

Fire activity on the Colombian Tropical Dry Forest

An environmental and social perspective

Marcelo Villa-Piñeros

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Faculty of Environmental and Rural Studies
Pontificia Universidad Javeriana
Bogotá, Colombia

Why the Tropical Dry Forest?

Highly threatened and understudied biome

What is the Tropical Dry Forest?

- Deciduous vegetation
- Relatively high fertility
- Limited to lowlands (1000 m.s.n.m.)
- Annual temperature: $> 25^{\circ}\text{C}$
- Annual precipitation: between 250 and 2500 mm
- **Strong seasonality**



Figure 1: Tropical Dry Forest in the El Tuparro natural national park, Colombia. Credits: Instituto Alexander von Humboldt.

Where is the Tropical Dry Forest?

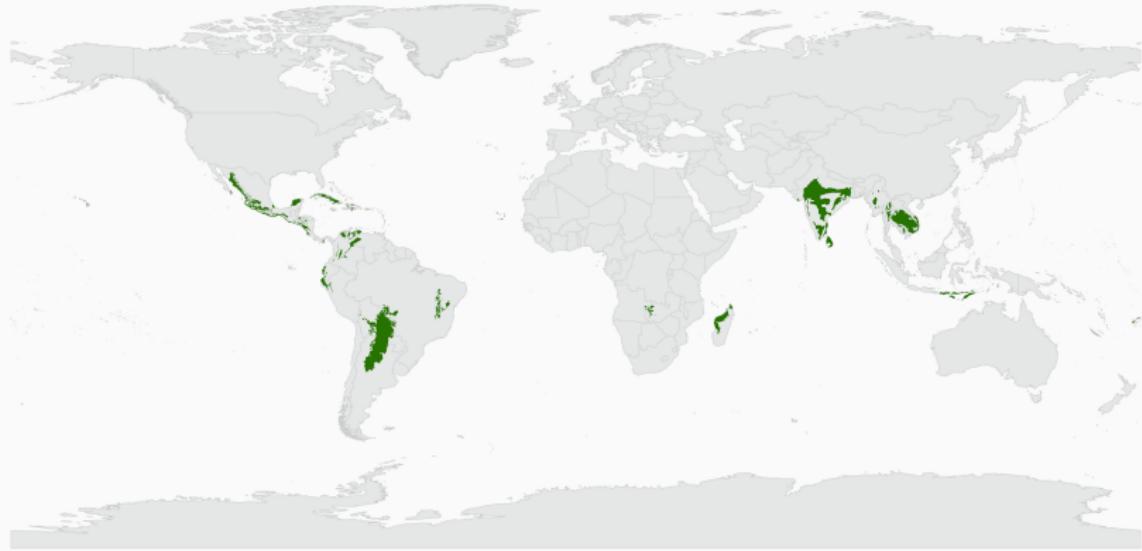


Figure 2: **Tropical and Subtropical Dry Broadleaf Forests** ecoregion. Data sources: Olson and Dinerstein (2002) and Natural Earth.



Figure 3: Tropical Dry Forest **biome** and **2014 distribution** in Colombia. Data sources: Ariza, Isaacs, and González (2014) and Etter et al. (2015), CGIAR/SRTM, Natural Earth.

What is the situation of the Tropical Dry Forest?

*“The rain forest is not the most threatened of the major tropical forest types. The **tropical dry forests** hold this honor.”*

— Janzen (1988)

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*“Virtually all of the **tropical dry forests** that remain are currently exposed to a variety of different threats.”*

— Miles et al. (2006)

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*“There is a general perception that the most urgent conservation issues in the tropics concern rain forests but their disproportionate scientific, policy and public profiles have distracted attention from the vulnerability of **tropical dry forests**.”*

— Pennington, Lehmann, and Rowland (2018)

| Threats | Status |
|---|---|
| <ul style="list-style-type: none">• Climate change• Forest fragmentation• Conversion to agriculture• Human population• Fire | <ul style="list-style-type: none">• 3% unexposed to threats globally• 10% remains intact in Latin America• 3% remaining in Colombia (critically endangered) |

