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REGIONAL FIRE PATTERNS IN THE LA PLATA BASIN

Role of Landscape and Human Practices from global fire datasets

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Introduction

Fires are important drivers of processes and structure of tropical ecosystems, as well as potential threats to social systems. As Fires are under the influence of climate, land use, ecological and socio-cultural processes, their distribution will be affected by global changes. Assessing the vulnerability (i.e. exposure, sensitivity and adaptive capacity) of land use systems to fire, is a first step to climate change impact assessment (Lavorel et al., 2006).

The aim of this study is to map exposure of land use systems to fire, across the South American La Plata Basin (LPB).

As the LPB encompasses a diversity of interacting and nested biomes, landscapes and land-uses, we first seek to characterize landscapes and major land-use pathways leading to high fire exposure (eg. Eva et Lambin, 2000).

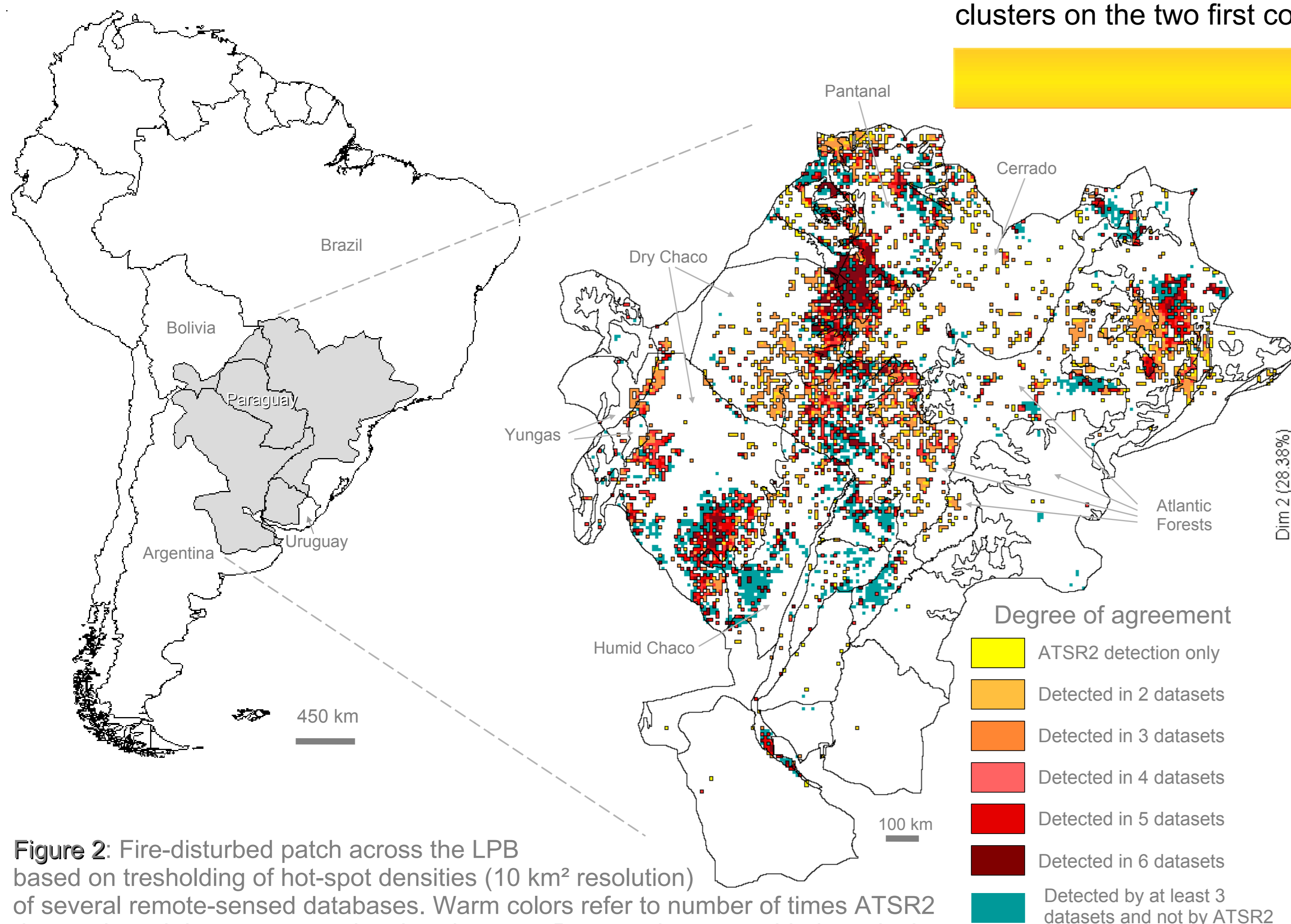


Figure 2: Fire-disturbed patch across the LPB based on tresholding of hot-spot densities (10 km² resolution) of several remote-sensed databases. Warm colors refer to number of times ATSR2 detected patch is also present in other datasets. Blue patches were added to take into account aventual ATSR2-omitted patch and were detected in at least 3 datasets.

► Mapping of fire density across the LPB revealed high spatial aggregation of fire activity in **599** ATSR2-patch complemented by **400** patches (other datasets), mainly distributed across the **Dry Chaco** (26%), the **Cerrado** (18%), the **Pantanal** (15%) and the **Humid Chaco** (13%) (Figure 2).

► Highly aggregated fire patterns across all biomes and indices of human activity in most patches (population, urban centers, croplands) indicate strong **control of fire activity by diversified land-uses** (eg. logging, grassland management, agricultural burnings...).

