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Nitrogen cycling in tropical pastures in the Northwestern Amazon

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1. Introduction

Unfertilized **grass monocultures** with extensive grazing management dominate pastures in Colombia's Caquetá region. These practices contribute to significant **nutrient losses**, particularly nitrogen (N), which result in **pasture degradation** and a decrease in pasture productivity. After pastures degrade, opening of new grazing areas is usually done by **forest slash and burn**.

Pasture's N supply could be improved by the inclusion of **legumes** in pastures [1,2] or grasses with the capacity of **biological nitrification inhibition** (BNI) [3].

Understanding soil N cycling is key to develop strategies that improve sustainability of Amazon pastures' management.

Figure 1. *Urochloa* pasture in the Caquetá region, Colombia

2. Objective

To quantify major soil N fluxes in *Urochloa*-based farmers' pastures in the northern Caquetá region of Colombia.

3. Methods

We evaluated plant biomass production and soil N transformation rates in the following pasture treatments:

- *Urochloa humidicola* grass alone (GA) and grass-legume (GL)
- *Urochloa decumbens* GA and GL
- *Urochloa brizantha* GA and GL

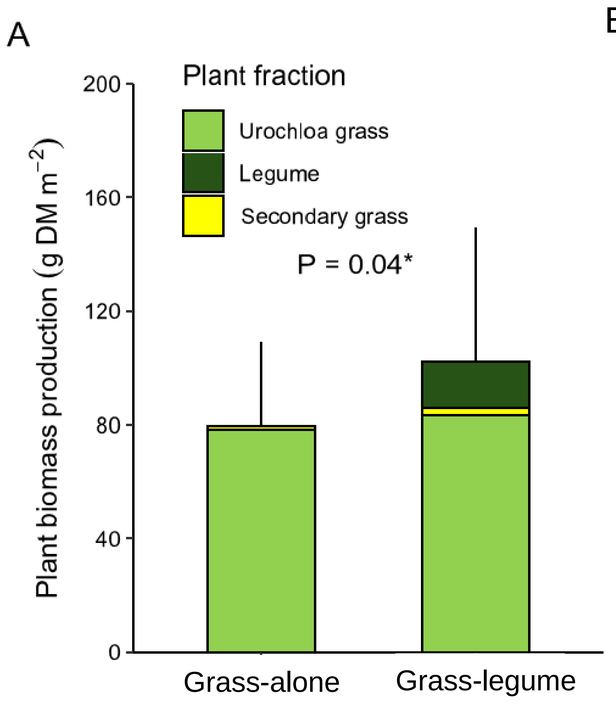
BNI capacity: *U*. *humidicola* > *U*. decumbens > *U.* brizantha [4]

Laboratory incubation:

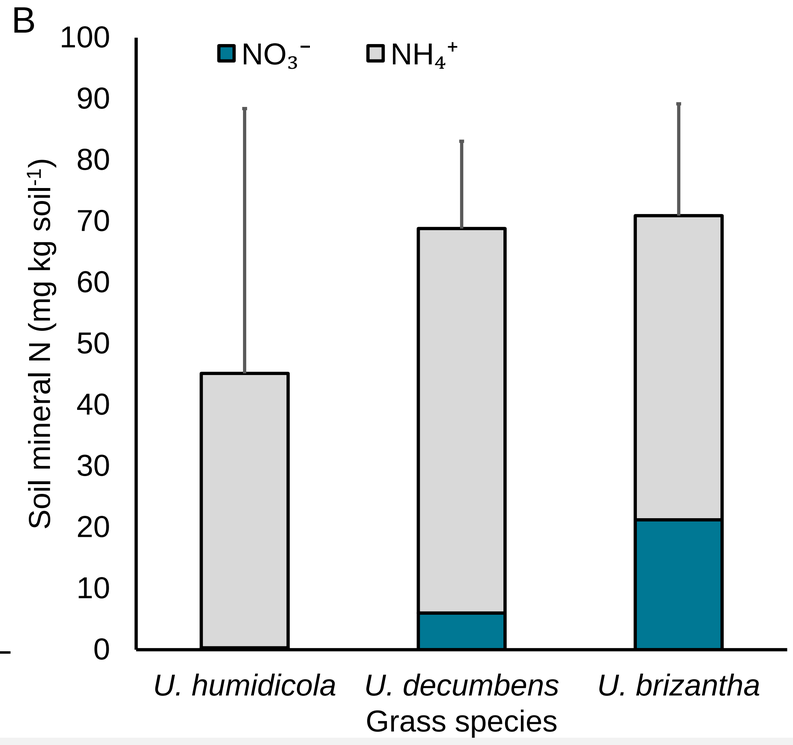
- Soil incubation for 96 h at 25°C at 60% of soil water-holding capacity.
- ^{15}N pool dilution method for gross N fluxes determination [5].

4. Results and discussion

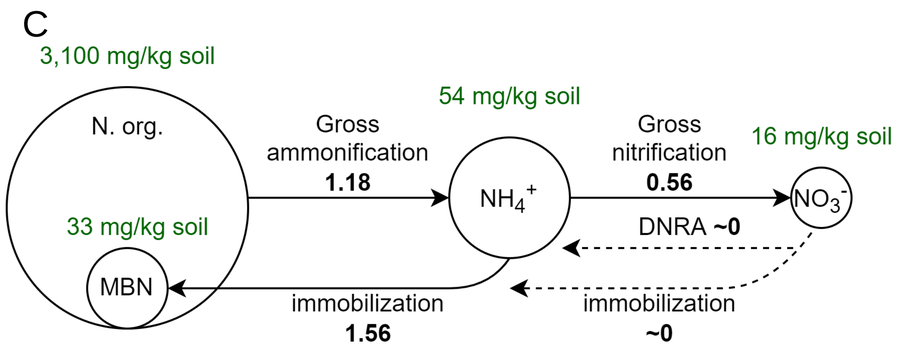
Plant biomass production was 30% higher in grass-legume (GL) than grass-alone (GA) pastures.



Nitrate (NO_3^-) was a more relevant form of soil mineral N in *U. brizantha* pasture soils compared to *U. humidicola* and *U. decumbens.*



Soil ammonium consumption (NH_4^+ immobilization + gross nitrification) exceeded ammonification in all pasture soils, indicating **net removal of NH_4^+** from the soil solution during laboratory incubation.



Gross nitrification rates tended to be **lower in *U. humidicola*** and *U. decumbens* compared to *U. brizantha* pasture soils.

Microbial NO_3^- immobilization was detected only in grass-alone (GA) pasture soils but not on grass-legume (GL) soils, which favored **higher net nitrification in GL soils**

5. Contribution to sustainable food systems

Mixed pastures of grasses and legumes provide a more sustainable pasture management strategy for the Amazon region compared to grass monocultures. **Legumes improve the N supply**, maintaining primary productivity and **avoid pasture and soil degradation**.

If N supply does not match the plant demand, higher NO_3^- in soils as observed in *U. brizantha* would indicate **risk of N losses via leaching to groundwater or gaseous emissions**. Further research is needed to elucidate the effect of pasture composition on N losses and N use efficiency in the Amazon region.

6. References

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