

# *Wildfires risk and spatio-temporal dynamic in the Chiquitania region (Bolivia)*

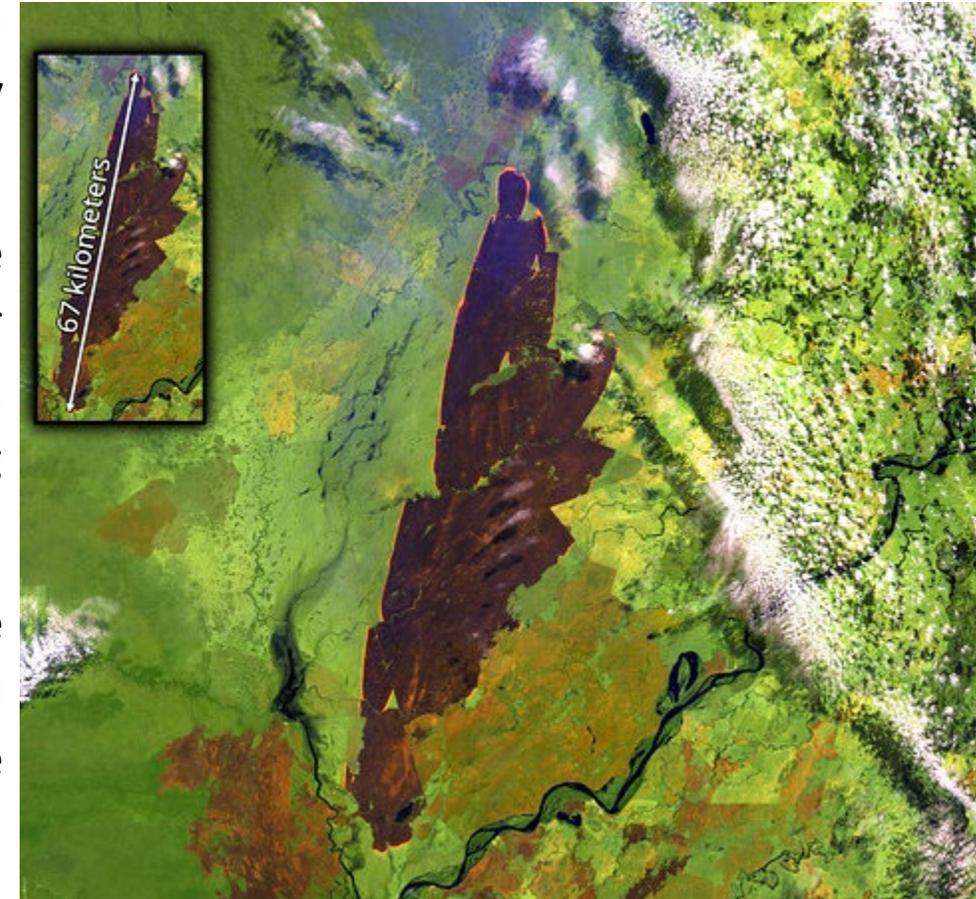
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# Motivations

- Wildfires risk in the South American forest will probably increase in the future as a consequence of the predicted increased frequency of droughts combined with the growing rate of deforestation.
- The main cause of fire ignition is human-made: burning is the easiest and cheapest way to clear the land and to prepare fields for the next year's crop. This usual practice, called *chaqueo* in Bolivia, can easily get out of control and initiate large fires, burning hectares and hectares of forest.
- Although it is evident that fires in Bolivia, mainly caused by the practice of *chaqueo*, and land use/land cover changes (LULCC) provoked by deforestation, are related, the relation among these two elements has not been deeply investigated yet.

