Workshop on Climate Information for Risk Assessment and Regional Adaptation

from Global Scale Climate Projections to Local Scale Climate Hazards

Framework to assess wildfire global vulnerability in Colombian Ecosystems

Ellie Anne López-Barrera, Alejandro Casallas, Camila Jimenez

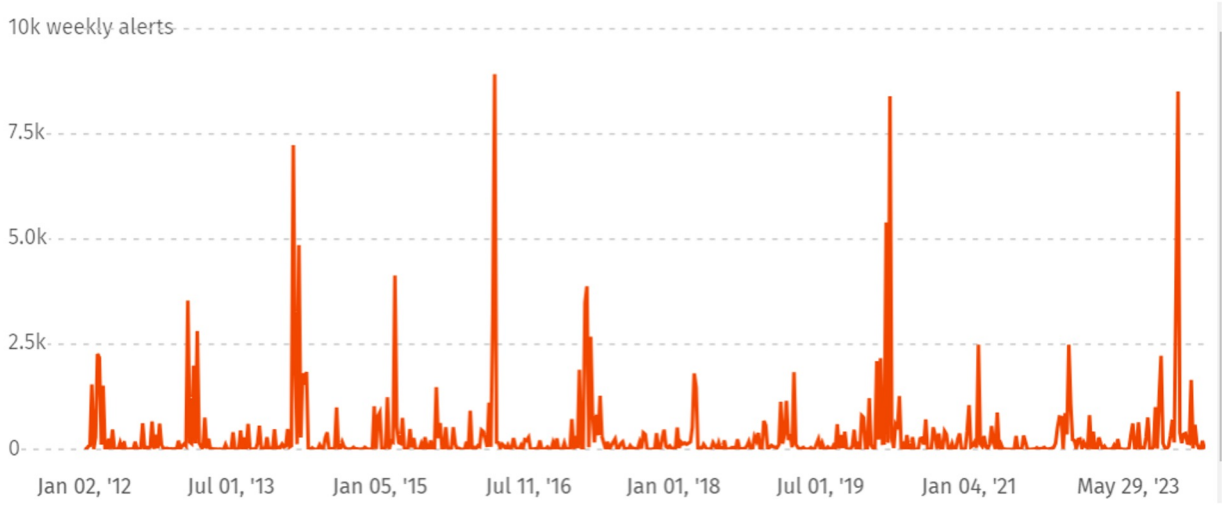
PROGRAMA IBEROAMERICANO CYTED CIENCIA Y TECNOLOGÍA PARA EL DESARROLLO

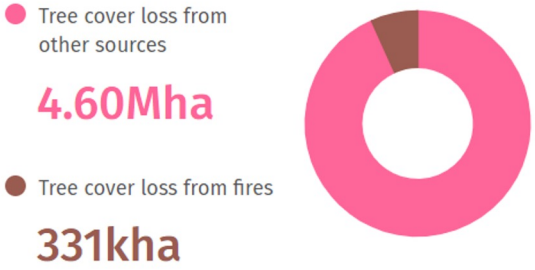
UNIVERSIDAD SERGIO ARBOLEDA

https://www.globalforestwatch.org/

Background

Wildfire alerts in Colombia





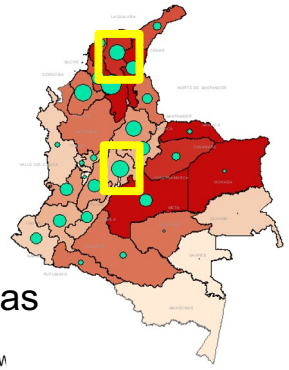
In Colombia, for the years between 2001 and 2021, fires were the cause of 6.7% of the loss of tree cover

Between January 2012 and May 2023, Colombia had a total of 195,847 wildfire alerts