Fire activity relationships in Tropical Forests

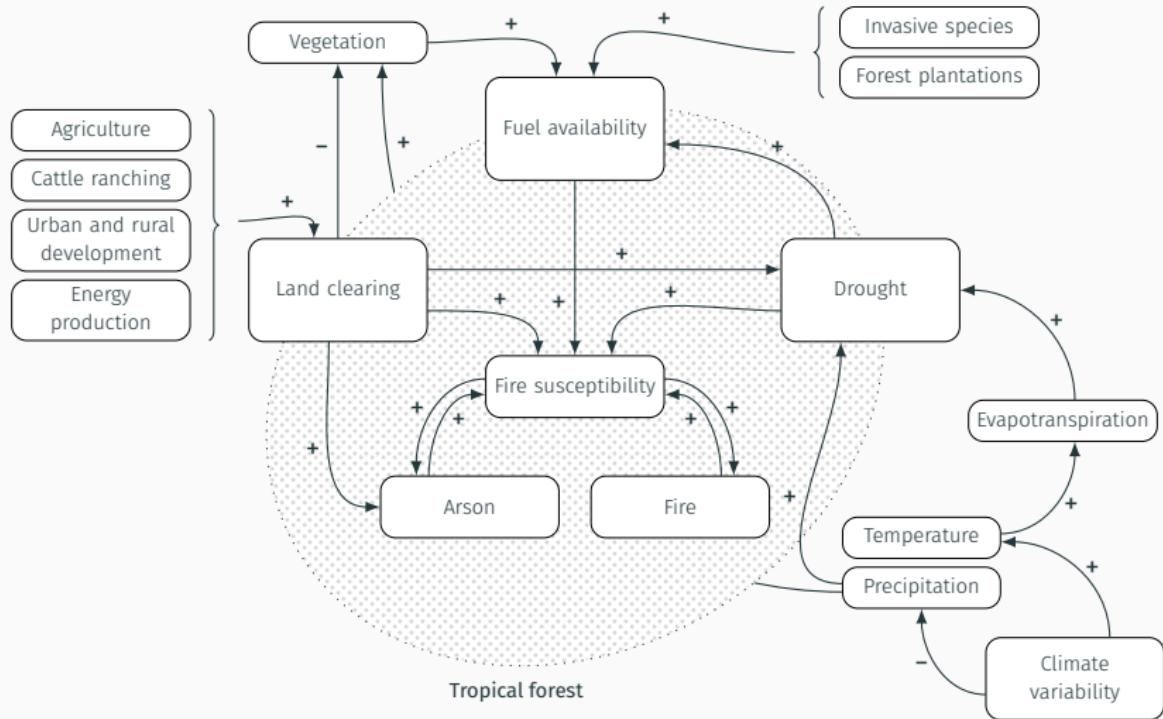


Figure 4: Theoretical model of environmental controls and human pressures regulating fire activity in tropical forests. Based on Cochrane (2003), Shlisky et al. (2009), and Bowman et al. (2011)

Data

Table 1: Retrieved datasets and their properties

| Dataset | Source | Product | Temporal res. | Spatial res. |
|---------------------------|--------|---------|---------------|--------------|
| Thermal Anomalies | MODIS | MOD14A2 | Weekly | 1 km |
| Precipitation | TRMM | 3B43 | Monthly | 0.25° |
| Enhanced Vegetation Index | MODIS | MOD14A3 | Monthly | 1 km |
| Land cover | MODIS | MCD12Q1 | Yearly | 500 m |

