Nitrogen cycling in Brazilian tropical forests and savannas: an isotopic approach

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LBA
EXPERIMENTO DE GRANDE ESCALA DA BIOSFERA-ATMOSFERA NA AMAZONIA - LBA

Forests

- N cycling in abundance
- ↑ N mineralization rates and N gas emissions
- ↑ leaching
- ↓ C/N ratios

MORE OPEN N CYCLE

Savannas

- Conservative N cycling
- ↓ N mineralization rates and N gas emissions
- ↓ leaching
- ↑ C/N ratios

MORE CLOSED N CYCLE

Nitrogen Stable Isotopes

- Species that fix N_2 from atmospheric air:

  $\Rightarrow$ have foliar $\delta^{15}N$ close to zero

  $\Rightarrow$ atmospheric δ15N is 0‰ and there is no fractionation during Biological N fixation

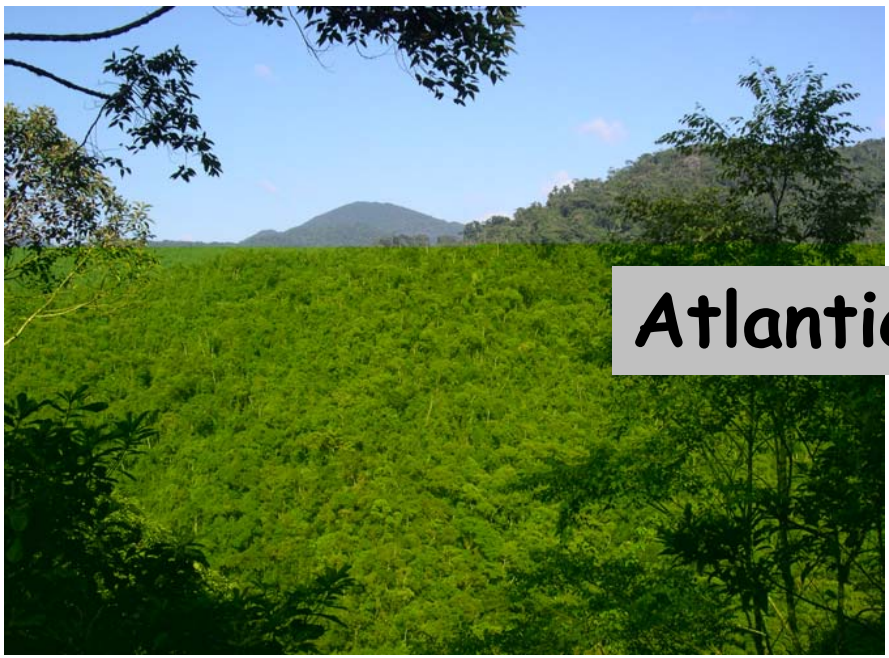
- Non-N_2-fixing species:

  $\Rightarrow$ show large variation in foliar $\delta^{15}N$ depending the forms of N available in the soil solution

Here we present data on foliar and soil $\delta^{15}N$ and N concentration from:

- areas covered with Brazilian Amazon terra-firme forest and Atlantic forest
- savannas encroached in the Brazilian Amazon region
- the Cerrado