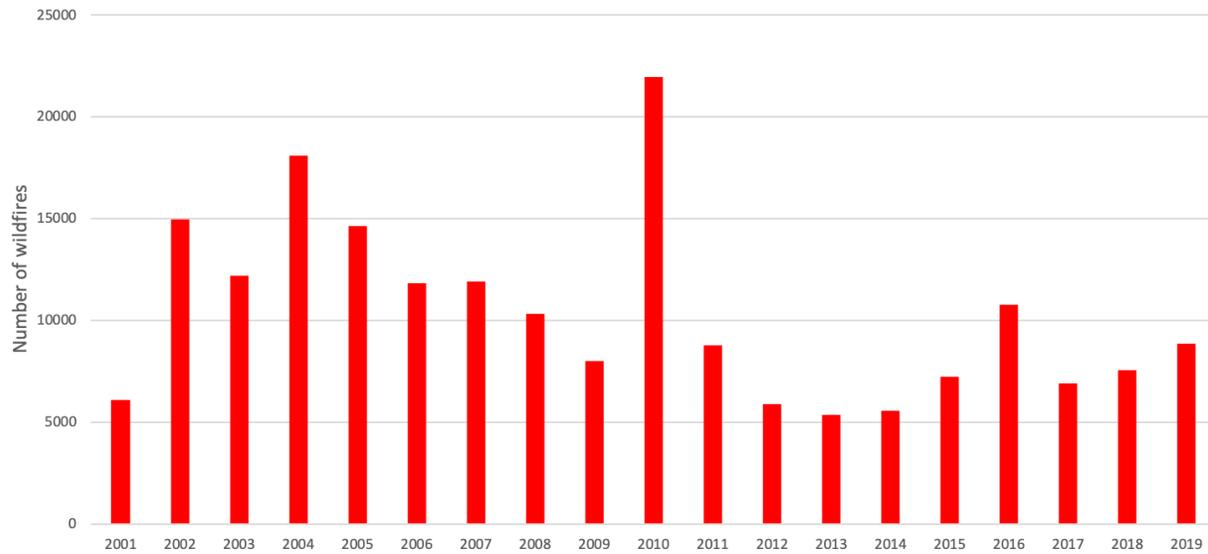


Wildfires at the border of Bolivia and Brazil  
Sentinel-2 NIR/SWIR/VIS view August 20th, 2019

