SOUTH AMERICAN CHACO
FIRES, LAND-USE AND CLIMATE

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Overview

Wildfires play an essential role in the bio-geophysical cycles of different world ecosystems, from dry savannas to humid wetlands. During the last decades, fire regimes of several global regions began to present significant alterations due to climate change and human land-use pressure. The South American Gran Chaco ecoregion contains one of the most important reservoirs of native forests and biodiversity in the world, including the largest continuous dry tropical forest and some of the most extensive wetlands.

In this work, we used Earth Observation products over the South American Chaco and over the last 20 years to assess the seasonality and frequency of fires, identify the main land cover types impacted and analyze links with climate variables.

Materials

Product	Period	Resolution
ESA CCI MRLC (Medium Resolution Land Cover)	1992 – 2019	300m – yearly
ESA CCI Fire 5.1	2001 – 2019	250m – monthly
W5E5: ERA 5 bias-corrected	1979 – 2019	0.5° – daily

The South American Chaco

A huge region with a major carbon stock. Vastly threatened. Largely understudied.

- Area: 1,080,532 km^2
- 25% of the European Union surface
- Much less known than the Amazon
- Fire prone forests, savannas and wetlands

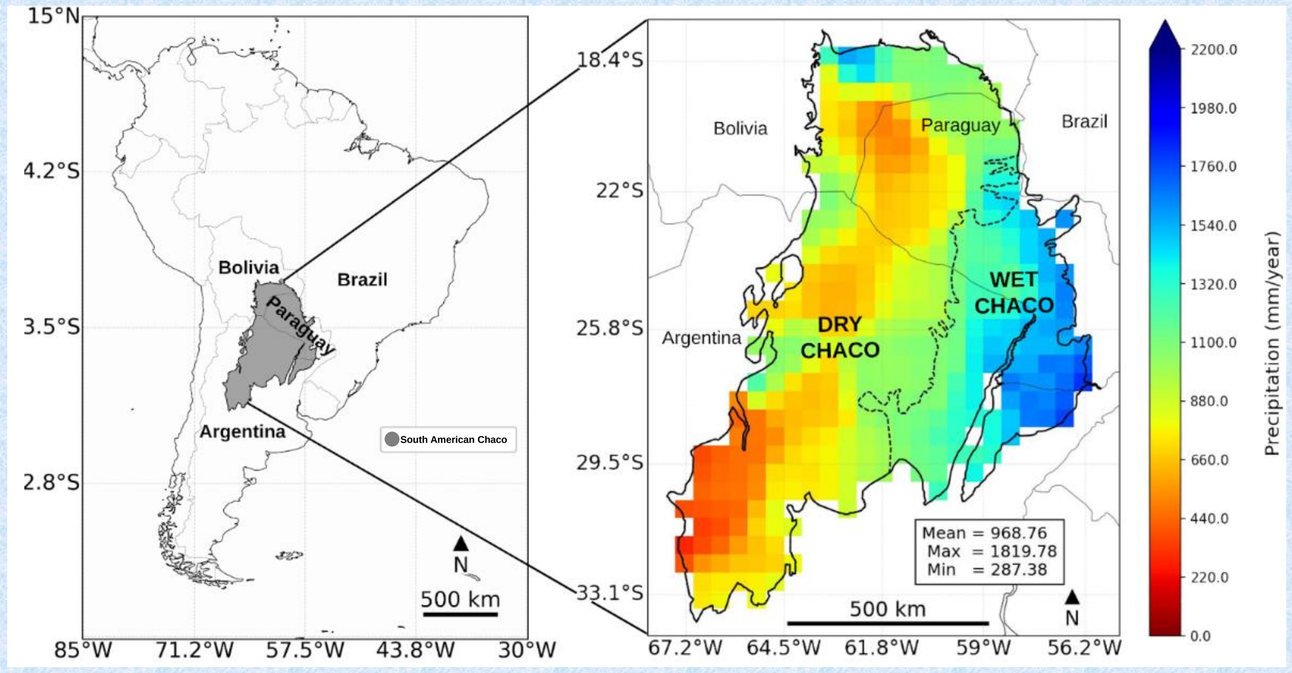

Fig. 1: Left: South American Chaco location. Right: ERA5 bias-corrected (W5E5 product) mean annual precipitation map 2001-2019.

