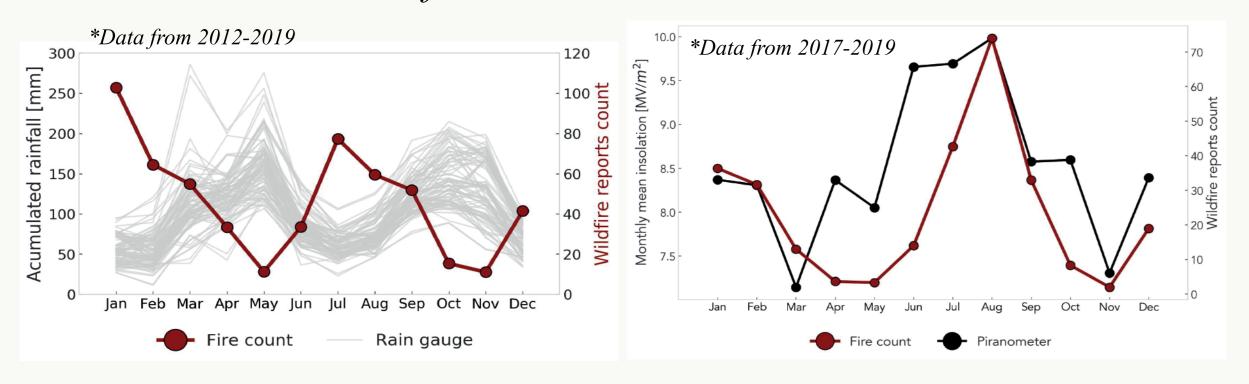






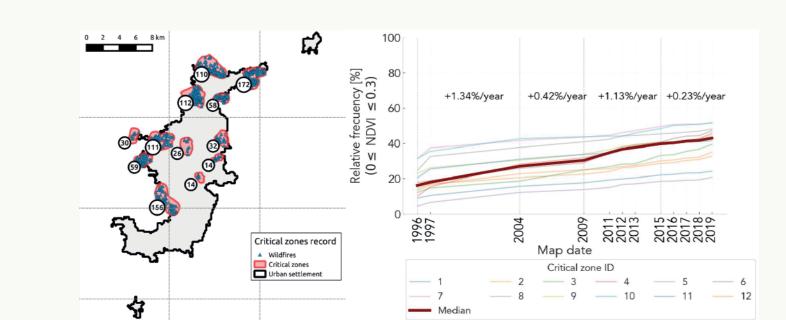
Weather variability

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

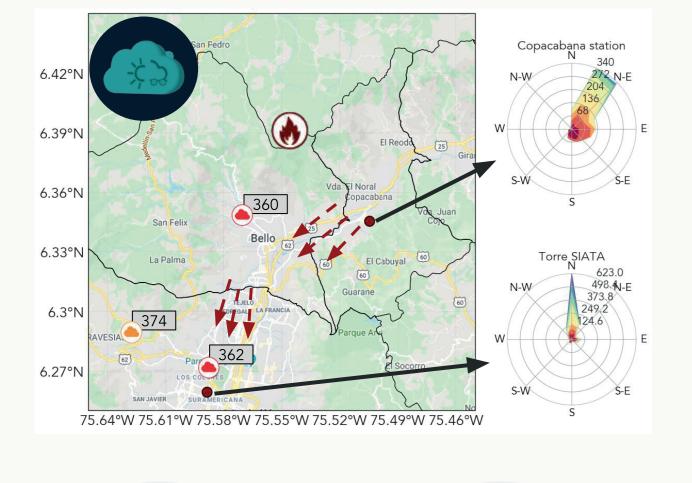


Human activities

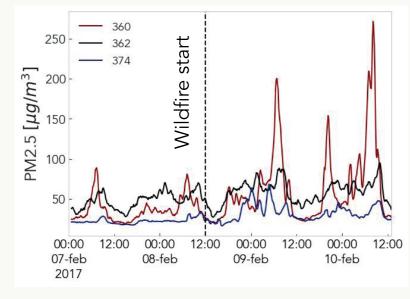
Urban growth dynamics has increased human interactions with nearby forest areas and grasslands.