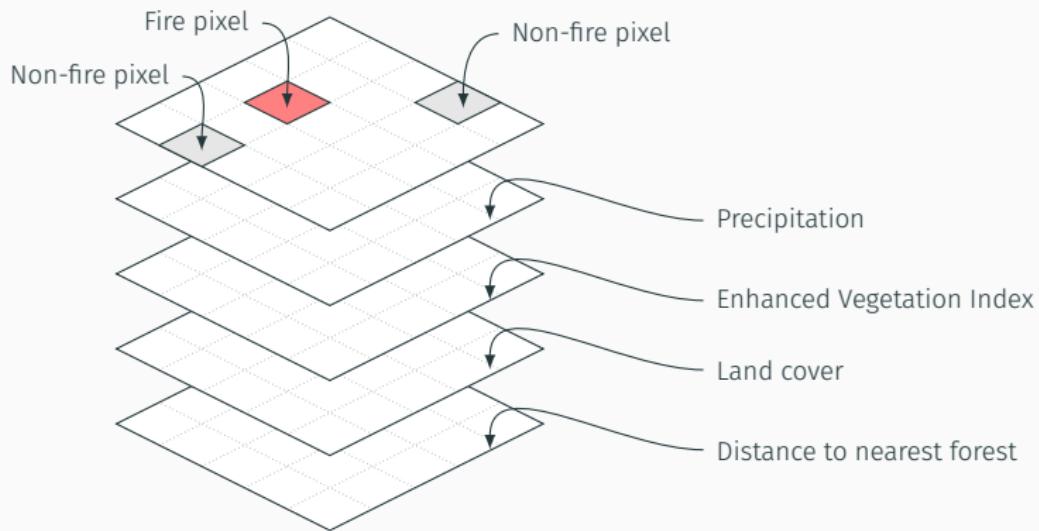


Figure 5: Data model representation

Environmental controls overview

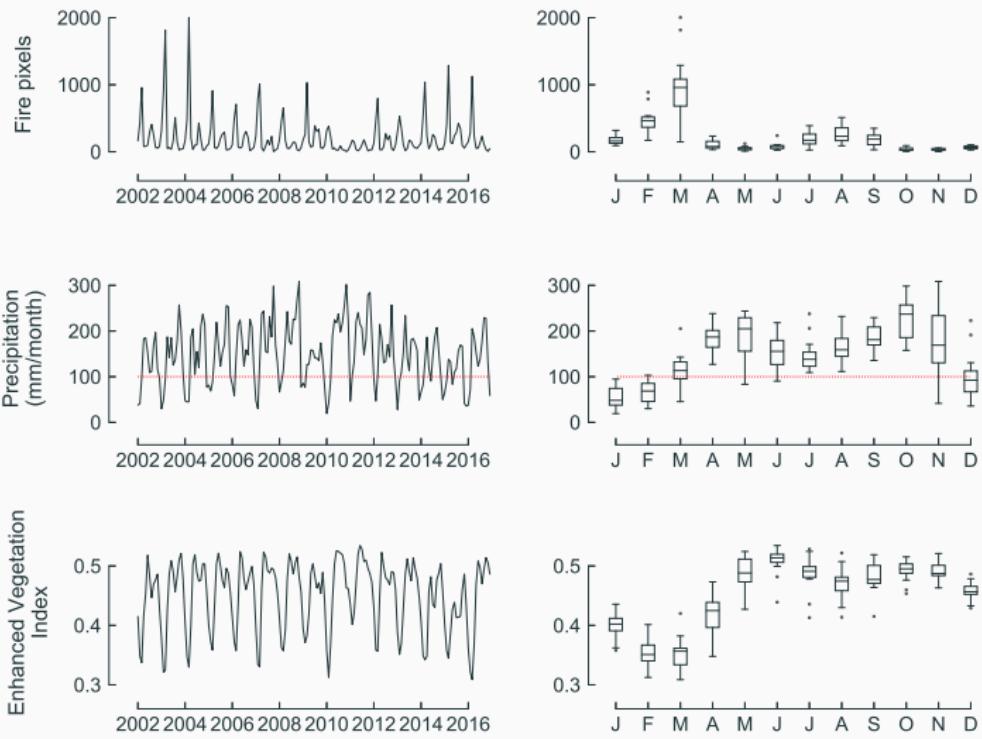


Figure 6: Fire pixels, Precipitation and Enhanced Vegetation Index time series (left side) and month aggregation (right side). Red line represents the dry month precipitation threshold (Van Der Werf et al., 2008).

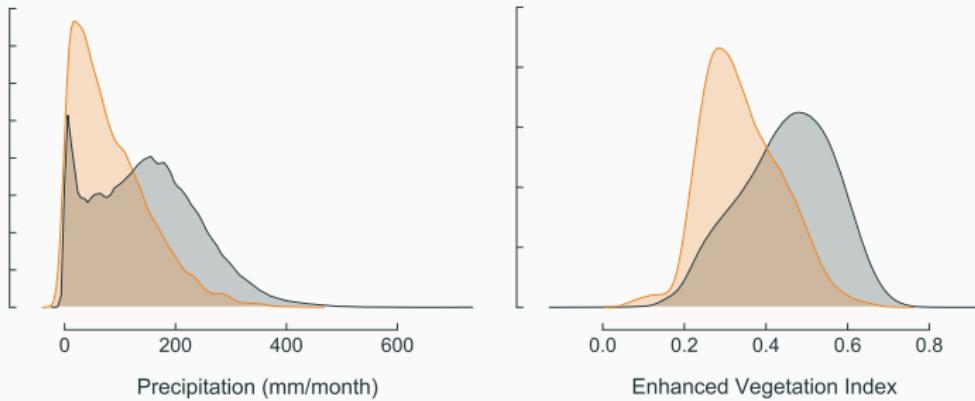


Figure 7: Precipitation and Enhanced Vegetation Index **all-pixel values distribution** and **fire-pixel-only values distribution**.

