



INMS Component 3: Developing regional assessments of nitrogen management

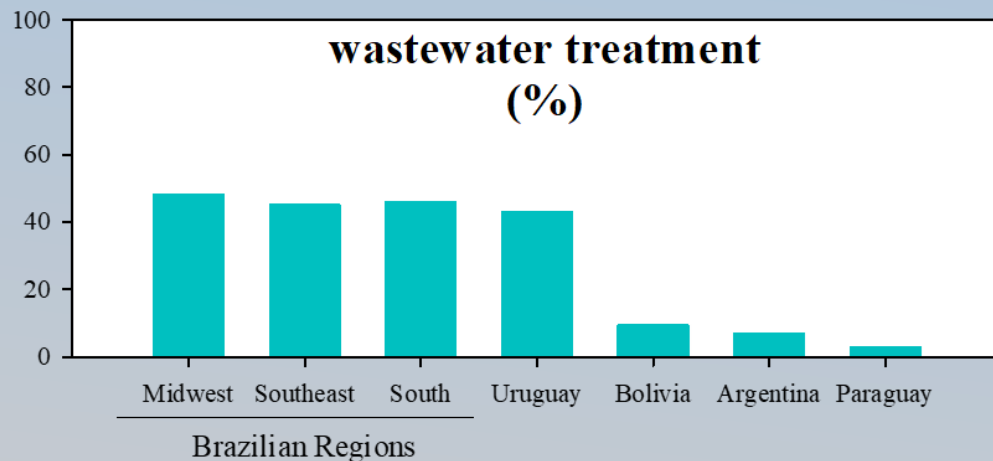
Latin America Demo region – La Plata Basin
Jean Ometto, Felipe Pacheco, Camille Nolasco

Latin America Group: Carla Reis, Cleto Kaveski, Gabriela Bielefeld Nardotto, Gisleine Cunha Zeri, Heitor Cantarella, Jalusa Palandi, Joao Paulo Sena Souza, Karina Lima Tôsto, Luciene Gomes, Luiz Antonio Martinelli, Marcela Miranda, Marco Antonio Nogueira, Mariana Almeida, Nestor Mazzeo, Piñeiro Gervasio

INMS-5 Meeting

1. Context of the region

- *Too much and too little nitrogen* - Relevant social/economic questions: pollution, agriculture (fertilizer use, food / biomass production), ecosystem services.
- The impacts of land use and land cover changes, urbanization and climate extremes in the nitrogen cycle, are issues still demanding deeper understanding in Latin America.
- In general, about 30% of the domestic wastewater in the region is treated and about 8% of the population has no access to sanitation;



- *Non-sustainable* agricultural practices deplete natural riparian habitats resulting in high sediment and nutrient load in rivers and streams, often causing reduction of flow and eutrophication

Geographic information:

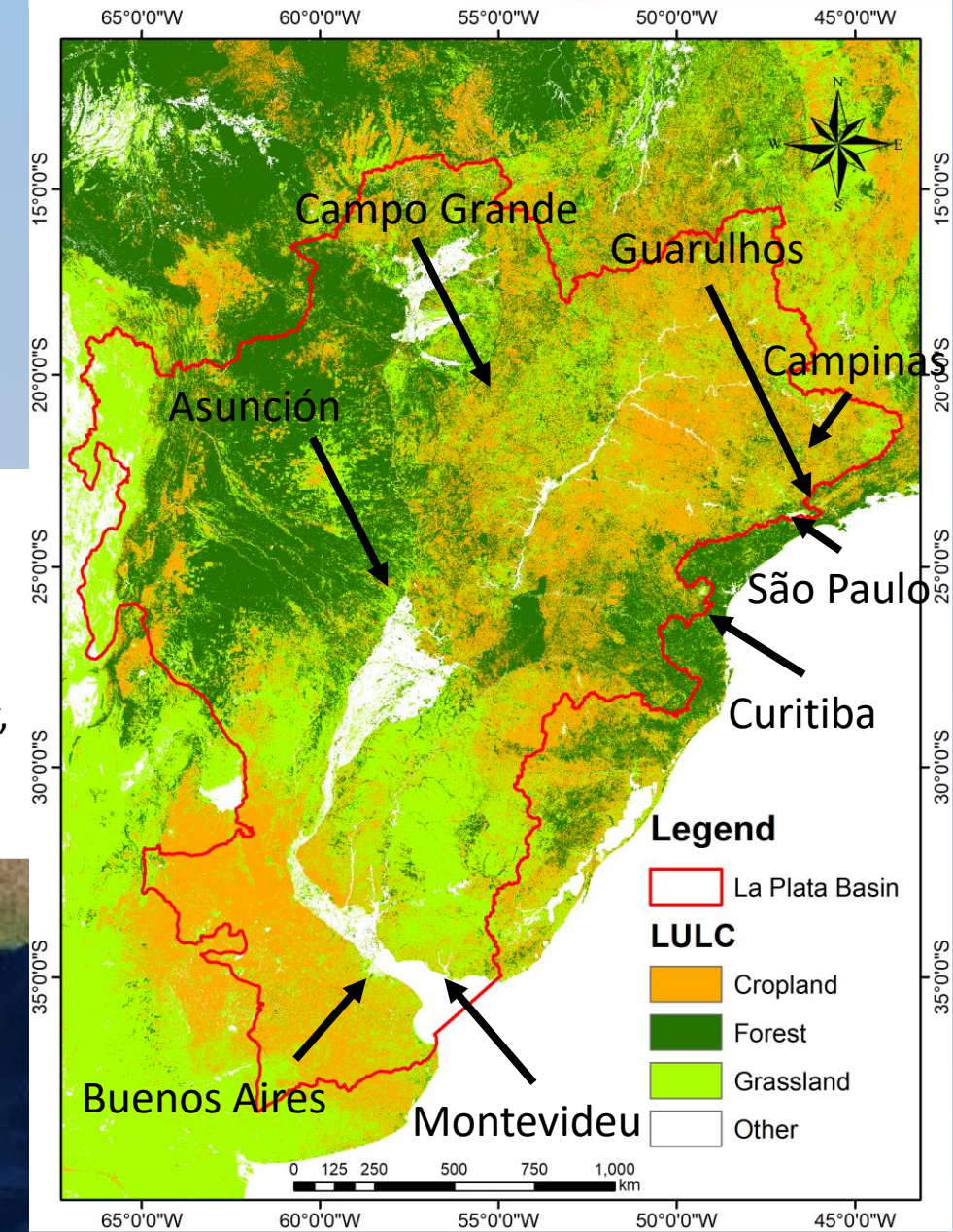
Area: 3.17 million km²

Pop.: 101 million

Countries: Brazil, Uruguay, Argentina, Paraguay and small portion of Bolivia



La Plata Basin

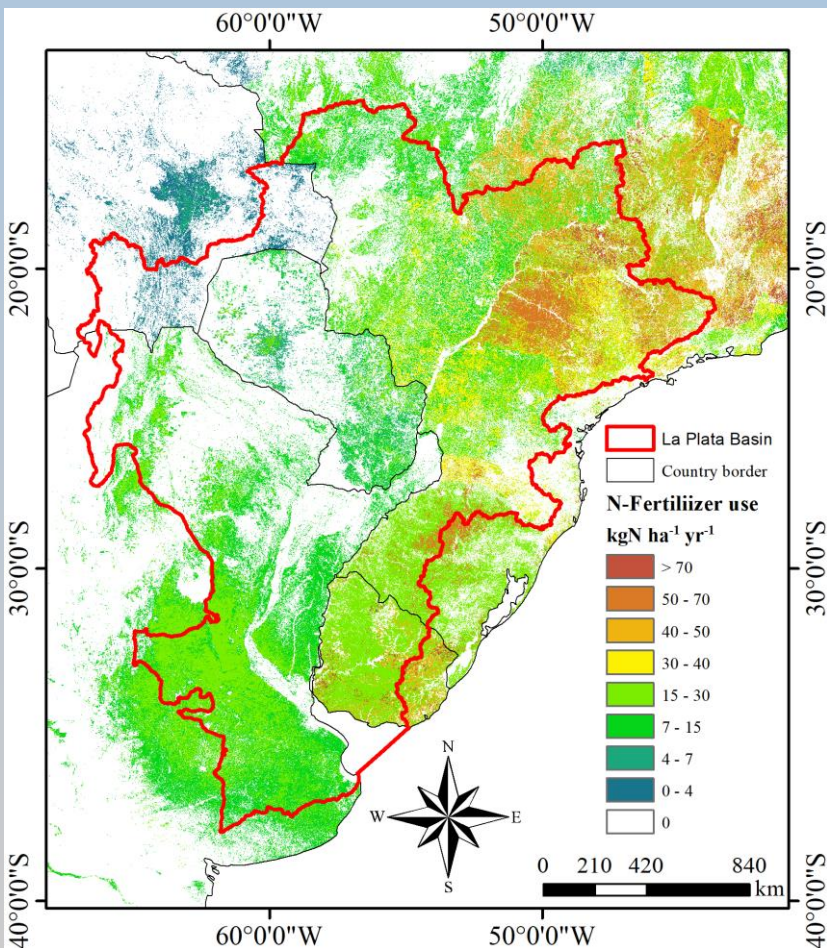


2. N fluxes: Analysis of nitrogen sources and fates, by sector