► Clustering of fire patches lead to identification of **six types of agro-ecological landscapes** (Figure 3). Mapping of these landscapes and comparison with local land-use and fire studies confirmed land-use pathway control as well as need for further analysis, as several fire practices appear embedded in a same landscape (Figure 4).

CONCLUSION: Land use systems exposed to fire across the LPB appeared to be numerous and diversified. Analysis of fire and Precipitation/Temperature time series according to biomes, landscapes and patches should be one of the next steps to evidence sensitivity of land-use systems to climate and assess impacts of climate change.

Data and Methods

Based on six remote sensed hotspot products (ATSR1, ATSR2, NOAA, MODIS, BAE and L3JRC) re-framed to the La Plata Basin (1 km resolution, Sample Interrupted Goode projection), we identified zones of high fire exposure over the 2000-2006 period. 10 km resolution fire density maps were computed by spatial aggregation of 1 km hotspot maps (Aggregation method, IDRISI). A Fire density threshold was applied to identify Fire disturbed patches (Figure 1). All data-sets were analyzed (ATSR2 was chosen as reference) in order to estimate a degree of agreement for each ATSR2 patch (number of time a patch was detected as "Fire disturbed", value between 1 and 6). ATSR2 patches were further complemented by patches detected in at least 3 data-sets to take into account limitation of fire detection methods.

Fire disturbed patches were characterized by their mean cropland, forest and grassland density (Fischer et al., 2008), population density (Salvatore et al., 2005) and average distance to urban centers (derived from Schneider et al., 2007). Agro-ecological landscape classification was established by clustering the patches on the basis of these 5 attributes (WEKA, X-means algorithm). Quality of clustering was assessed by plotting clusters on the two first components of a Principal Component Analysis (R software).