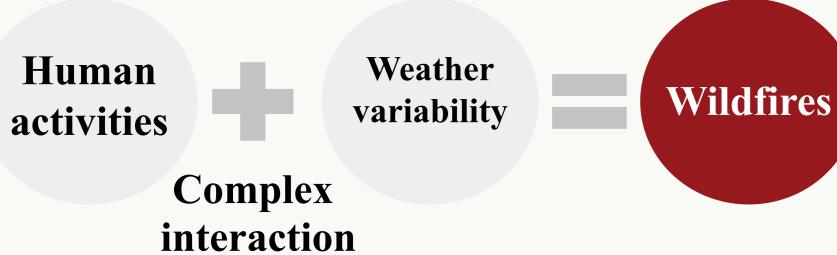
Health issues



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

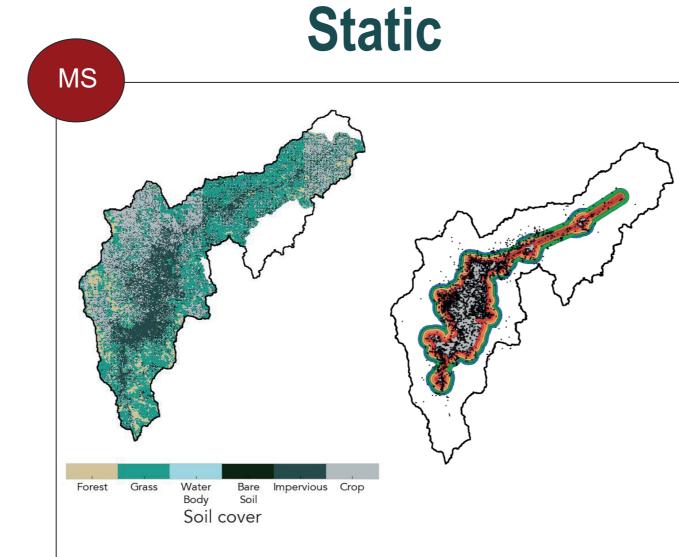


Scientific citizens is a local project held by SIATA to let people measure air quality in their homes by using low cost sensors.



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

Data and methodology



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

Moisture

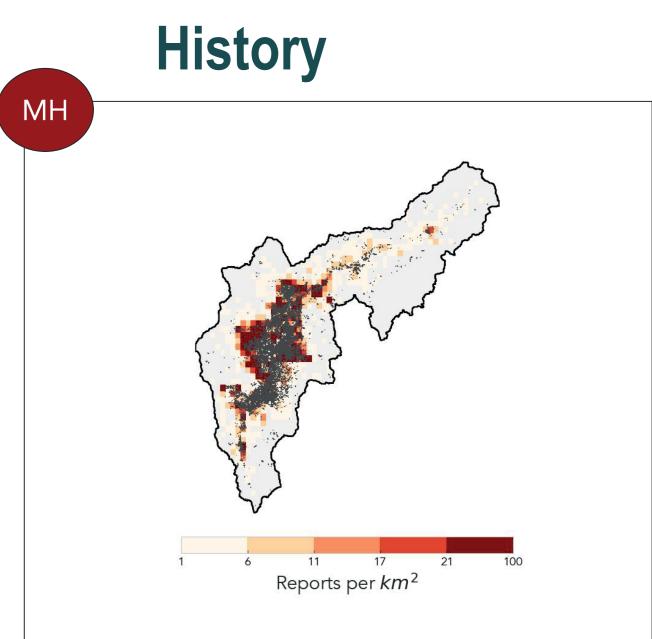
Calculated as the sum of capilar storage gravitational storage (first soil layer) of the WMF model.