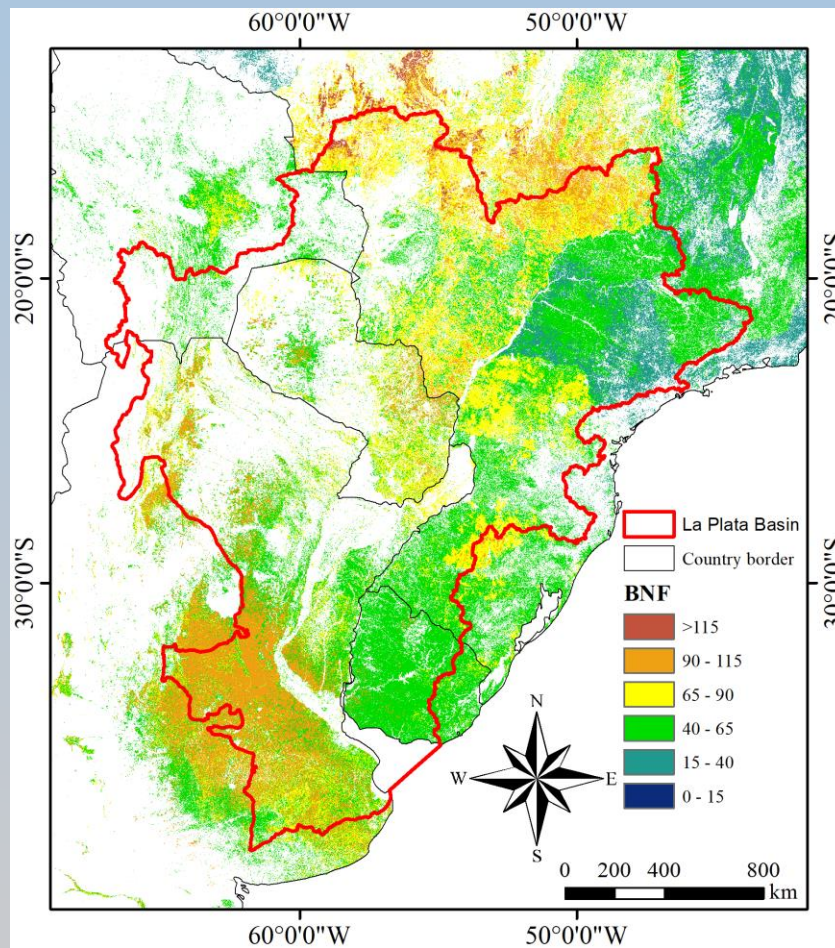
Budget approach – brief overview

Spatially explicit modelling (Year 2010)

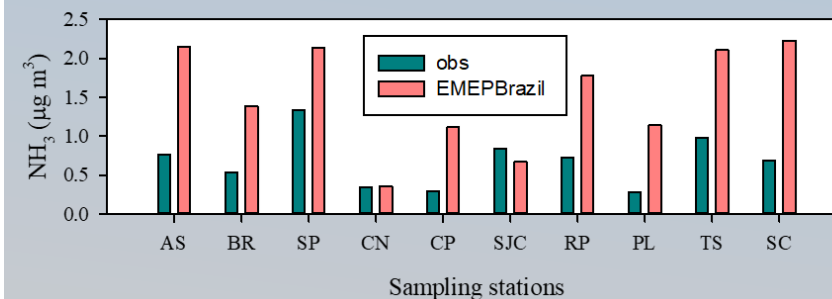
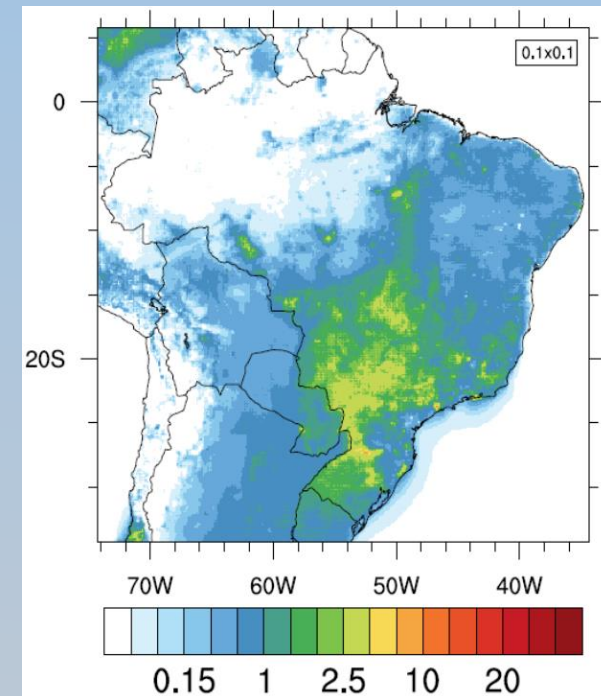
N-Fertilizer use ($\text{kgN ha}^{-1} \text{yr}^{-1}$)