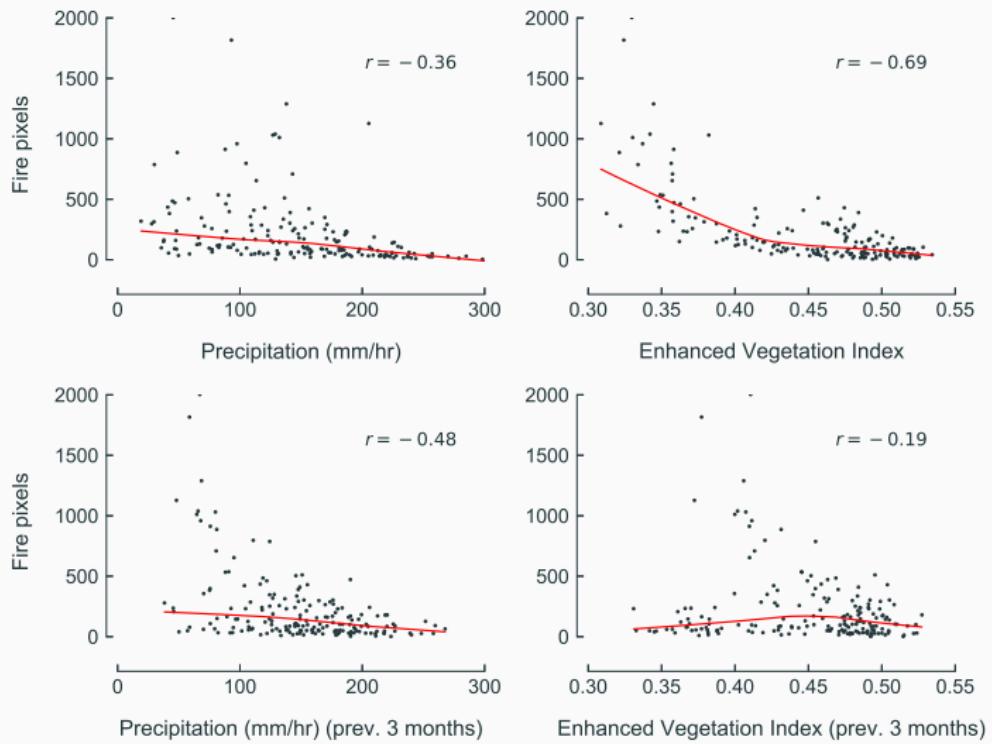


Figure 8: Correlation between fire pixels and both Precipitation and Enhanced Vegetation Index (including previous 3 month period average). A lowess model is fitted and the Pearson correlation coefficient is displayed for each variable.

Human pressures overview



Figure 9: Proportion of land cover type.

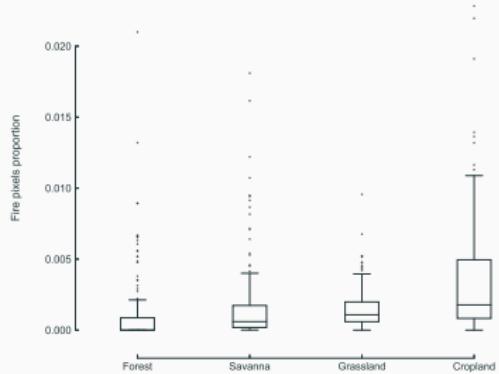


Figure 10: Fire pixel proportion per land cover type.

