Plant Functional Types Identification in the Lower Paraná River Floodplain, Argentina

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Framework and Aims

Large wetlands of temperate South American floodplains are mostly covered by herbaceous plants, which are expected to be adapted to a wide range of water availability and hydroperiods. While few species usually dominate at any particular location, at landscape and regional scales there is a large number of plant species, probably with functional redundancy.

Plant Functional Types (PFT) relying on a shared set of key structural and functional traits, promise to be a tool to assess wetland environmental conditions. Besides traditional vegetation surveys and phytosociological descriptions, this approach may synthesize the complexity of wetland plant communities with less emphasis on taxonomy.

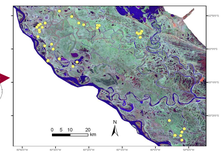
Aims

a) To identify PFTs within the herbaceous plant communities of the Lower Paraná floodplain, a freshwater temperate wetland dominated by emergent macrophytes.

b) To evaluate the association between dominant PFTs and environmental conditions determined by geomorphic setting, topographical position and soil features.

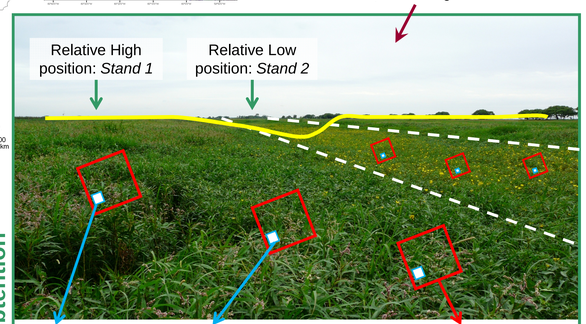
Methodology

Study Area



47 study sites at the Lower Paraná River Floordplanin, stratified at the **geomorphic settings:** Delta lobes (post-holocenic transgression), Levees and crevasse splays of the main channel, Scroll bars and in-channel levees, Islands of the main channel,Beach ridges

Data Obtention



Aerial Biomass

Soil samples – 2 layers pH, electrical conductivity, nitrogen, phosphorus, organic carbon, %sand %clay, %lime.

3 censuses per stand (cover-abundance estimation) Dominant species identification

5 individuals were collected from the dominant plant population

Traits measurement

In-situ measurement:

1) Graminoid herb (binary)
2) Photosynthetic stems (binary)
3) Hollow stems (binary)
4) Plant height (cm)
5) Maximum basal stem diameter (cm)
6) Number of leaves
7) Number of stems
8) Mean leaf thickness (mm)
9) Mean SPAD (Chlorophyll Meter units)

Measured in laboratoty with in-situ harvested material:

10) Leaf area (mm^2)
11) Leaf perimeter (mm)
12) Leaf dissection index (Per/√Area)
13) Specific leaf area (mm^2/g)
14) Foliar length (mm)
15) Foliar width(mm)
16) Foliar Perimeter/Length
17) Foliar Length/width
18) Total foliar area (mm^2)
19) Foliar Nitrogen (%N of dry weight)
20) Foliar Phosphorus (%P of dry weight)

Data Analysis

Reduction of trait redundancy through correlation analysis

Remaining traits: #3, 4, 8, 10, 13, 16, 19

Matrix
53 dominant plant populations x 8 traits

Cluster Analysis *

Plant populations → **Plant Functional Types**

* Gower distance, Ward aglomeration method

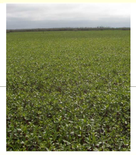
Discriminant Analysis *(What traits better discriminate PFTs?)*

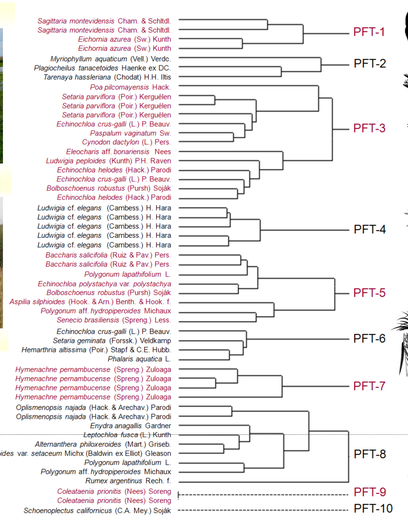
Multiple linear regressions *(How are plants related with environment?)*

Results

The 53 dominant populations (35 species of 10 families, mainly Poaceae, Asteraceae and Polygonaceae) where assigned to **10 Plant Functional Types**.

Traits that better discriminated PFTs were: Plant height, Number of leaves and **Leaf nitrogen content**. These were also correlated with Leaf chlorophyll content (SPAD units), Leaf P content and several structural variables that indicate elongated graminoid leaves.





1. Broadleaf herbs. Few leaves with high area and perimeter. High %P, high SPAD.

2. Broadleaf herbs. Numerous leaves with high perimeter / length relation. High %N.

3. Mainly graminoid herbs. Short plants. Elongated leaves, with high specific area.

4. Broadleaf plants. Numerous leaves, with low dissection index and specific area. High SPAD.

5. Tall plants. High %N, %P and SPAD.

6. Graminoid herbs. Hollow and photosyntetic stems. Few elongated and thin leaves. Low %N and SPAD.

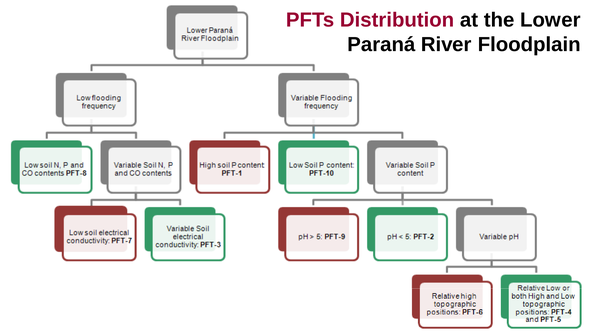
7. Tall graminoid herbs. Hollow and photosyntetic stems. Few leaves with high area. Low %N and %P.

8. Mainly broadleaf herbs. Hollow and photosynthetic stems. High dissection index and specific foliar area. High %N, %P and SPAD

9. Tall graminoid herbs, tussocks. Numerous elongated leaves, with high perimeter and dissection index and low specific area. High total foliar area. High %N and %P.

10. Tall sedges, with photosynthetic stems. High photosynthetic area and high specific stem area. Low %N and %P.

PFTs Distribution at the Lower Paraná River Floodplain



Leaf nutrients content. N and P leaf content could be explained by P content in the first soil layer and plant community biomass. The effect of community biomass on N and P content is different for Poaceae and Not Poaceae plants.

All plants
↑ Soil P content
↑ Foliar N and P content

Not Poaceae
↑ Community biomass
↑ Foliar N and P content

Poaceae
↑ Community biomass
↓ Foliar N and P content

Final remarks

Contrary to our expectations, PFTs distribution was not related to geomorphic settings. However, some PFTs dominated only when flooding frequency was low, and some PFTs were related to particular soil features. In this way, PFTs may serve as biological indicators of soil and flooding features.

Although other authors suggest that belonging to a PFT is a species' feature, we found that populations of the same species may not be assigned to the same PFT (e.g. *Echinochloa crusgalli* in PFTs 3 and 6; or *Polygonum lapathifolium* and *P.* aff. *hydropiperoides* both in PFTs 5 and 8). We suggest that different populations of the same species may vary on their traits' values following environmental features.

This work is the first attempt for identifying PFTs for the Lower Paraná River Floodplain, and is one of the few PFTs examples in temperate freshwater wetlands.

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