Fires and Land Cover Change

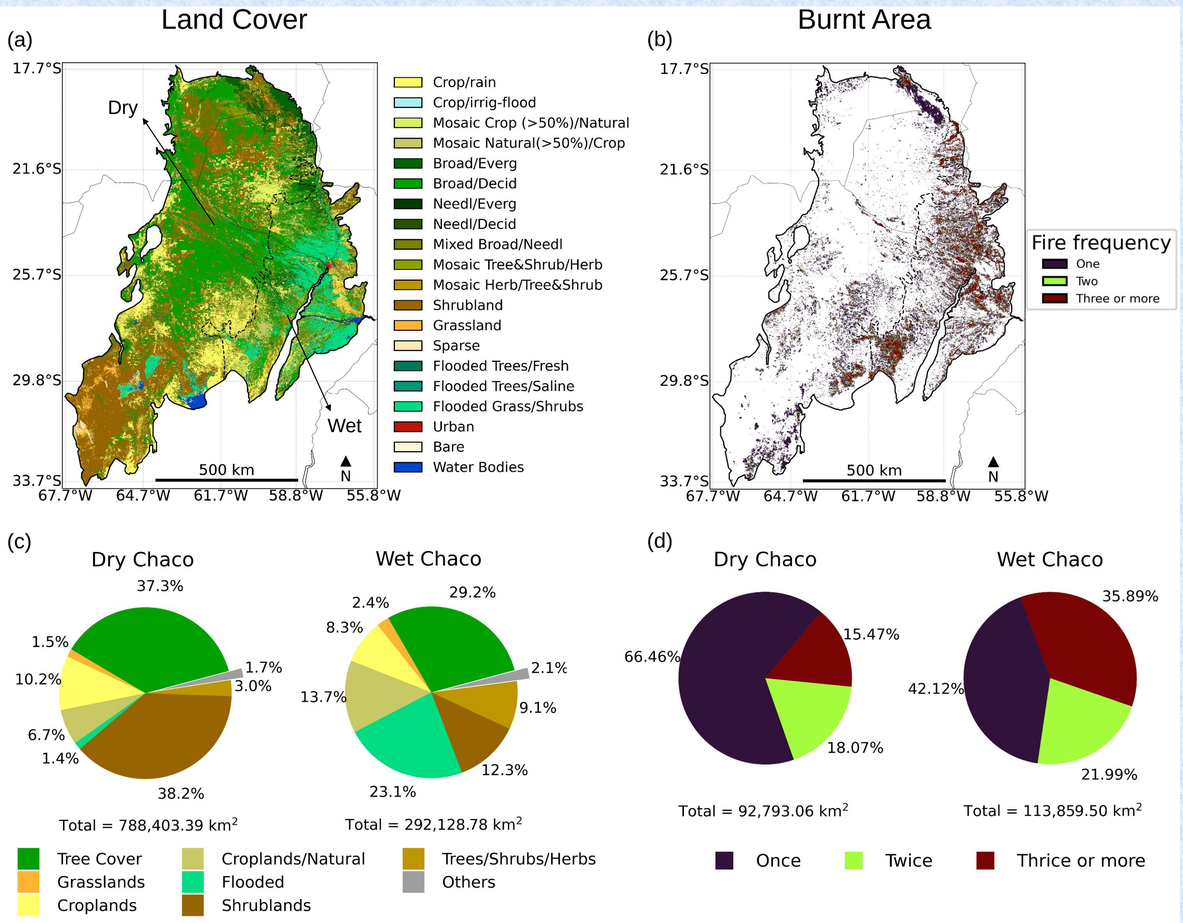

Fig. 2: Left: ESA CCI MRLC land cover map for 2019 (a) with pie charts showing major LC classes in each subregion (c). Right: ESA CCI Fire total fire detection map for the period 2001-2019 (b) with pie charts for each subregion (d).