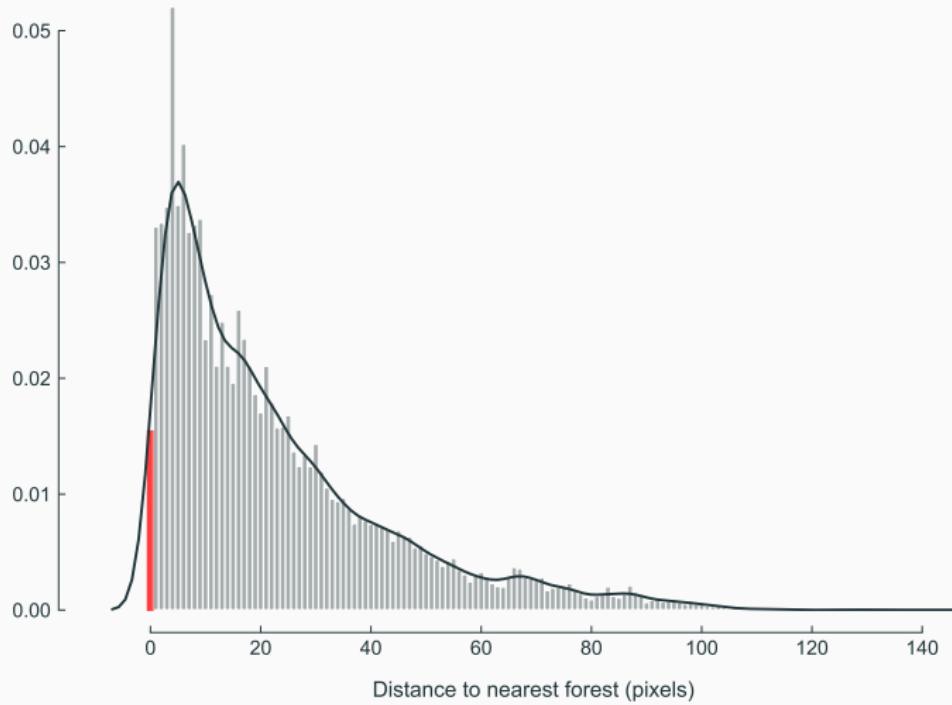


Figure 11: Distance to the nearest forest pixel values distribution. Each bar corresponds to distance of one pixel. Red bar represents pixels with zero distance (i.e. forest pixels).

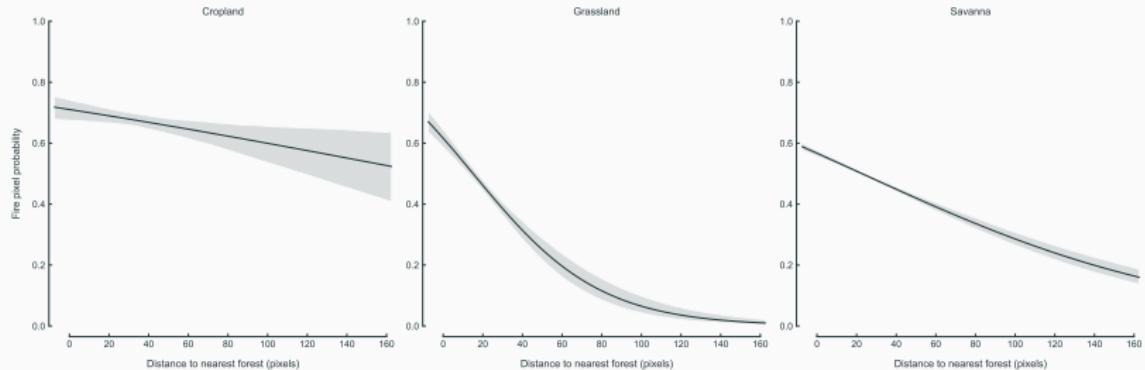


Figure 12: Fire pixel probability as a function of distance to the nearest forest pixel and land cover type.

Further thoughts

The Cerro Los Cristales Fire

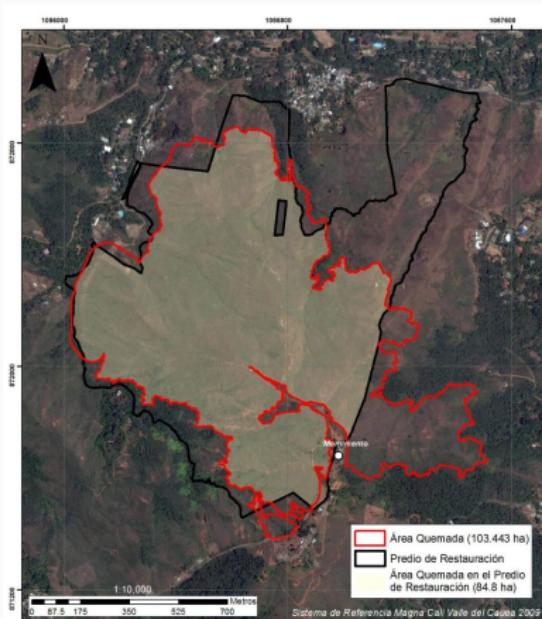


Figure 13: Burned area vs. restoration project area. Source: Grupo Conservación de Ecosistemas.



Figure 14: Fire on the Cerro Los Cristales, 31 August 2018. Credits: Grupo Conservación de Ecosistemas.

Conclusions

- Climate as a dominant control

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- Human shaped burning patterns

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- Human shaped burning patterns
- Important underlying social and economic factors

⌚ github.com/marcelo-villa-p/fire-congress-2019-tdf-talk

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