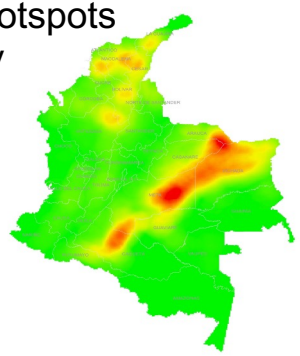
In 2010, Colombia had 81.4 Mha of natural forest, extending over 72% of its land area. In 2021, it lost 259kha of natural forest, equivalent to 159Mt of CO_2 emissions

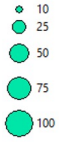
Study area

Colombia, South America

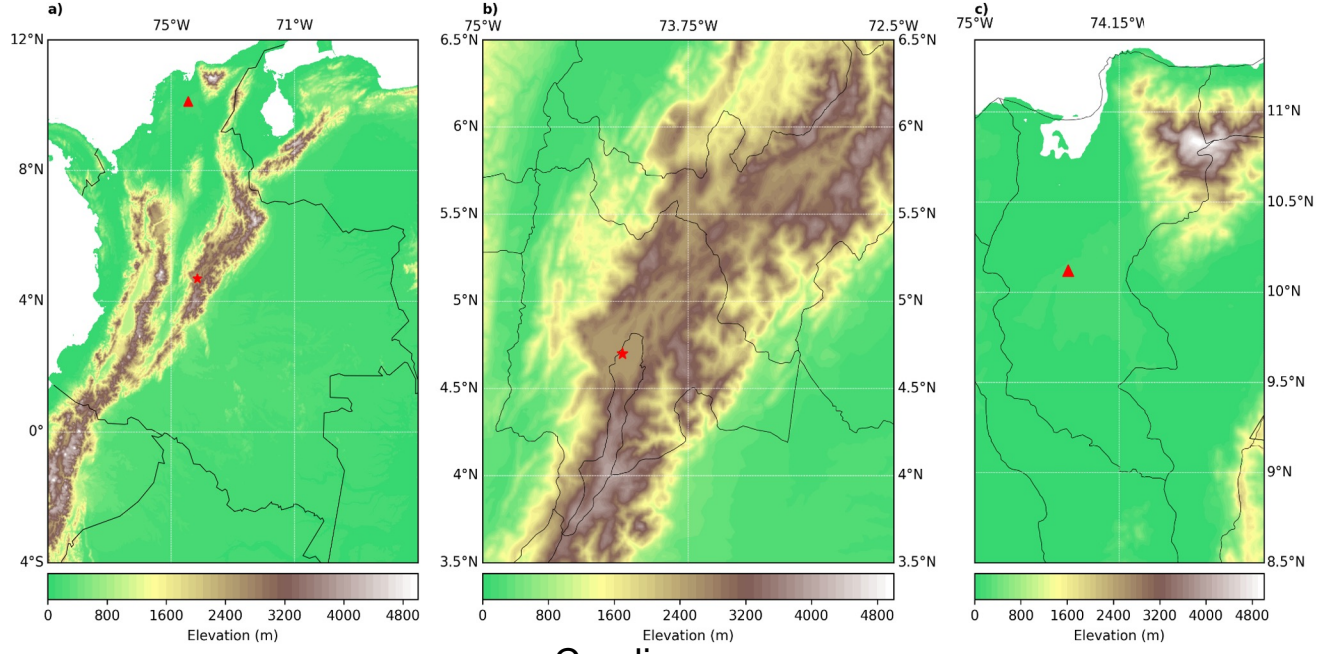


Wildfire hotspots frequency





Population in Urban areas



Cundinamarca

Magdalena

- Historic wildfire hotspot
- MODIS Burned Areas
- Normalization for area
- Adjacent urban areas