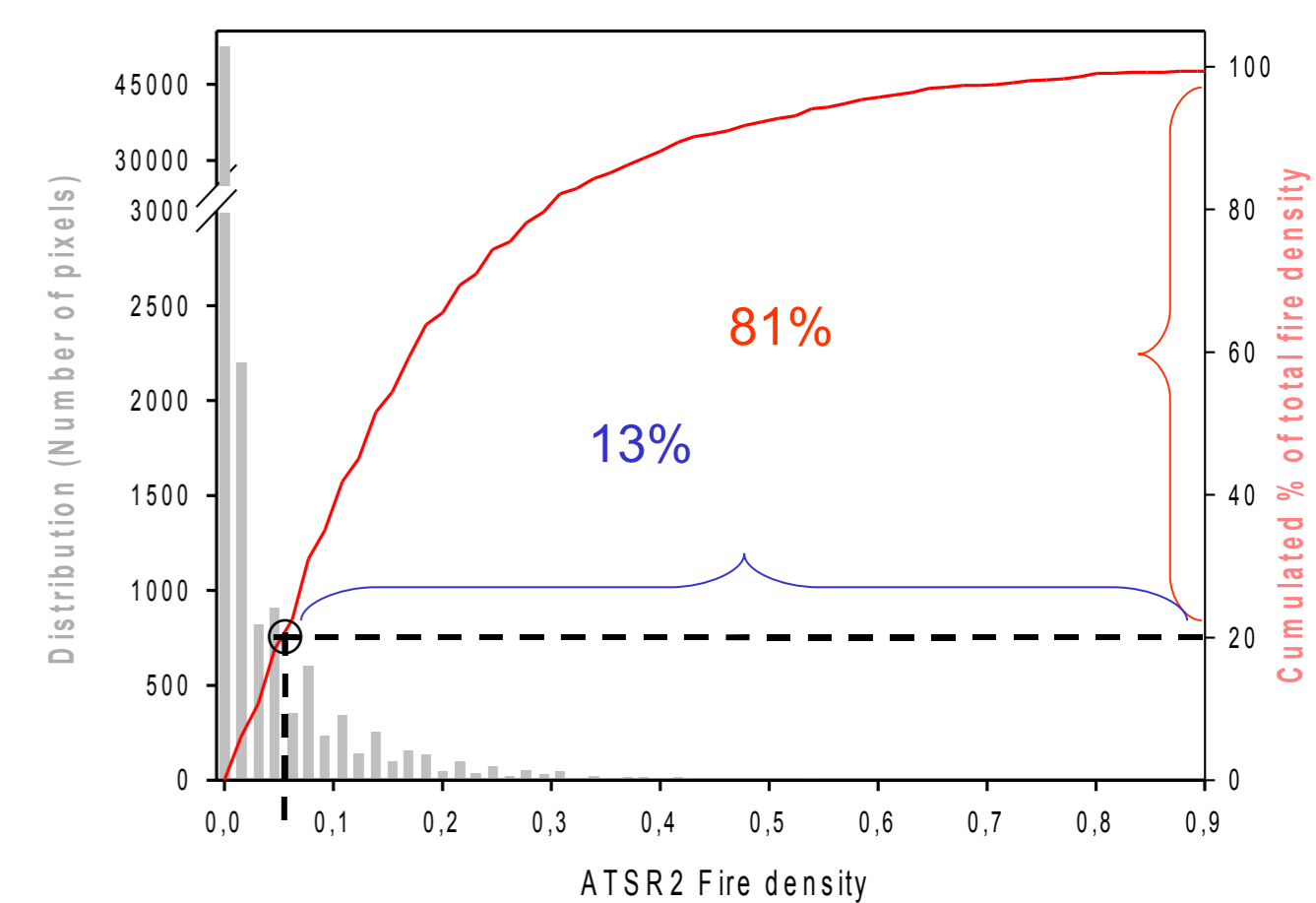