BNF crop and pasture lands ($\text{kgN ha}^{-1} \text{yr}^{-1}$)



Model Results (EMEP-Brazil)
 NH_3 concentration ($\mu\text{g m}^{-3}$)



2. Nitrogen budget: Analysis of nitrogen sources and fates, by sector

Key N flows for the region

- **Agriculture**
 - BNF – Soybean and sugar cane production
 - Mineral Fertilizer – maize, sugar cane, cotton and wheat.
 - N_2O and NO_x emissions, NH_3 volatilization
- **Urban activities**
 - N_2O and NO_x emission from industries and transport sectors

Uncertainties for the region

- Large farms vs small farms (access to technology and technical support);
- No specific initiatives or consistent monitoring program at regional scale to address nitrogen problem and fluxes;
- Agricultural practices, production systems, crop rotation and livestock production;
- No historical data on LULC changes for the entire region.

2. Nitrogen budget: Analysis of nitrogen sources and fates, by sector

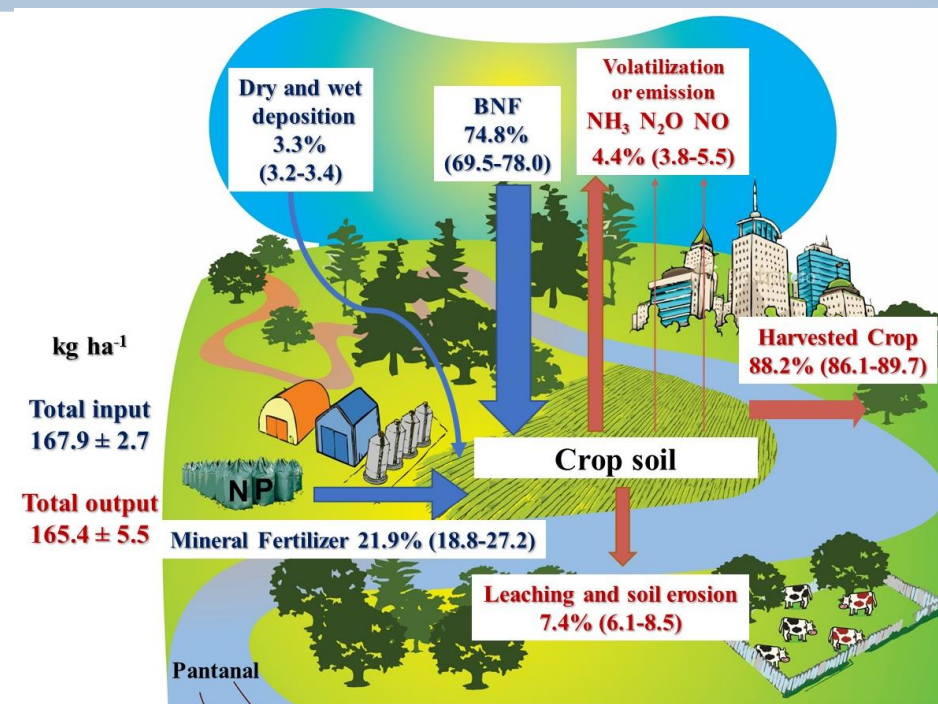
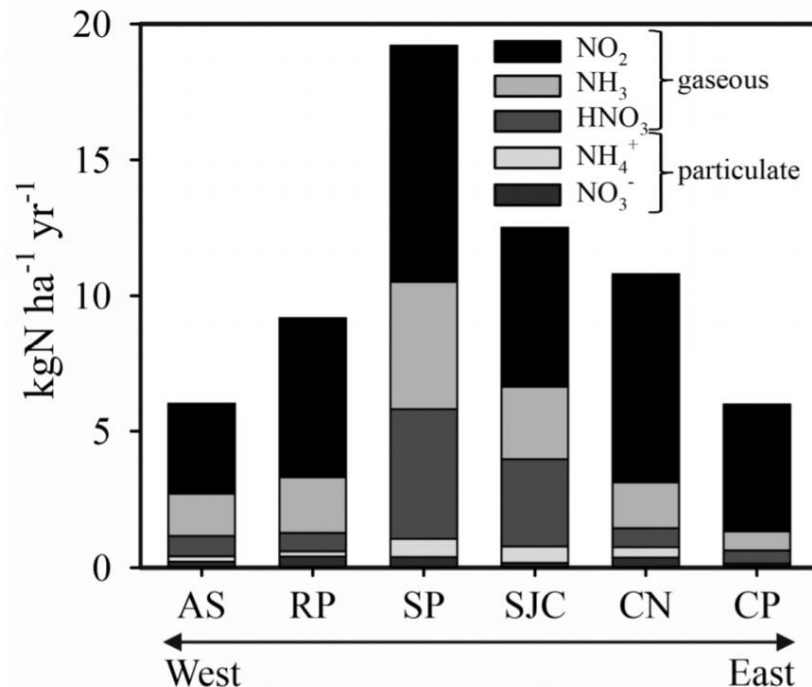
Project published/submitted data based on nitrogen fluxes