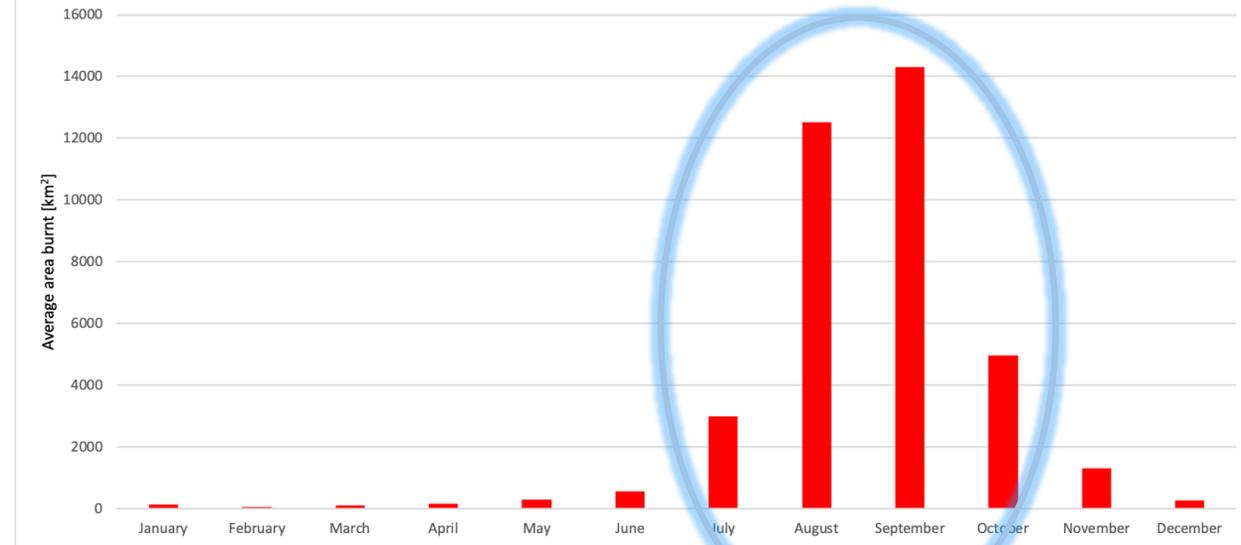


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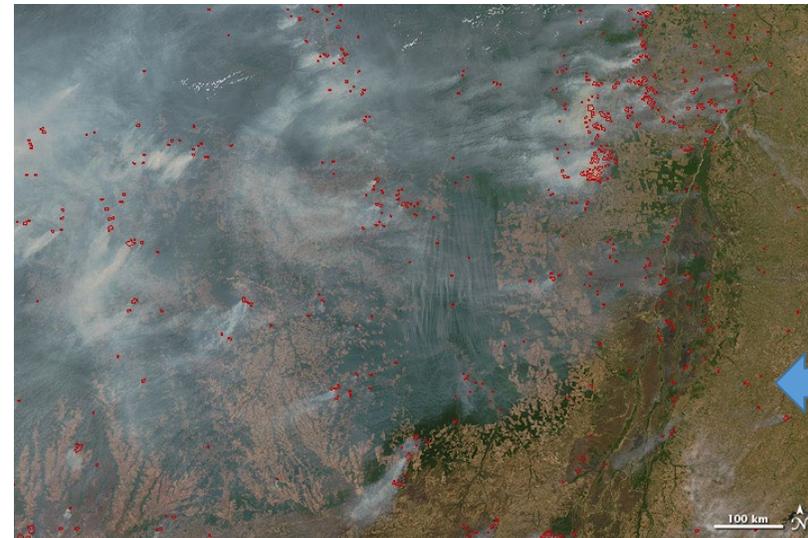
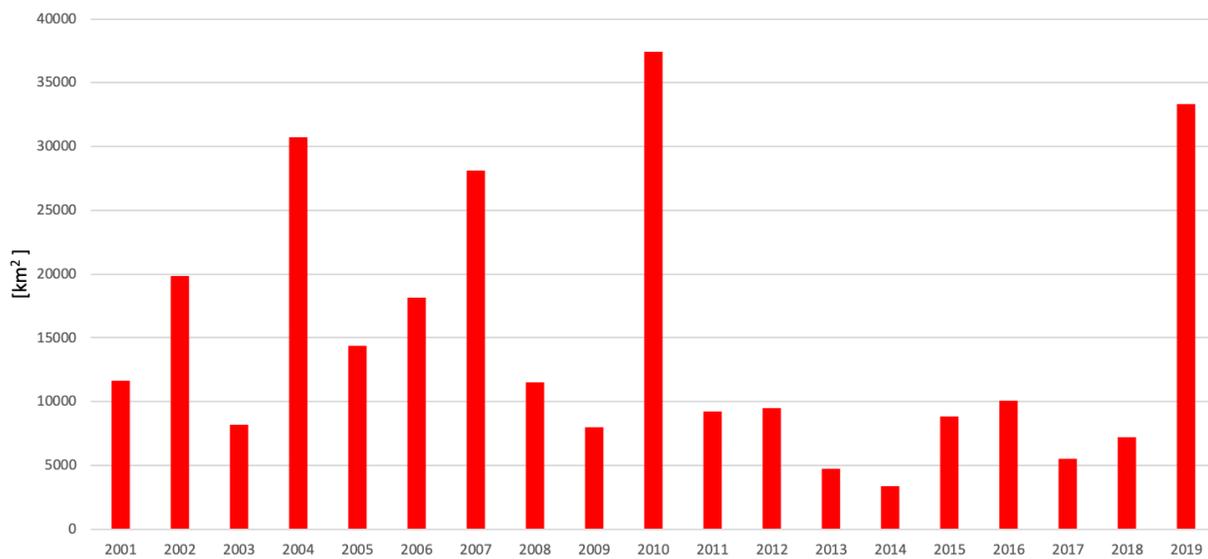
### Number of wildfires in Bolivia by year