Colombian ecosystem

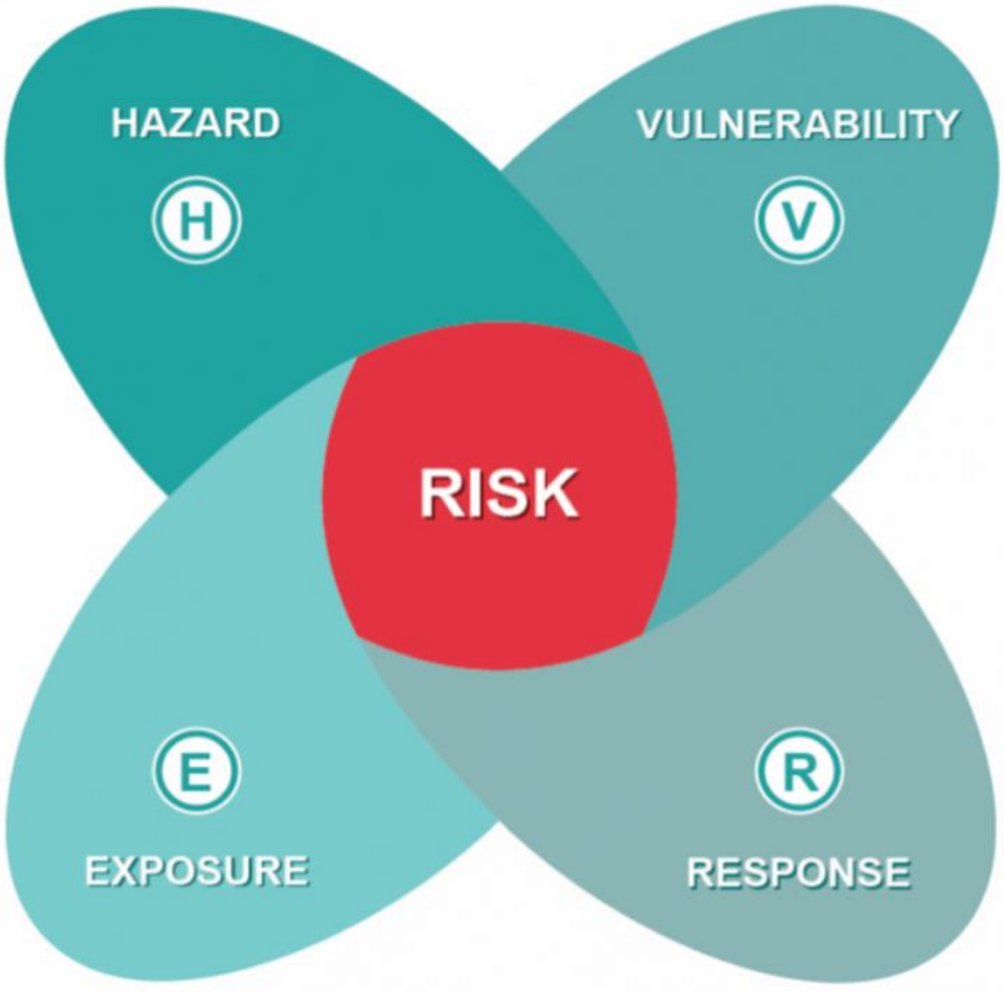
Tropical dry Forest

Andean Forest

Paramo

Tropical dry Forest

Increase Fire Wild Index (FWI)