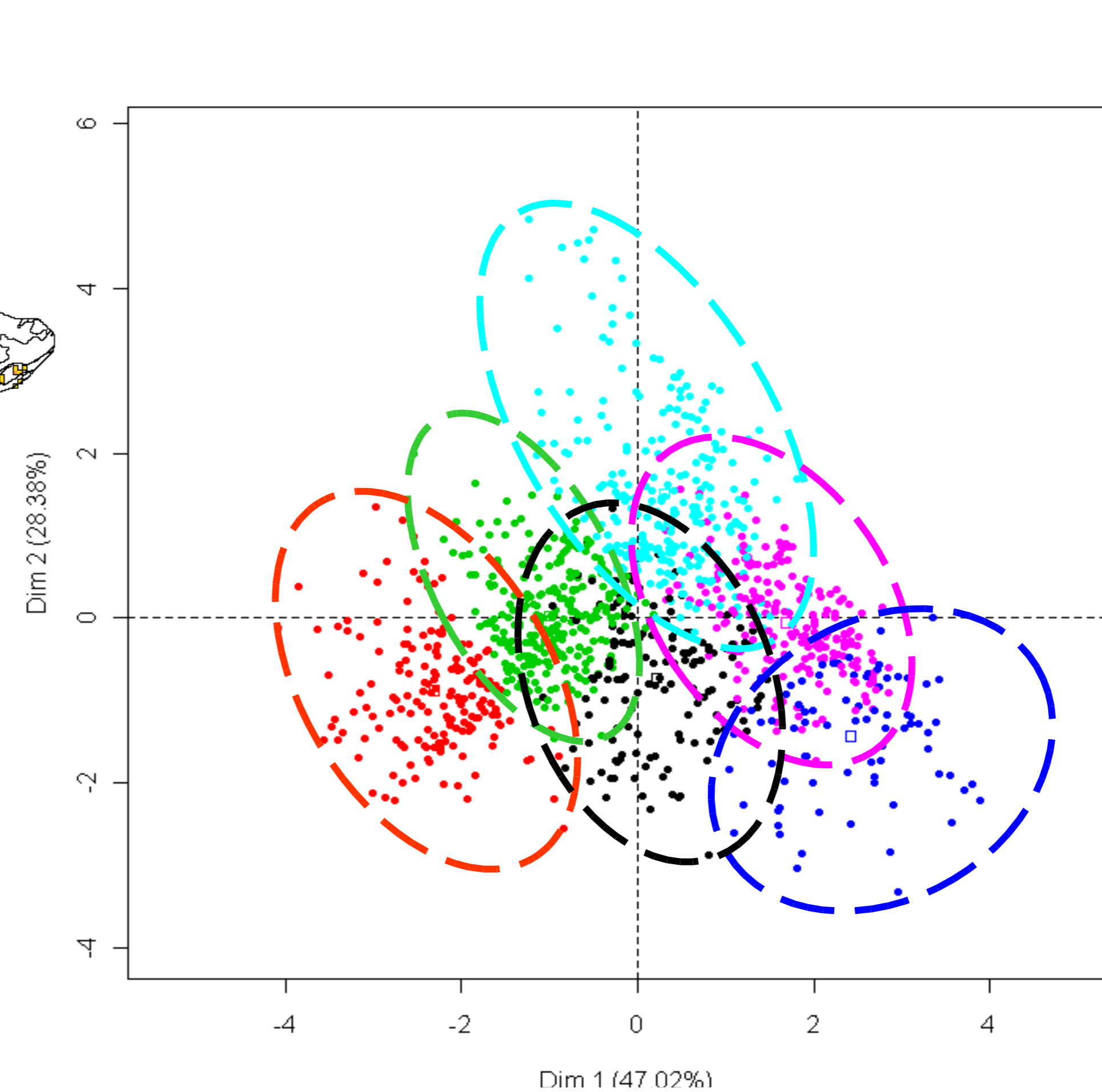