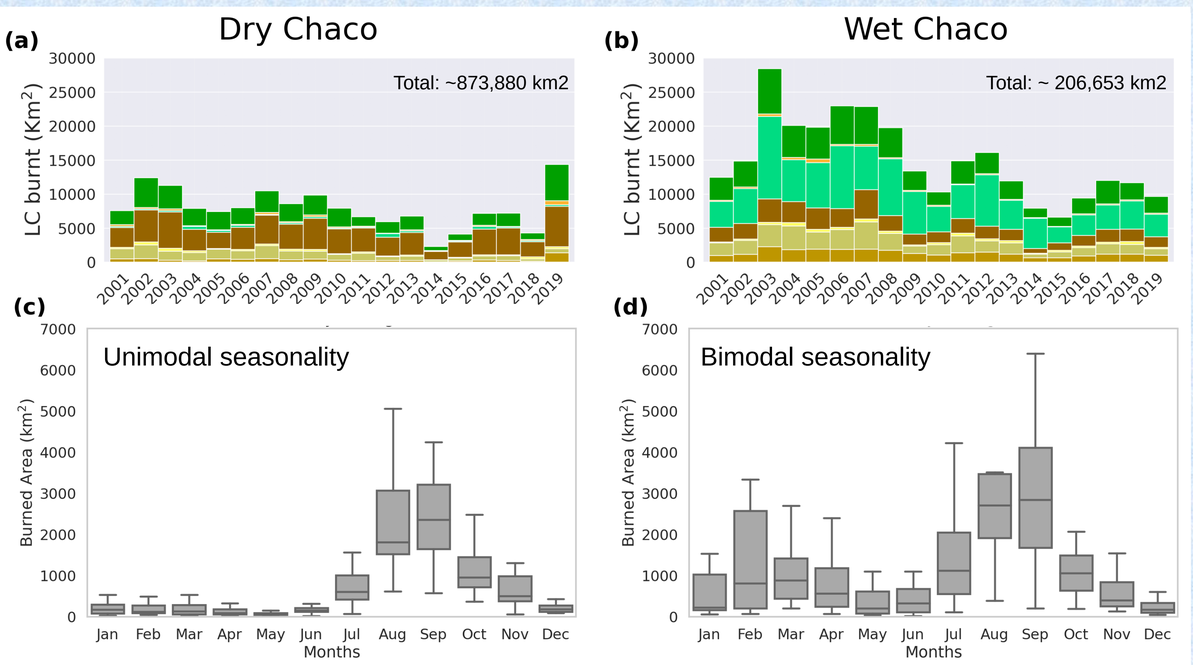

Fig. 3: (a,b): Absolute annual burnt area (km^2) for the Dry (left) and the Wet (right) Chaco, colored by the land cover type. (c,d): Mean annual cycle of burnt area (2001-2019) for the Dry (left) and the Wet (right) Chaco.