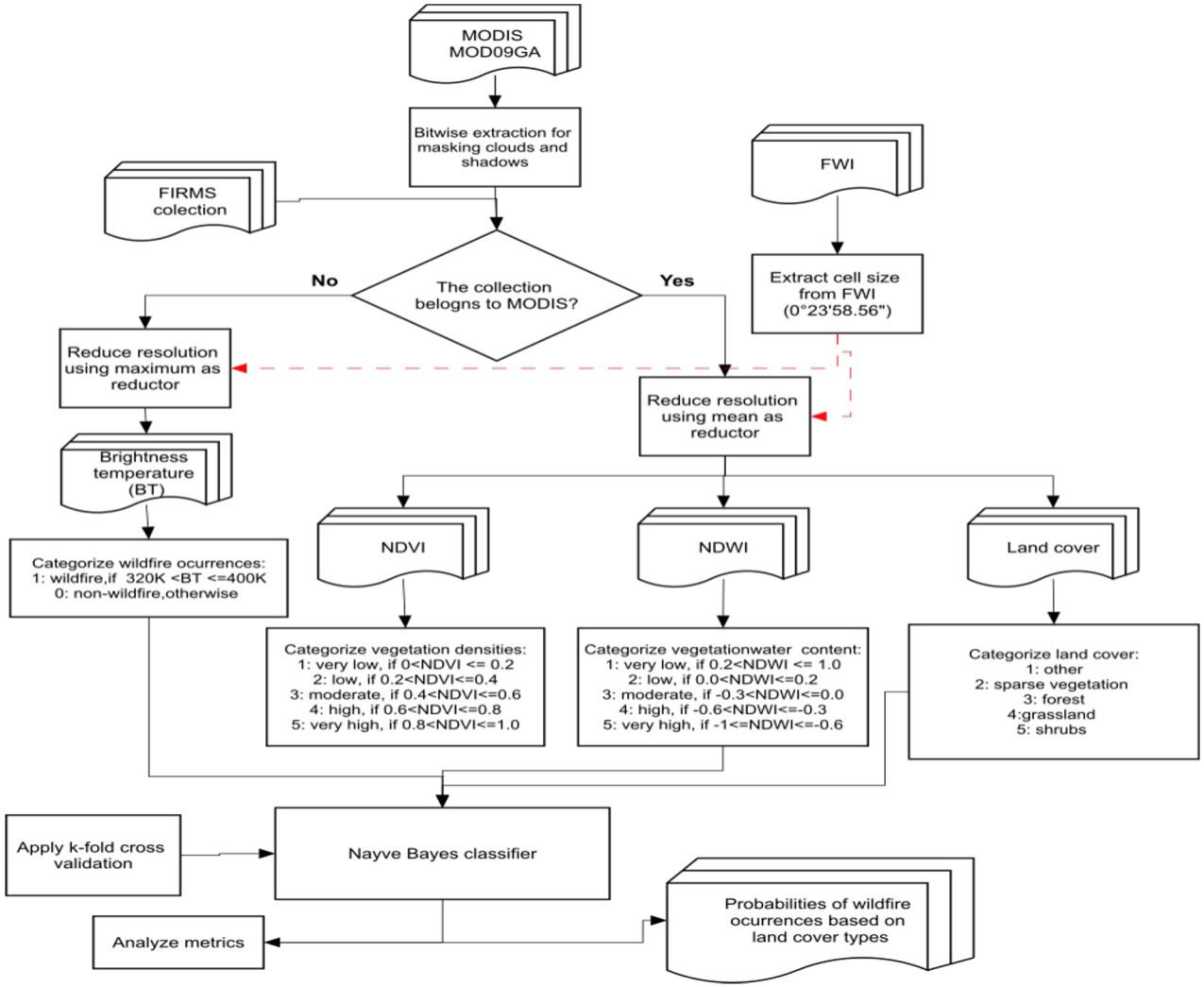


Land cover Susceptibility

Wildfire

Social-economic capacity

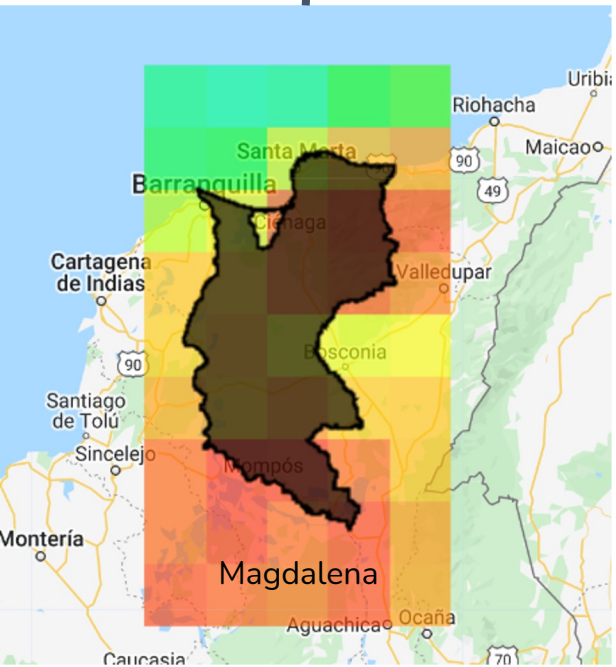
Analysis of fire events and importance of land cover type