Nr Deposition

Souza, M. d. A., Pacheco, F. S., Palandi, J. A. d. L., Forti, M. C., Campos, M. L. A. M., Ometto, J. P. H. B., Reis, D. C. O., and de Carvalho Junior, J. A. (2020), Atmospheric concentrations and dry deposition of reactive nitrogen in the state of São Paulo, Brazil, *Atmos Environ*, 230, 117502.

N budget

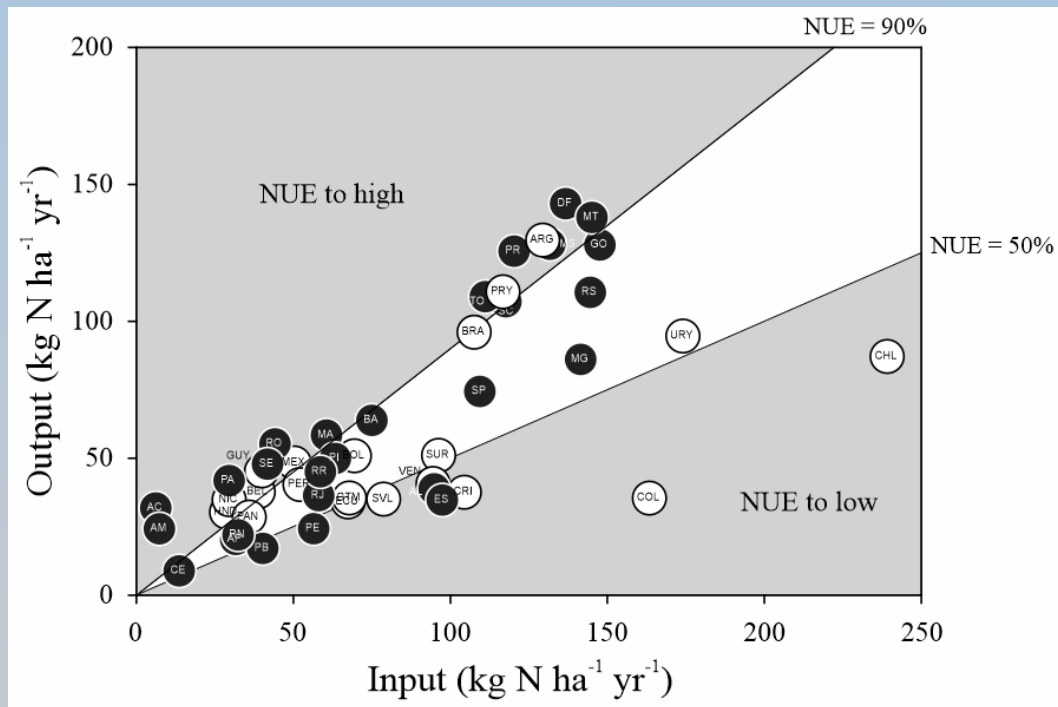
Pacheco, F. S., Ometto, J. P. H. B., Gomes, L., Tôsto, K., Miranda, M., Loverde-Oliveira, S., Pessi, D. D., Cox, C. (submitted). Nutrient balance and use efficiency in agricultural lands in the Vermelho River watershed, Upper Pantanal, Brazil. JGR-Biogeosciences.



