



“Remote Sensing and covariance fluxes to evaluate productivity in buffelgrass (*C. ciliaris*) and subtropical scrub in arid zones of Northwest Mexico”



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Introduction



Fig. 1. Buffel grass in study site “El Churi”

The introduction of exotic species to increase forage is common in the Sonoran Desert (2). In particular, the introduction of Buffel grass (*Cenchrus ciliaris*) has led to changes in large areas of land in the region (1, 4), this grass is considered a serious environmental treat in arid and semi-arid areas where it has been introduced (3). In the present work, we intend to compare carbon flux dynamics, in sites with subtropical scrub and with buffel, using different spatio-temporal scales, in order to analyze modifications, in carbon uptake processes, caused by the introduction of exotic species in desert areas. The productivity of the ecosystems (GPP) can be determined in real time by measuring their carbon fluxes using covariance towers to measure turbulent flows, however their spatial coverage is limited. The use of satellite images would allow greater spatial and temporal coverage, so it is necessary to use and calibrate them using proxies that correlate them with the productivity of ecosystems.

Also, it is important to evaluate how climatic phenomena affect on the productivity of vegetation in arid zones, specifically, El Niño Southern Oscillation (ENSO), which is known that can change the CO₂ dynamics in the Sonoran Desert (5).



Fig. 2. Buffel grass

Objectives

- Describe the ecosystem productivity patterns (carbon sequestration) in buffel grass and subtropical scrub grasslands, using satellite images and eddy covariance flow measurements.
- Analyze vegetation indices and carbon dynamics in buffel grasslands and subtropical scrub.
- Analysis of the relationship between carbon fluxes (GPP) and ENSO.

Methodology

Six study sites: 3 sites with subtropical scrub and 3 sites with buffel grass in “El Churi” (La Colorada, Sonora, Mexico).



Satellite images → MODIS



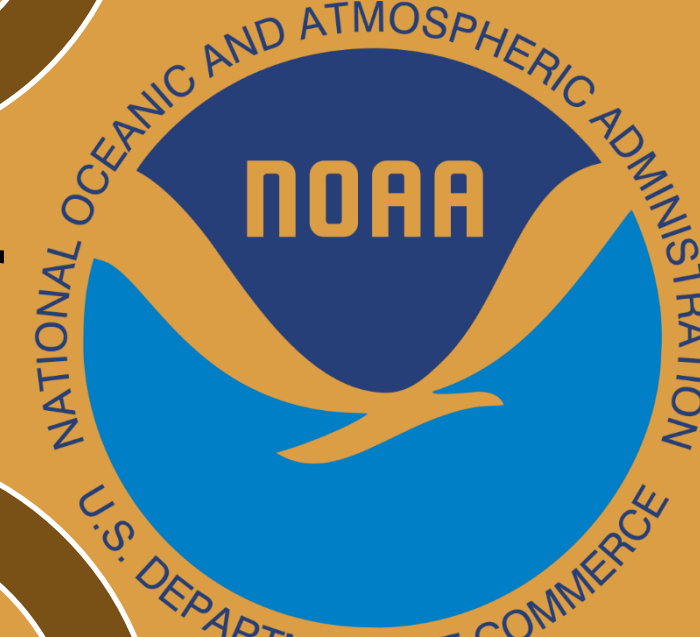
Carbon fluxes → EC towers



Modeling variables

GPP for summer and winter

GPP Differences ENSO phases?