Rainfall

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

Temperature 16.00 19.23 22.46 25.70 28.93 32.16 35.39 38.63 41.86 45.09

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

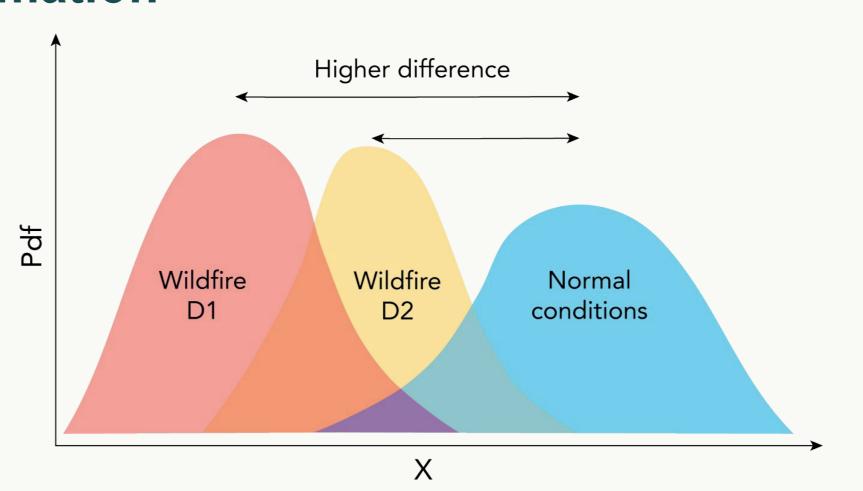


More than 3000 events. Grouped as density per km2.

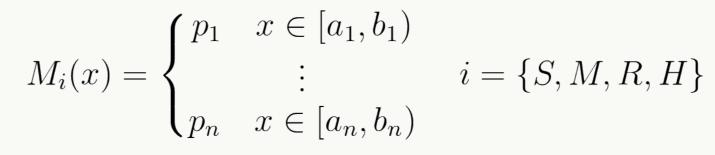
Susceptibility estimation



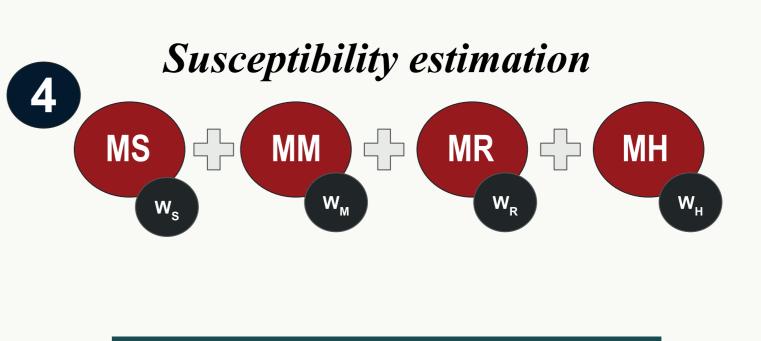
For each physic variable multiple pdf are obtained by different aggregation rules to assess which one represents "wildfire conditions".



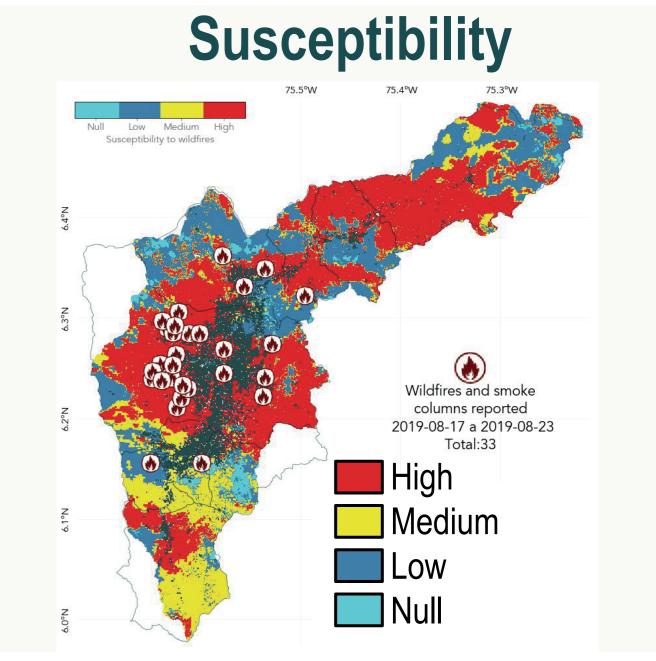
Chosen distribution used to transform each physic variable to probability