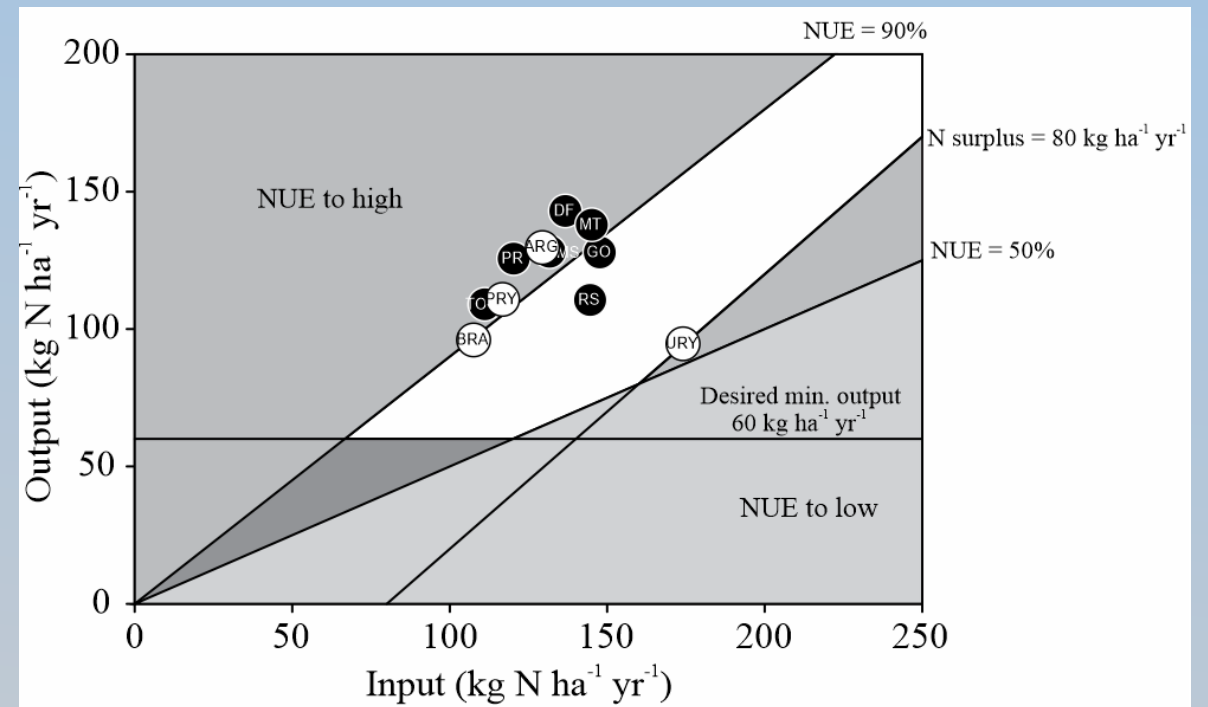
3. Description of region in relation to performance indicators

A policy discussion about the N use in Brazil in the cereal production and related environmental problems.

Regional NUE



NUE where crops with high BNF inputs are predominant (mainly soybean)



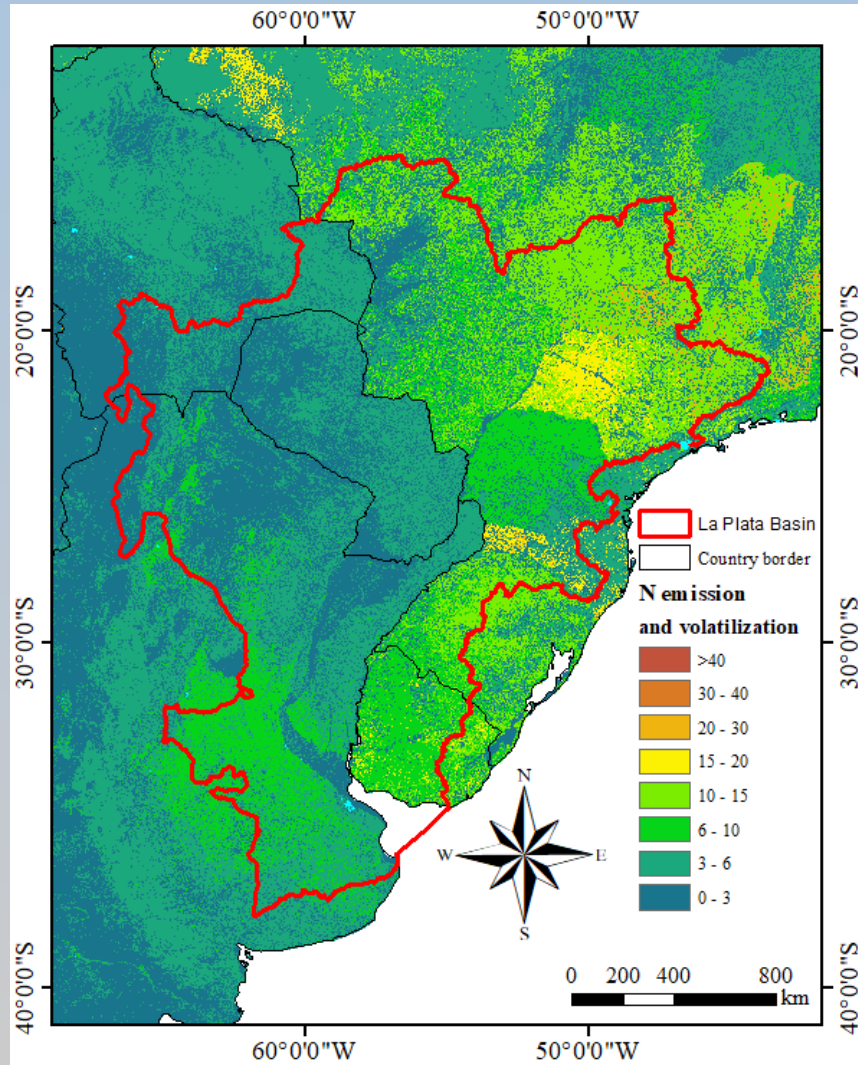
Latin American countries (white circles) and Brazilian states (black circles).