Study Area

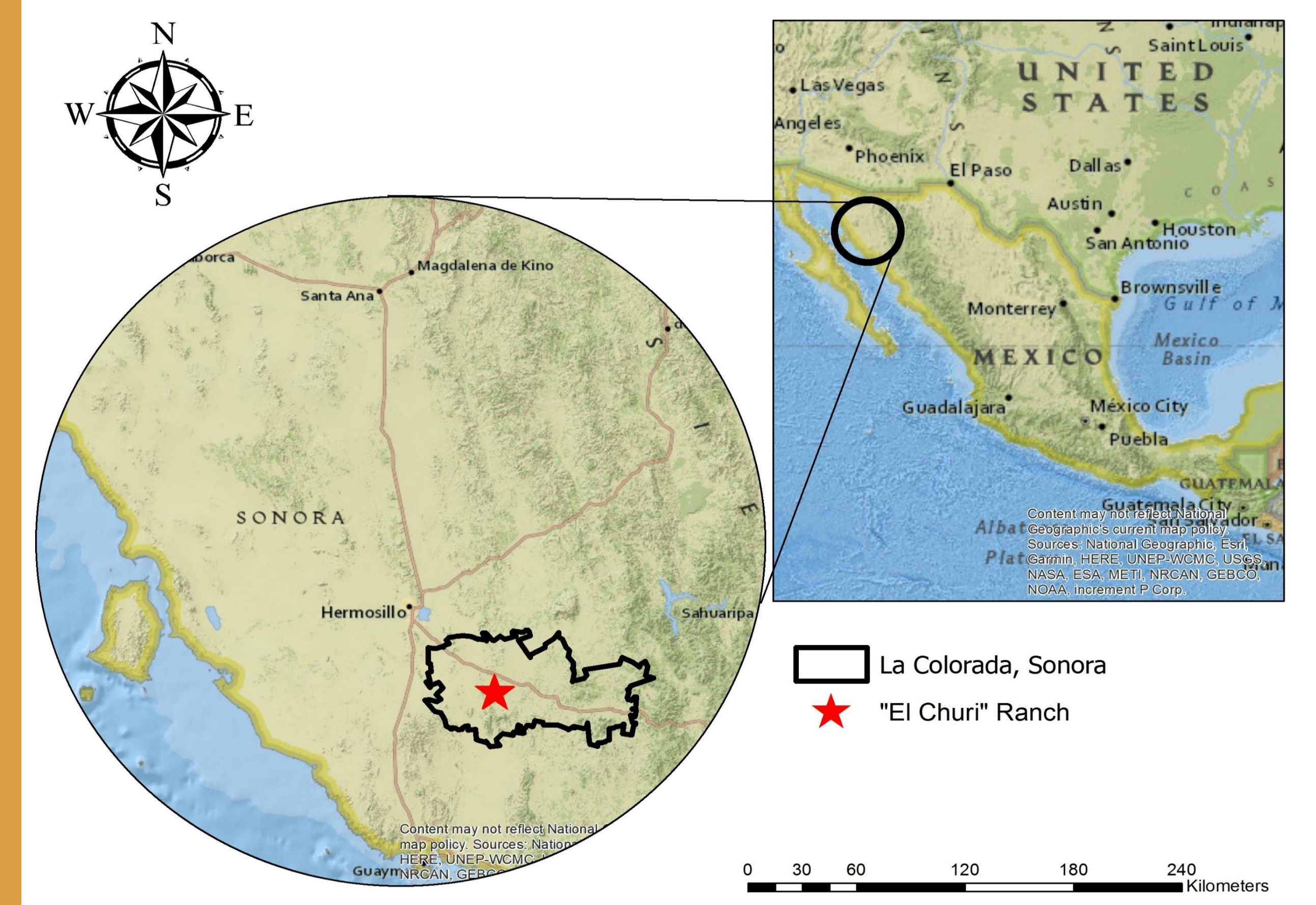


Fig. 3. Location of the study site – “El Churi” in La Colorada

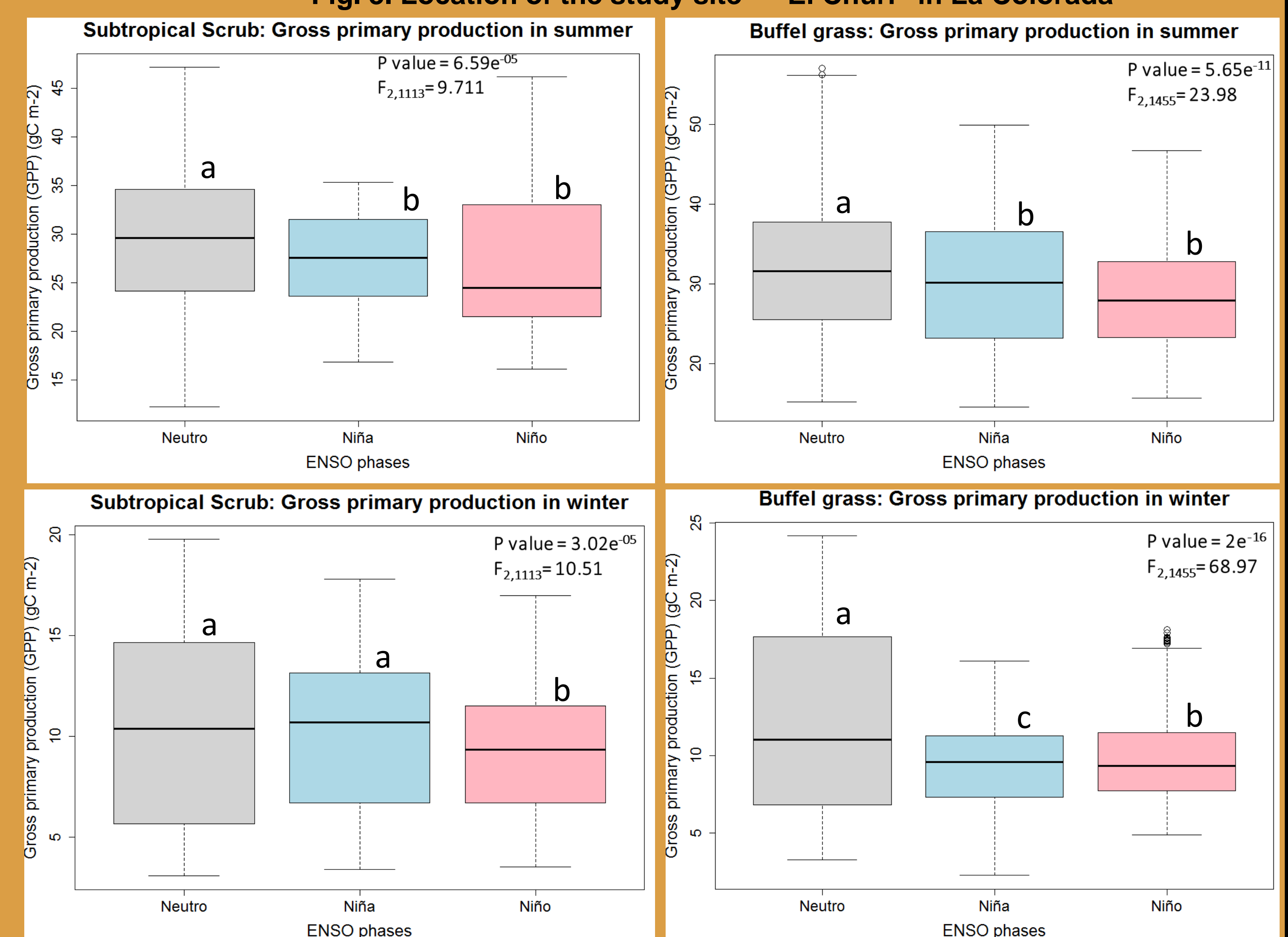


Fig. 5. Gross Primary Productivity (GPP) in both types of vegetation during different ENSO phases on summer and winter.