Land cover analysis

Meteorological Neural Network

Probability of wildfire occurrence as function of Land Cover



FWI estimate
2017-2022
Resolution ≅44.5 km
Temporal = 3 hours

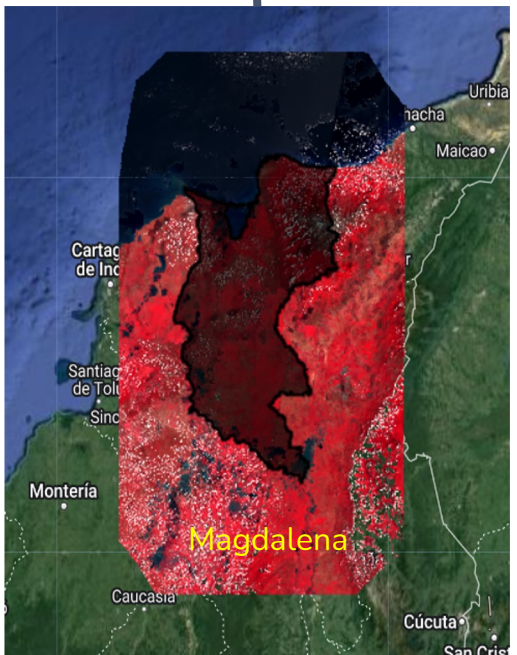
Images LS08
2017-2022
Resolution ≅30 m

Scale reduction

Px LS08

Px FWI

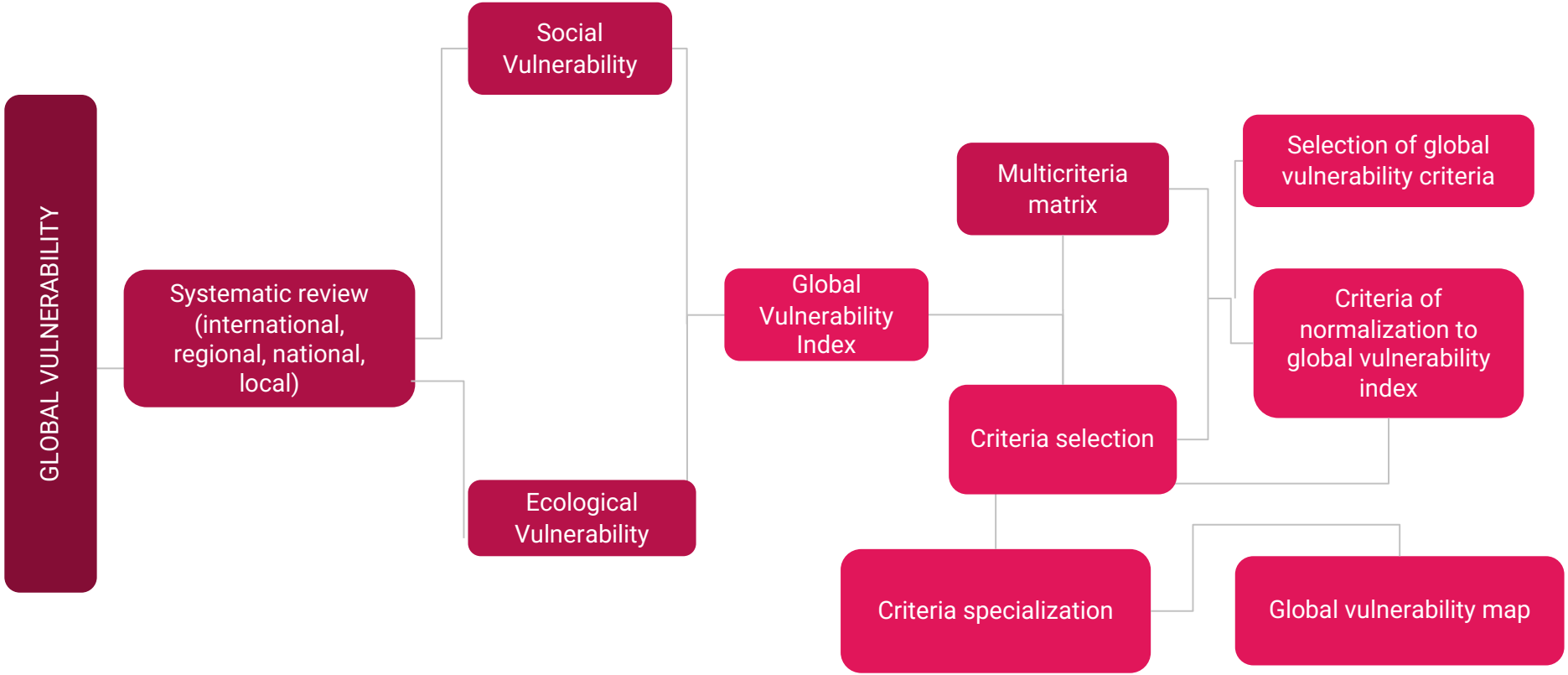
Pixels aggregation



Land cover type susceptibility to wildfires

Category	NDVI (Faour et al., 2004)	NDWI	Land Cover Type (Based on Armenteras et al., 2009)
Very Low	0 - 0,2	0,2 - 1	Other
Low	0,2 - 0,4	0,0 - 0,2	Sparse Vegetation
Moderate	0,4 - 0,6	-0,3 - 0	Forest
High	0,6 - 0,8	-0,6 - -0,3	Grassland
Very High / Extreme	0,8 - 1	-1 - -0,6	Shrubs

Framework Vulnerability analysis