Gomes et al., 2019

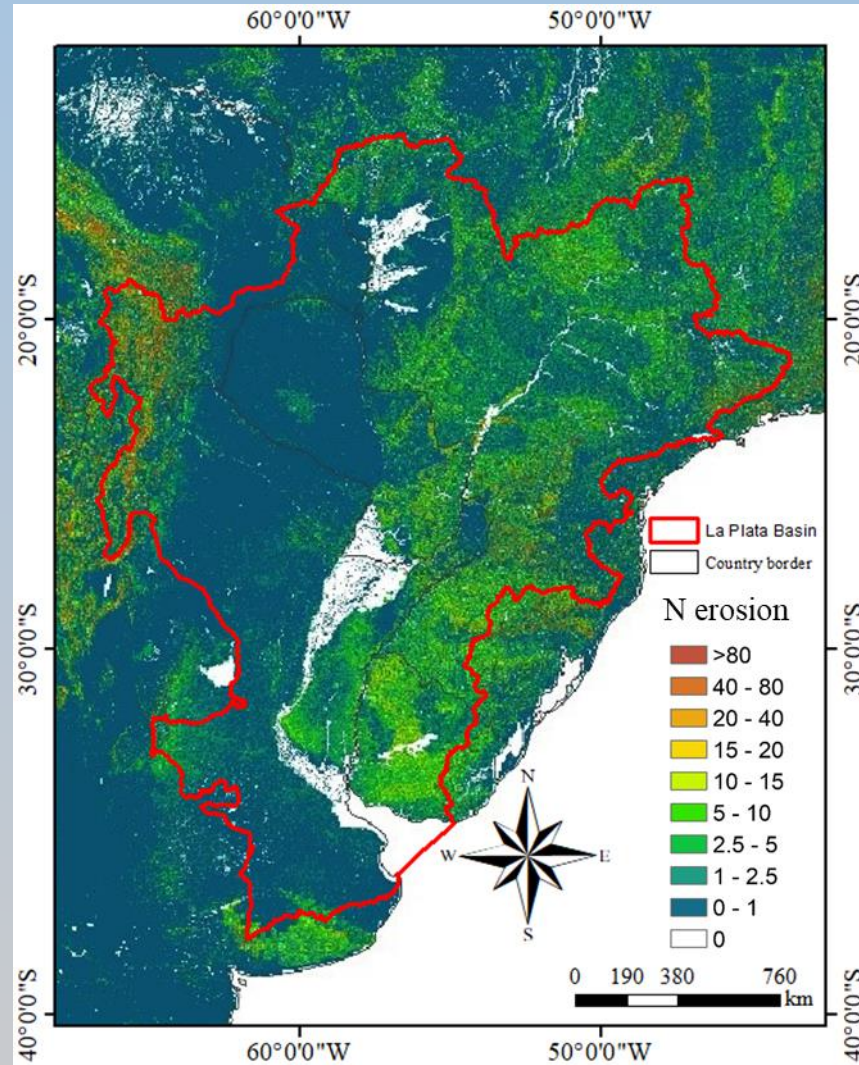
Several places with high risk of nutrient mining or nutrient loss that may put at risk the long-term agricultural sustainability

3. Description of region in relation to performance indicators

N (NH_3 , NO_x , N_2O) loss by volatilization/emission ($\text{kgN ha}^{-1} \text{yr}^{-1}$)



N loss by erosion ($\text{kgN ha}^{-1} \text{yr}^{-1}$)



Severely eroded areas loses 13.2 to 25.9 times more nitrogen in Brazilian Cerrado.