### Average area burnt by month in Bolivia between 2001 and 2019 [km<sup>2</sup>]



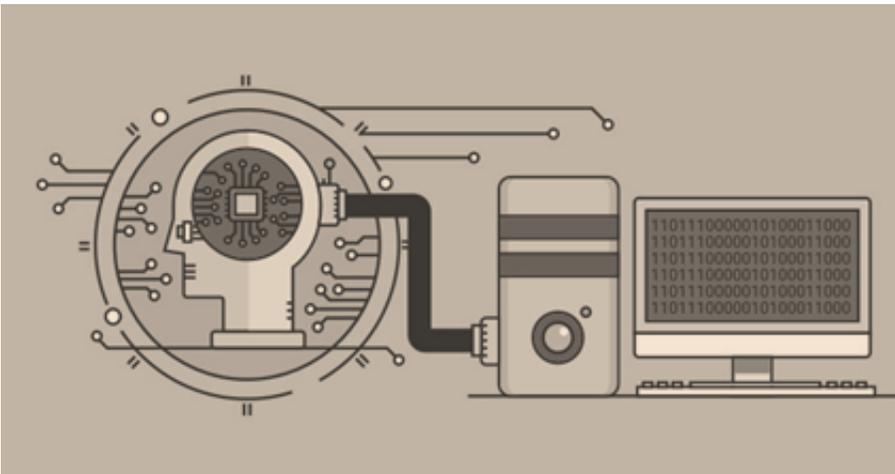
### Area burnt in Santa Cruz since 2001 in km<sup>2</sup>



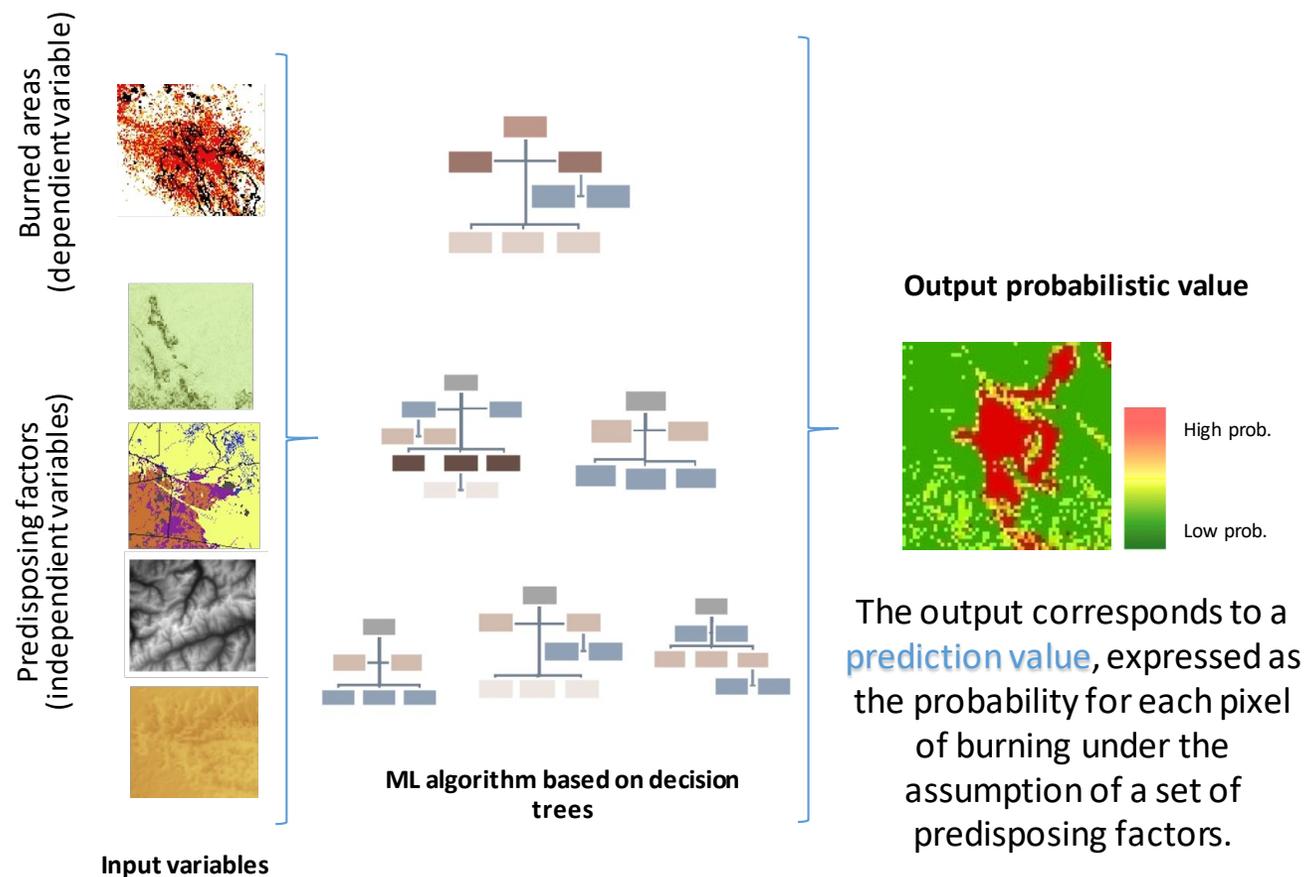
Use of the practice of *chaqueo* during the dry season