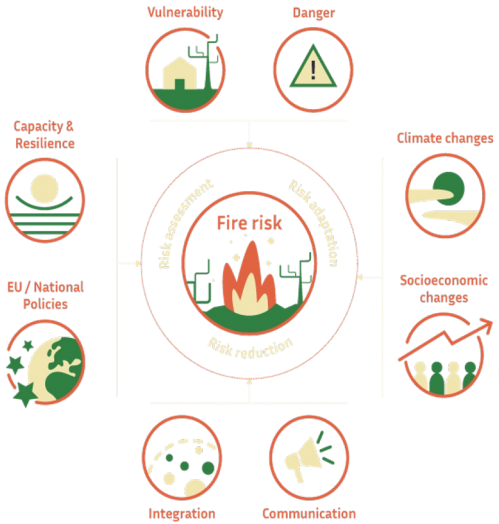
Global vulnerability in Colombia

Criteria	Source/Database
Occupation in WUI	Map of population density in municipal areas (Projection DANE, 2020)
Neighborhood	Map of occupation and vegetation cover (Galiana-Martin et al., 2011)
Response capacity	Municipal Disaster Risk Index Adjusted by response capacities (https://colaboracion.dnp.gov.co/CDT/Prensa/IndiceMunicipaldeRiesgodeDesastres.pdf)

Criteria	Source/Database
Types of covers (adaptation to fire/combustion)	IGAC, Land Map 2018 Corine Land Cover
Strategic ecosystems	Ecosystem red list of Colombia (Etter et al, 2017)
Wildland-Urban Interface (WUI)	Land cover and Urban center (Miranda et al 2020)