Fires and Rain

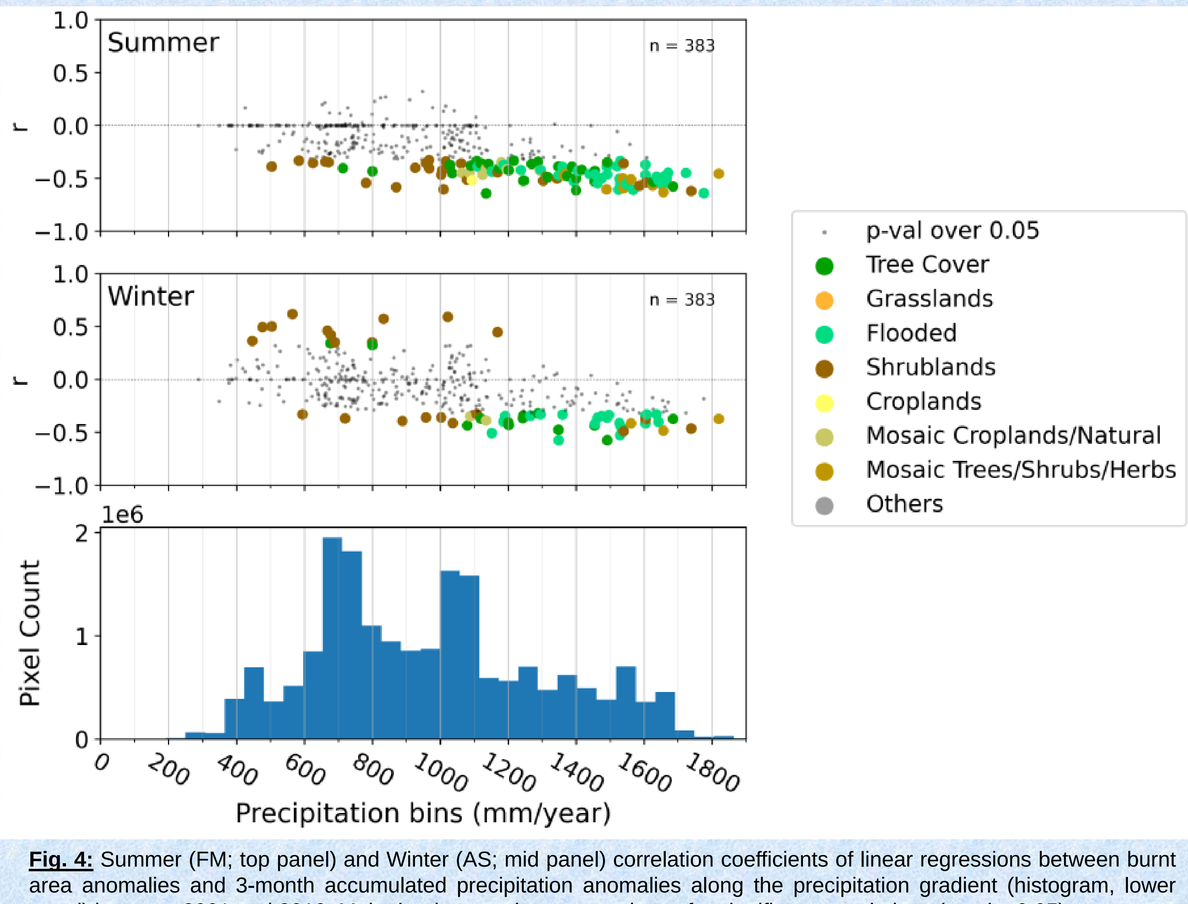

Fig. 4: Summer (FM; top panel) and Winter (AS; mid panel) correlation coefficients of linear regressions between burnt area anomalies and 3-month accumulated precipitation anomalies along the precipitation gradient (histogram, lower panel) between 2001 and 2019. Major land cover classes are shown for significant correlations (p-val < 0.05).

Both winter and summer correlations were stronger in the Wet Chaco.

We detect a change in correlation slopes from null or positive in dry areas (0-800mm) to negative in wet areas (800-1850mm).

Wet areas become more sensible to rain in summer (wet season). Specially observed in floodplains and wetlands, where during droughts the herbaceous vegetation dry out and becomes highly flammable fuel.

In dry areas, precipitation may not have such major impacts on fires, or it could have an effect by encouraging vegetation growth that would become fire fuel in the dry season. This is detected mainly over shrublands.

Perspectives

We are working on further analysis on the link between land cover type and biomass on the burnt area, paying particular attention to the harsh drought and severe wildfires affecting the area since 2020.

Next steps involve getting down to the fire scale to understand the key processes and assess the main drivers among climatic and socio-economic variables.