# Main Objective

Elaborate a wildfire susceptibility map for Santa Cruz (Bolivia) and assess the main drivers for fire risk in the region by applying Random Forest, a Machine Learning (ML) algorithm based on decision trees.



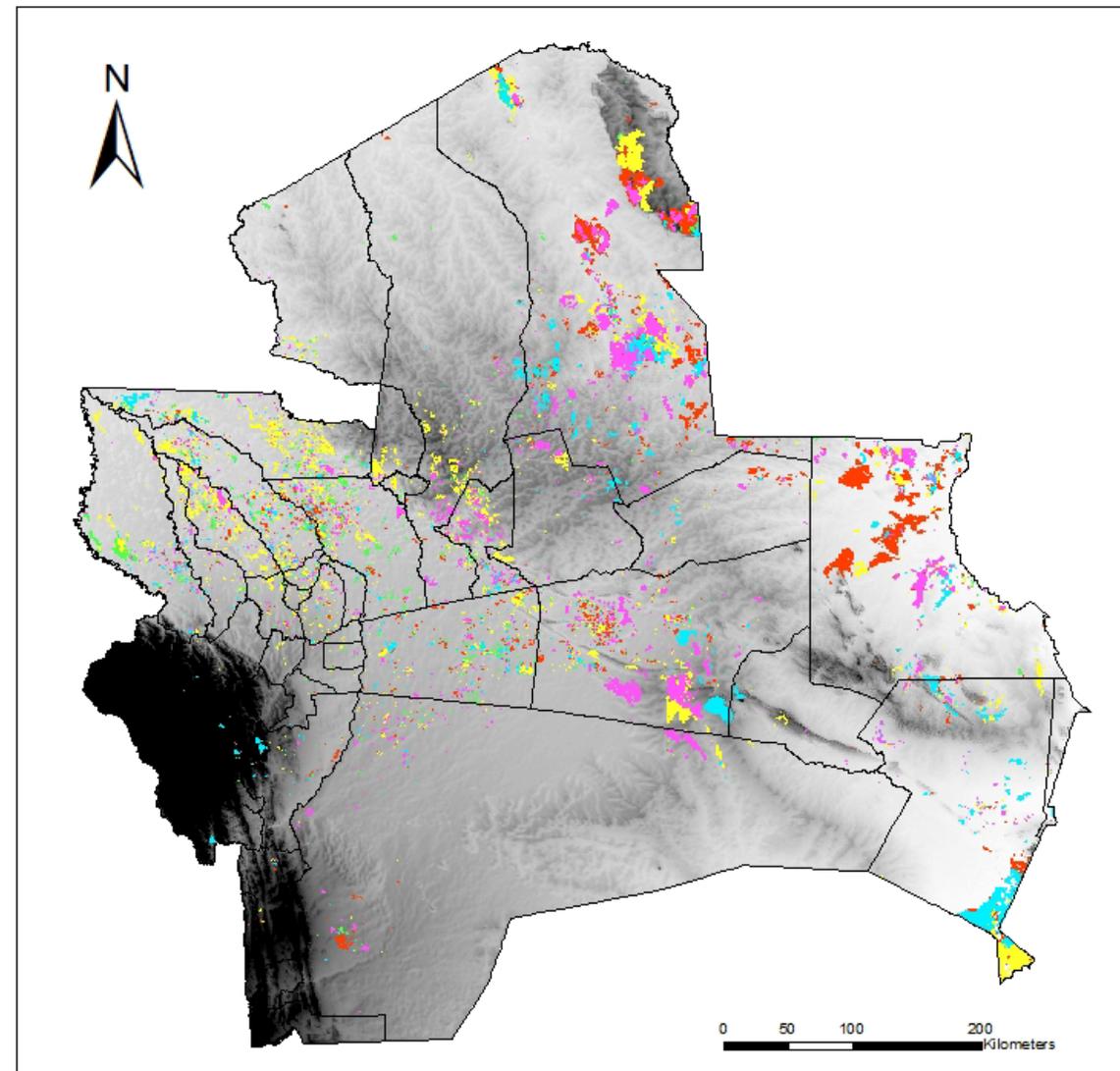
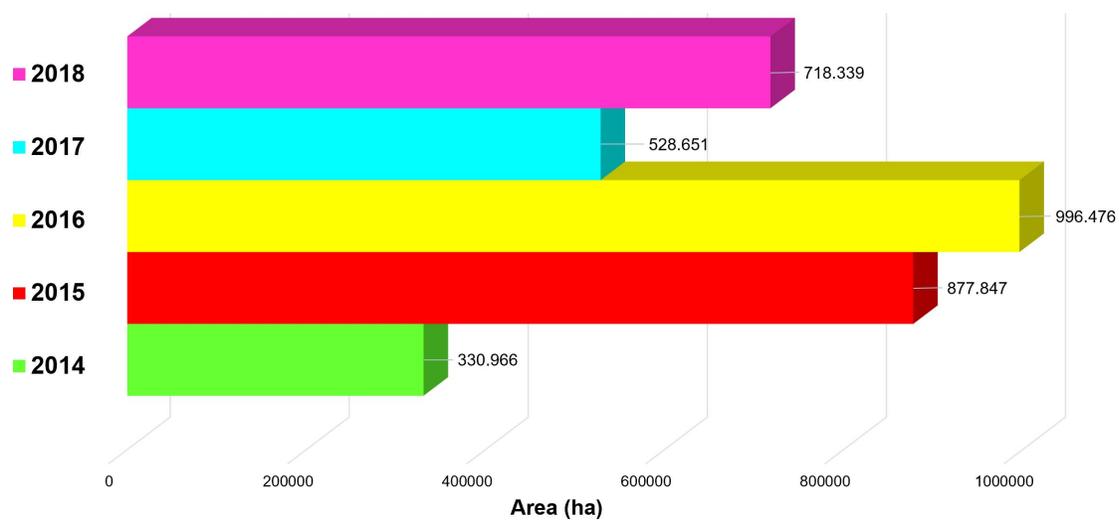
# Methodology: Random Forest based approach