Figure 1: Fire density threshold was chosen in order to have total patches surface account for less than 15% of the LPB but more than 80% of the fire density

Results and Discussion



	Dim 1	Dim 2
Cropland density	+0.7862	-0.2925
Forest density	-0.8950	-0.4058
Grassland density	+0.5443	+0.7702
Population density	+0.6835	-0.4352
Distance to cities	-0.4103	+0.6213

Figure 3: Fire patches clustered in 6 agro-ecological landscapes, represented on the two first components of a PCA (47% and 28% of total variancy). According to their structure (table above) they can be interpreted as :

-Dim 1: positive values are highly populated and cropped whereas negative values present high percentage of tree cover and dispersed city centers.

- Dim 2, positive values have high grassland density and few city centers while negative values have mixed landcovers and moderate population.

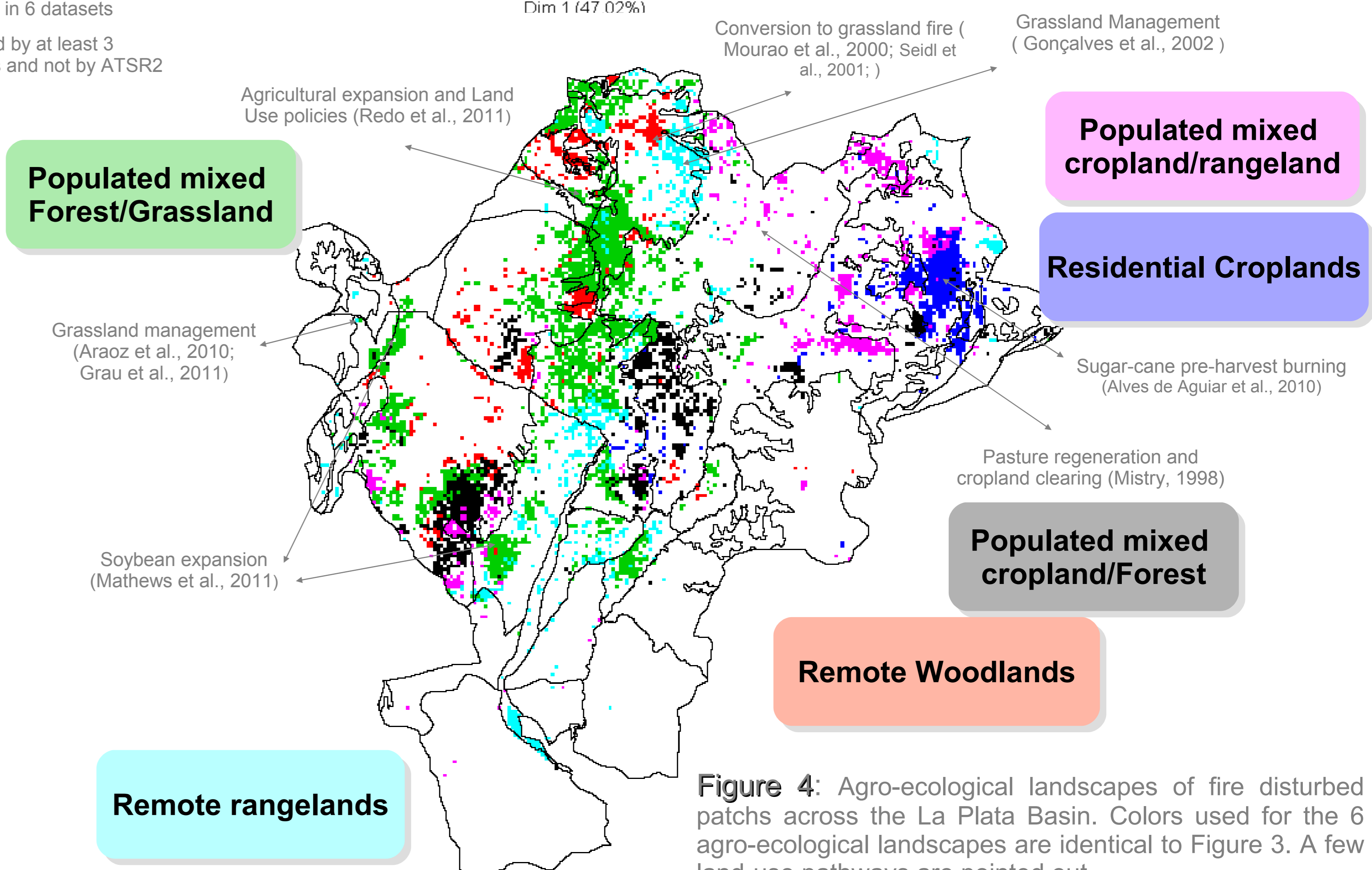


Figure 4: Agro-ecological landscapes of fire disturbed patches across the La Plata Basin. Colors used for the 6 agro-ecological landscapes are identical to Figure 3. A few land-use pathways are pointed out.

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