GLOBAL VULNERABILITY

Socioeconomic vulnerability + Ecological vulnerability

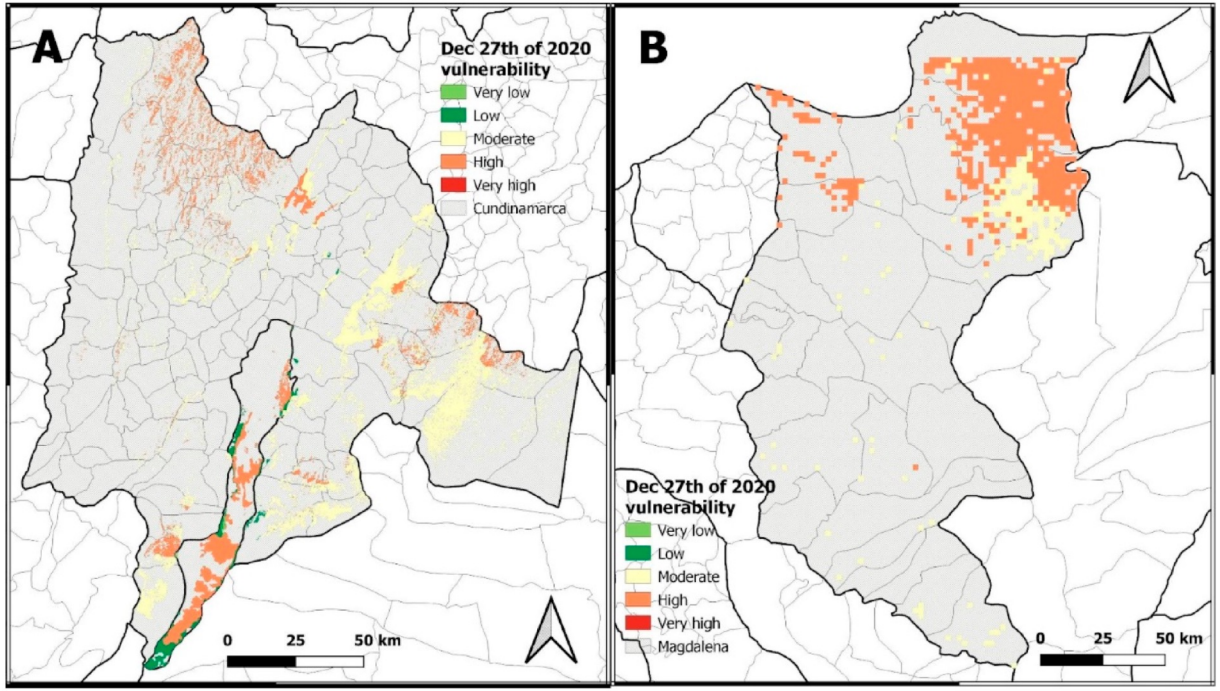


$$V = 0.25WUI_i + 0.18C_i + 0.12CR_i + 0.17TC_i + 0.08EC_i + 0.2WUI_{ei}$$

Where, V: Global Vulnerability, WUI_i: Occupation in WUI, C_i: Neighborhood, CR_i: Response capacity, TCi: Types of covers (adaptation to fire), EC_i: Strategic ecosystems, WUIei: Wildland-Urban Interface (WUI).

Casallas et al (2022) Sensors

Quantification of the forest fires vulnerability and risk



Category	Global vulnerability
Very Low	1 - 3,8
Low	3,8 - 6,6
Moderate	6,6 - 9,4
High	9,4 - 12,2
Very High / Extreme	12,2 - 15

Figure 1. Global vulnerability of *Cundinamarca* (**A**) and *Magdalena* (**B**). Colors represent the global vulnerability category as very high (red), high (orange), moderate (yellow), low (green), very low (light green).