Gomes et al., 2019

BRAZIL'S Nitrogen Footprint



Objective: Develop the N-Print Concept (Galloway et al., 2010) for Brazil
➔ aligning the research related to nitrogen developed by CCST and partners in the scope of the INMS

(ongoing)

Country-level

N-Footprint for Brazil = release by June 2019

Based on the N-Calculator tool (Leech et al., 2012)

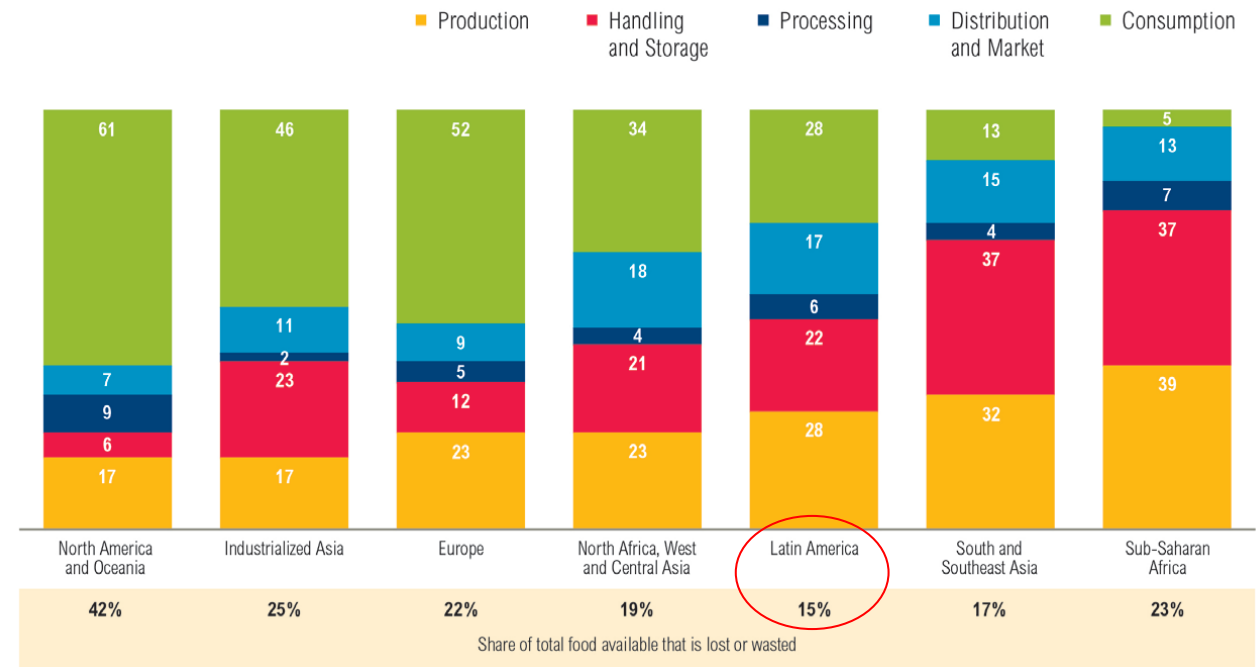
- Data from 5 regions in Brazil

- Communication and outreach
- Development of educational material
- Spatialization of N-Footprint results on Brazilian Territory

(based on Nolasco et.al (2016))

Food Lost or Wasted by Region and Stage in Food Chain, 2009

kilocalories (kcal) lost and wasted along the food chain in different regions



4. Options for, progress in and barriers to better nitrogen management (Tasks 3.1.7-3.1.8/A1.6)

Based on the specificities of the demo sites, highlight current actions for good N management.

Available options related to N

- Organic agriculture; soil management practices;
- Service crops (Ar)
- BR – Forest Code (buffer for aquatic systems)

Success stories

- Advance on tropical agriculture practices (e.g, sugar cane, cattle)
- Feedstock production (pig, chicken, ..)
- Bioenergy and biofuel production (sugar cane, soybean – Brazil, Argentina, Paraguay, Bolivia)

Barriers to change

- Political and economic context (BR, AR);
- Extensive livestock production system: 90% of the cattle are pasture-fed only
- Civil society is weakly represented where it is present, it frequently focuses on water quality and availability.

Questionnaire

- Translated to Portuguese.
- Waiting for feedbacks

5. Future look (Interaction with Activities 1.5/2.1)

Key three-scenarios of N management for the region

- Improvement wastewater management.
- Intensification of livestock production system and improve pasture management.
- Avoid the conversion of natural habits (agro-system pressure)

Interaction with modelling groups

- Potential use of IMAGE (e.g., soil N budget) and GLOBIO outcomes
- Previous experience with GLOBIO in the region(IPBES Americas chapter)

ACTIVITY 3.1 – LATIN AMERICA DEMONSTRATION SITE

LA PLATA BASIN

Thank you!!