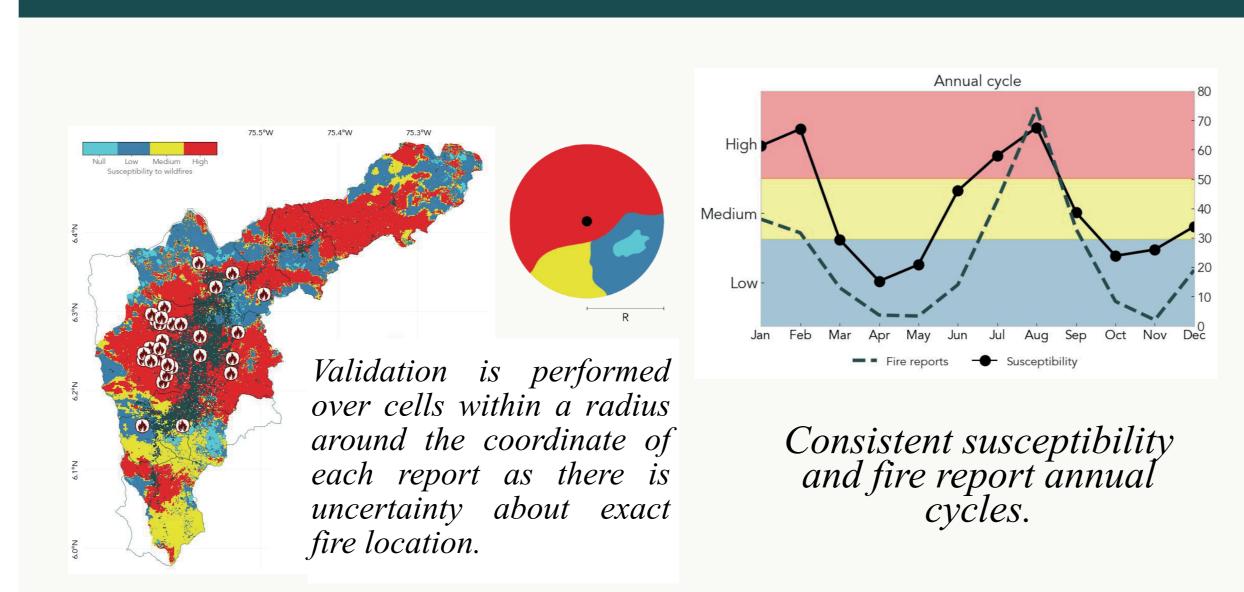
Montecarlo calibration $W_S - W_M - W_R - W_H$



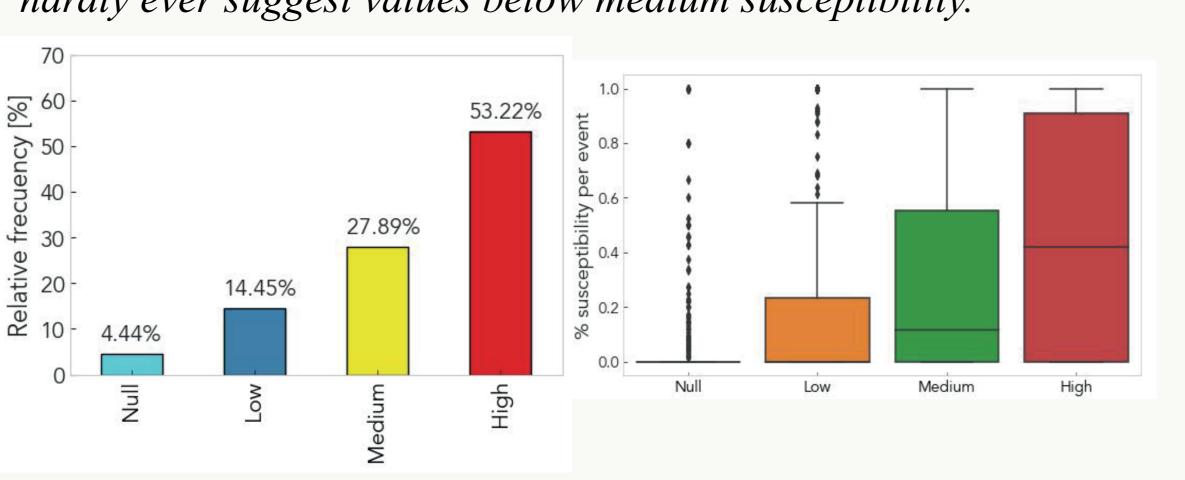
Temperature filtering



Results



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.