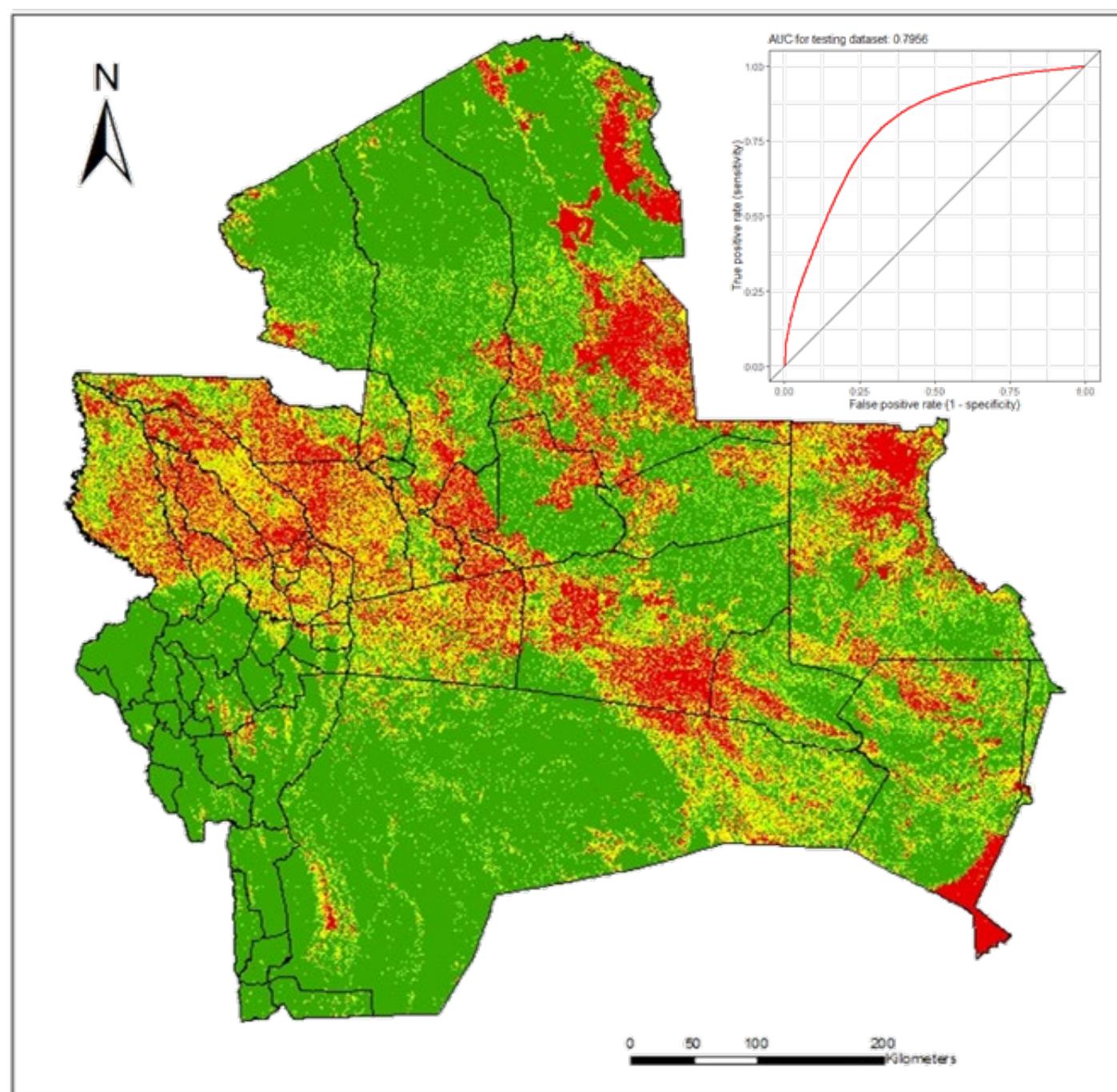
Variables	Type	Range
Digital Elevation Model (DEM)	Numerical (continuous)	77 - 321
Slope	Numerical (degrees)	0 - 60.73
Landuse	Categorical	20 classes
Vegetation	Categorical	41 classes
Ecoregion	Categorical	7 classes