Results and Discussion

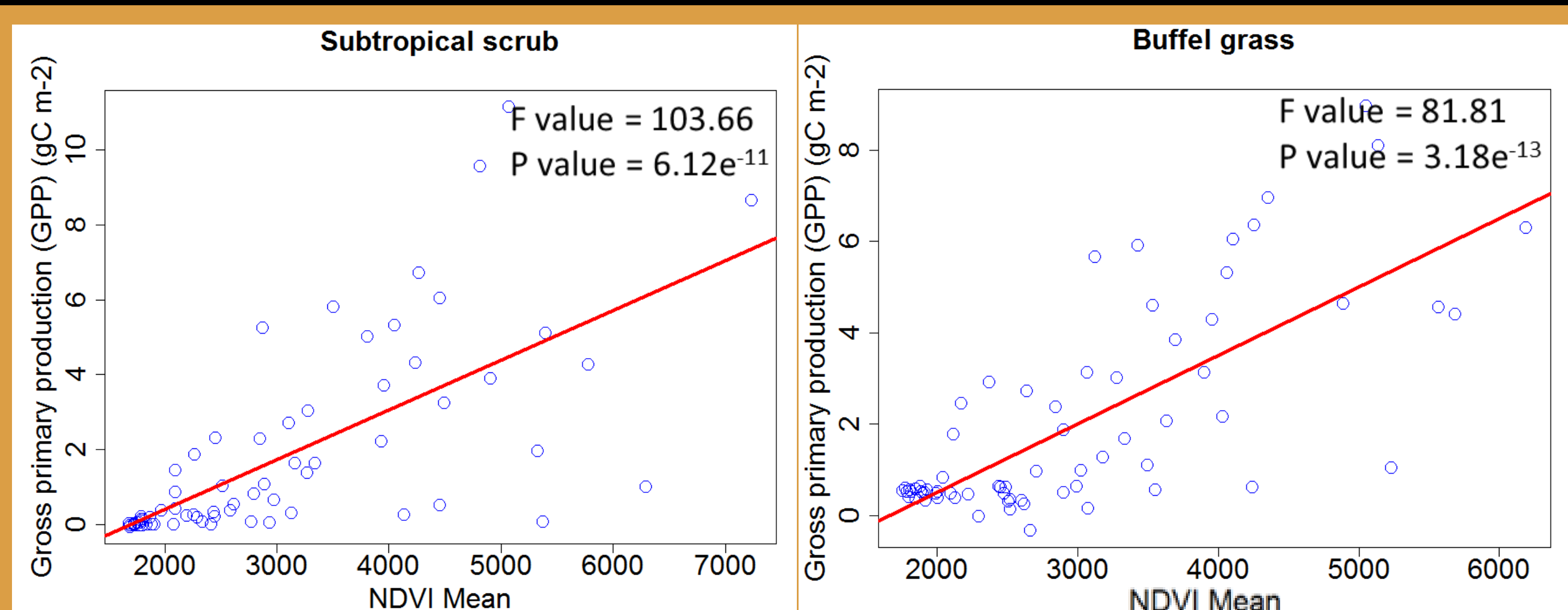


Fig. 4. Gross primary production form flux data (GPP) and NDVI for both types of vegetation.

Gross ecosystem productivity (GPP) and the Normalized Difference Vegetation Index (NDVI) were highly correlated. These analyzes suggest that satellite data can be used to assess productivity at the landscape level, in native an exotic ecosystem (natural grasslands and buffel grasslands) of the semiarid Central region of Sonora.

We also found higher values of GPP in the presence of “Neutral phases” of ENSO. This suggests that neutral phases of El Niño present higher values of precipitation, since vegetation productivity in arid and semiarid environments, are expected to be highly and positively correlated with the amount of rainfall.

Conclusions

Our results show a significant correlation between NDVI and data from the Eddy Covariance towers, allowing the development of models to estimate carbon fluxes on large scale in the landscape.

The presence of climatic events, such as ENSO, can alter the ecosystem dynamics and modify vegetation productivity.

Future studies to estimate how carbon dynamics works over the landscape are currently on development, in order to estimate change at the local and regional level.

References

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