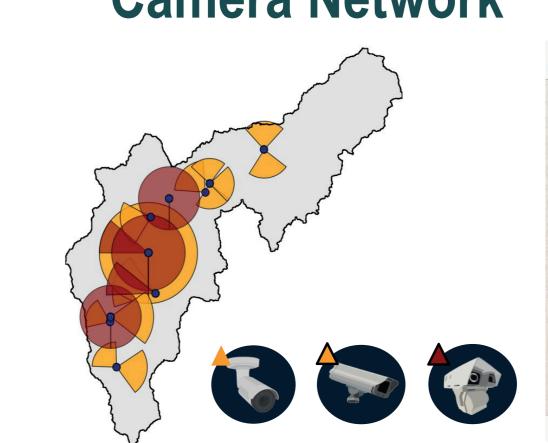
Susceptibility frecuency

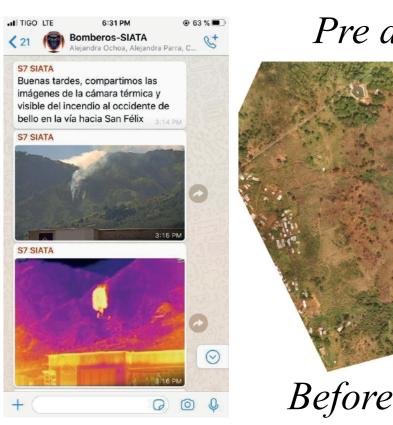
During last dry season susceptibility values increased gradually where wildfires occurred. Allowing to forecast that fires would be more likely to happen since the previous days.

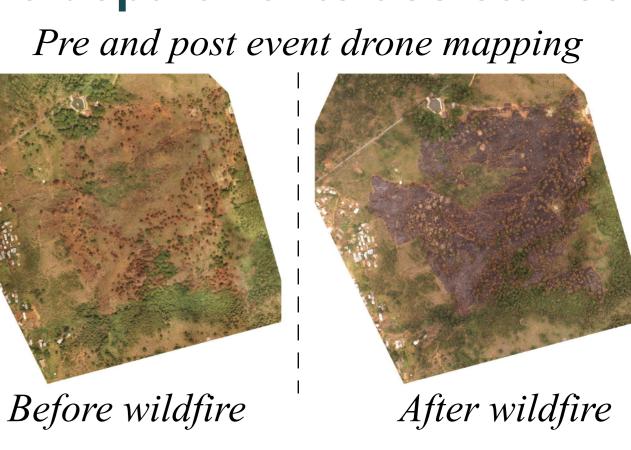
Monitoring & divulgation

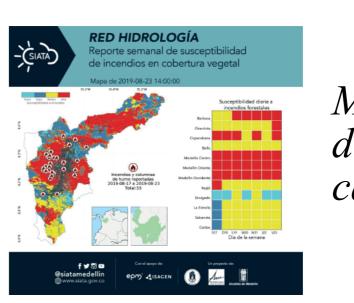
Camera Network

Fire departments assistance





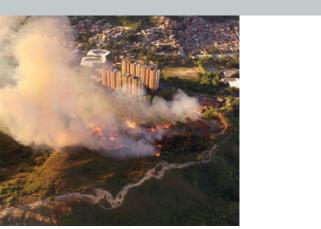




Model results delivered to fire captains daily.







Acknowledgements

This work was supported by Área Metropolitana de Medellín y el Valle de Aburrá, Municipio de Medellín, Grupo EPM and ISAGEN under the contract CCT504 of 2019. This work is also supported by universidad Nacional de Colombia, Sede Medellín.

















Name: Sebastián Ospina Leal