# Annual history of burned areas in Santa Cruz, during the period 2014 - 2018



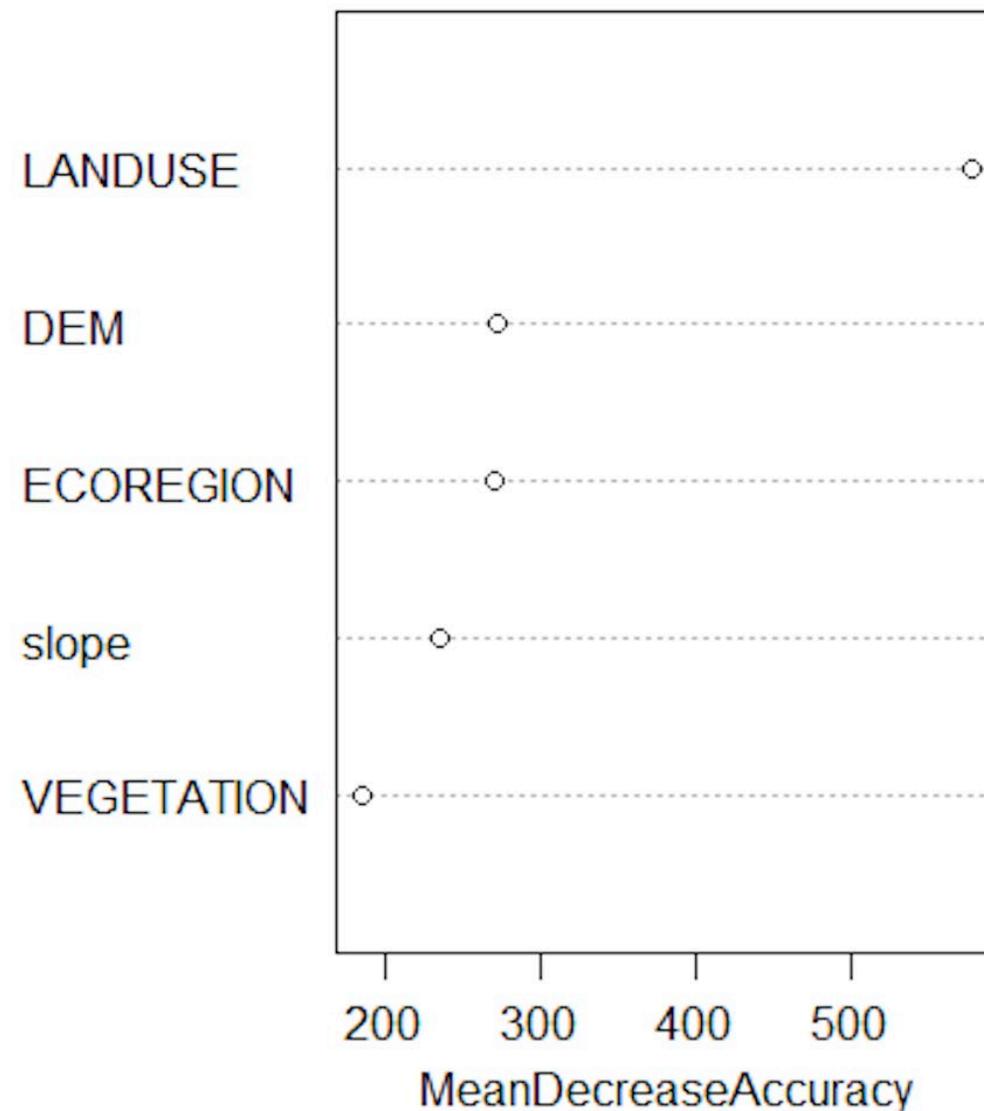
# Results: wildfire susceptibility map



# Results: variable importance ranking

Variables with a large mean decrease in precision (Mean Decrease Accuracy) are more important for data classification.

In this case, the **landuse** plays the most important role on wildfire susceptibility.



# CONCLUSIONS

## BIBLIOGRAFY

Anívarro, R., Azurduy, H., Maillard, O., Markos, A. (2019). *Diagnóstico por teledetección de áreas quemadas en la Chiquitania*. Informe técnico del Observatorio Bosque Seco Chiquitano, Fundación para la Conservación del Bosque Chiquitano, Santa Cruz, Bolivia, 70 pag.

Tonini, M., D'Andrea, M., Biondi, G., Degli Esposti, S., Trucchia, A., & Fiorucci, P. (2020). *A Machine Learning-Based Approach for Wildfire Susceptibility Mapping. The Case Study of the Liguria Region in Italy*. *Geosciences*, 10(3), 105. doi: 10.3390/geosciences10030105



Machine learning has great potential for spatial and spatio-temporal predictions, as is the case with natural threats.



It is a fairly new topic in the field of geoscience and remote sensing, so it is advisable to delve into it to get the most out of this methodology.



It is extremely important to have adequate and updated predisposing factors (vegetation, land use, etc.). In this case, it could be analyzed to include variables related to human activity (expansion of the agricultural frontier) in order to analyze its importance when these natural events occur.



Creating a susceptibility map is a useful tool for forest fire risk prevention and mitigation.



The wildfire susceptibility map for the department of Santa Cruz plays an important role in carrying out strategies that reduce the negative impact of the occurrence of these events.