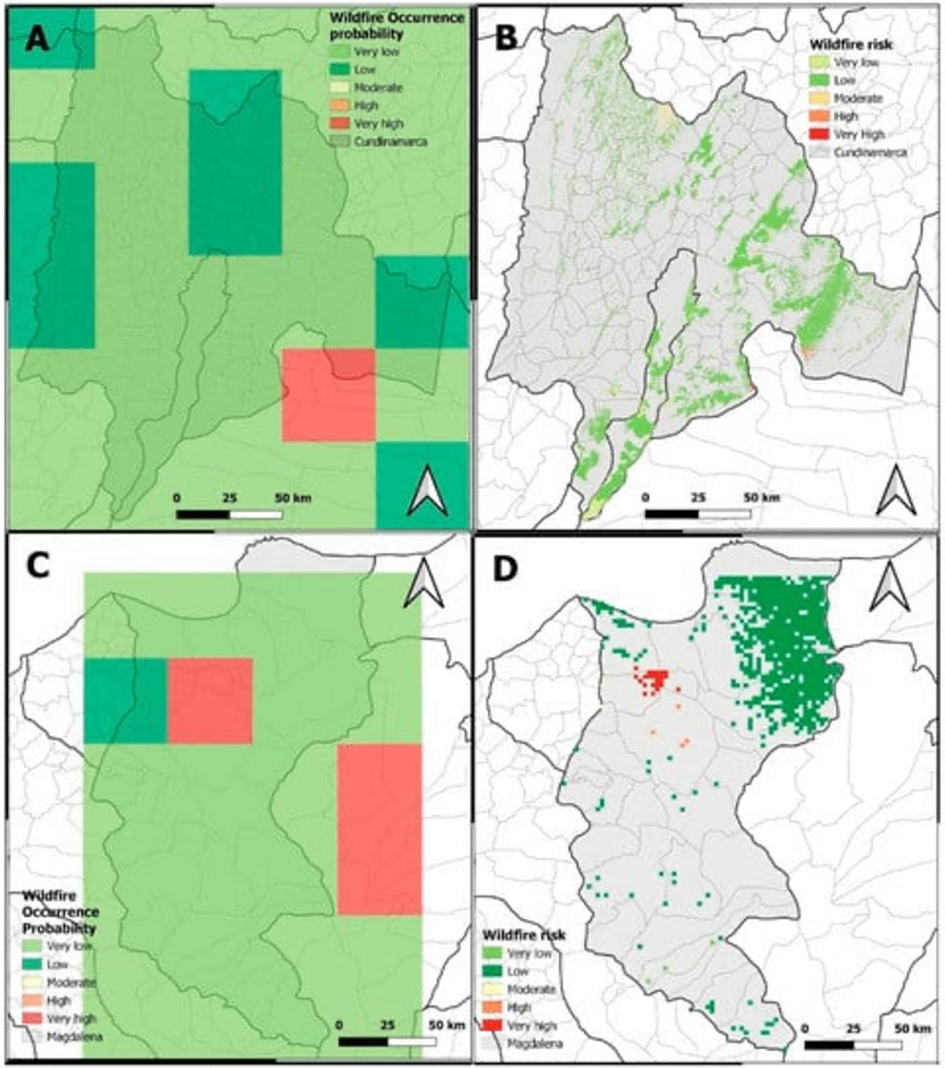


Figure 2. Wildfire Occurrence Probability of *Cundinamarca* (**A**) and *Magdalena* (**C**); Wildfire Risk Map in *Cundinamarca* (**B**) and *Magdalena* (**D**) on 27 December 2020. Colors represented as very high (red), high (orange), moderate (yellow), low (green), very low (light green).

Cartegory	Probability of occurrence of a wildfire	Risk of wildfire
Very Low	0 - 0,126	0 - 0,48
Low	0,126 - 0,255	0,48 - 1,68
Moderate	0,255 - 0,405	1,68 - 3,81
High	0,405 - 0,59	3,81 - 7,19
Very High / Extreme	0,59 - 1	7,19 - 15

Wrap up

- The vulnerability framework is being adapted by other Latin American countries e.g., Peru, Chile, depending on data availability
- Colombia have a database that can be used to wildfire risk assessment.
- The predicted wildfire vulnerability can be used to increase response capacity.
- These results have been used to adaptation plan by temperature increase

Ellie Anne López Barrera
ellie.lopez@usa.edu.co

UNIVERSIDAD SERGIO ARBOLEDA