Amazon Forest



Atlantic Forest

Silva

Silva

Amazonian Savannas

Cerrado

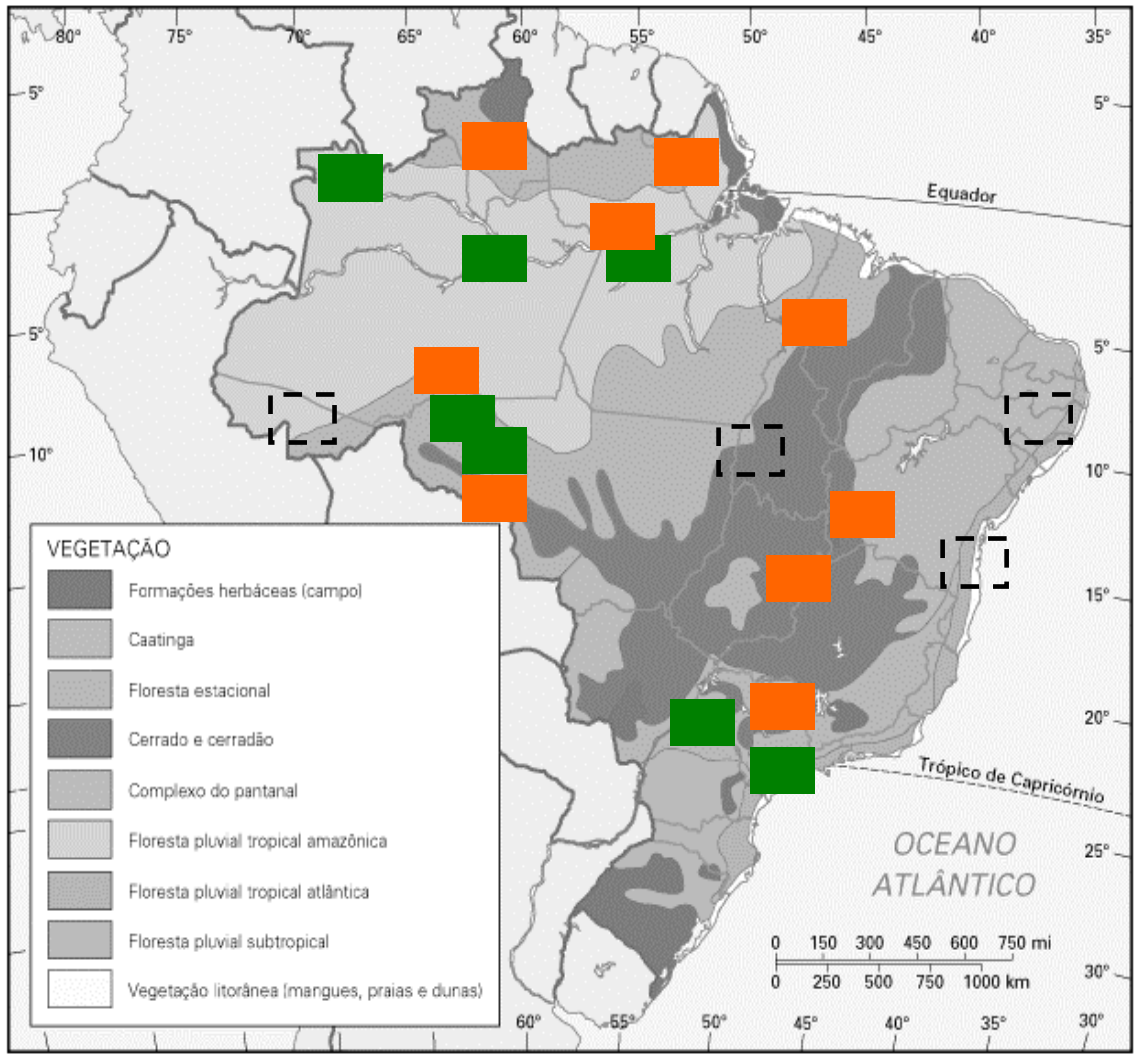
Study Sites

Forests (in green):

- FLONA Tapajós - Santarém
- ZF2 Reserve - Manaus
- São Gabriel da Cachoeira
- Samuel Reserve – Porto Velho
- REBIO - Ji-Paraná
- Intervales State Park - SP
- Morro do Diabo State Park - SP

Savannas (in orange):

- IBGE Reserve - Brasília
- PDG reserve – Vassununga
- Chapada dos Parecis – RO
- Humaitá - RO
- Alter do Chão – Santarém
- Carolina – MA
- Redenção – BA
- Roraima
- Amapá



Next sites (dashed line):

Amazon forest – AC; Bananal Island, Caatinga – PE and Atlantic Forest - BA

Data sets:

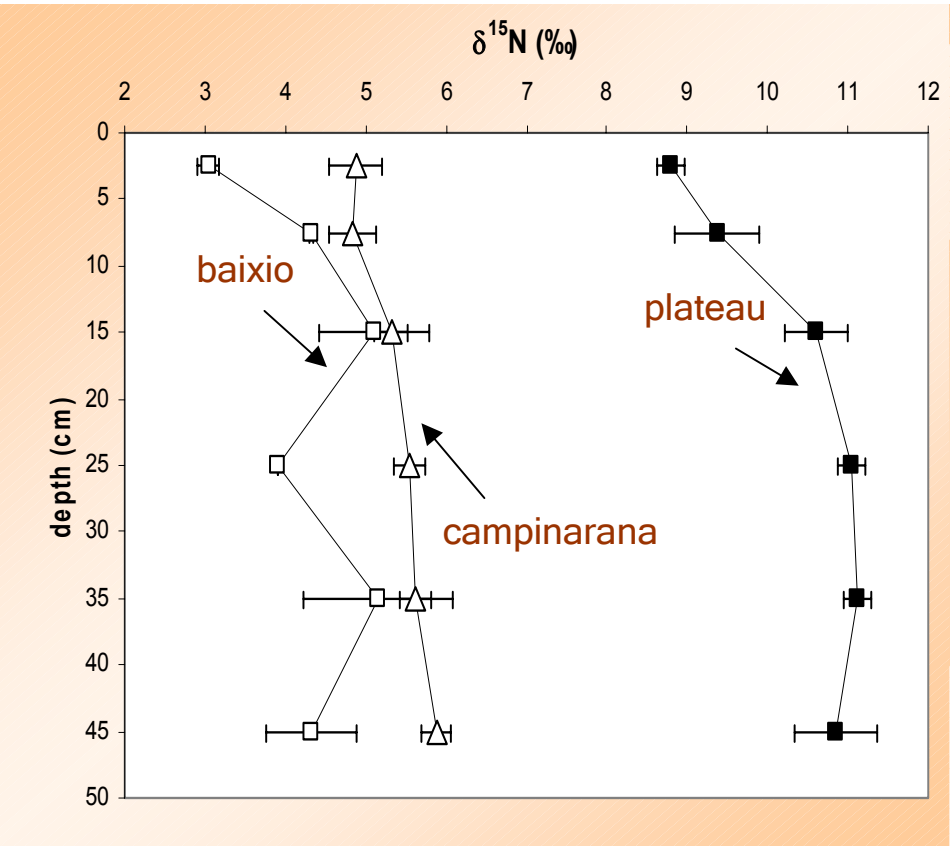
- Represent stable isotope ratio and concentration for NITROGEN on organic material collected as part of:

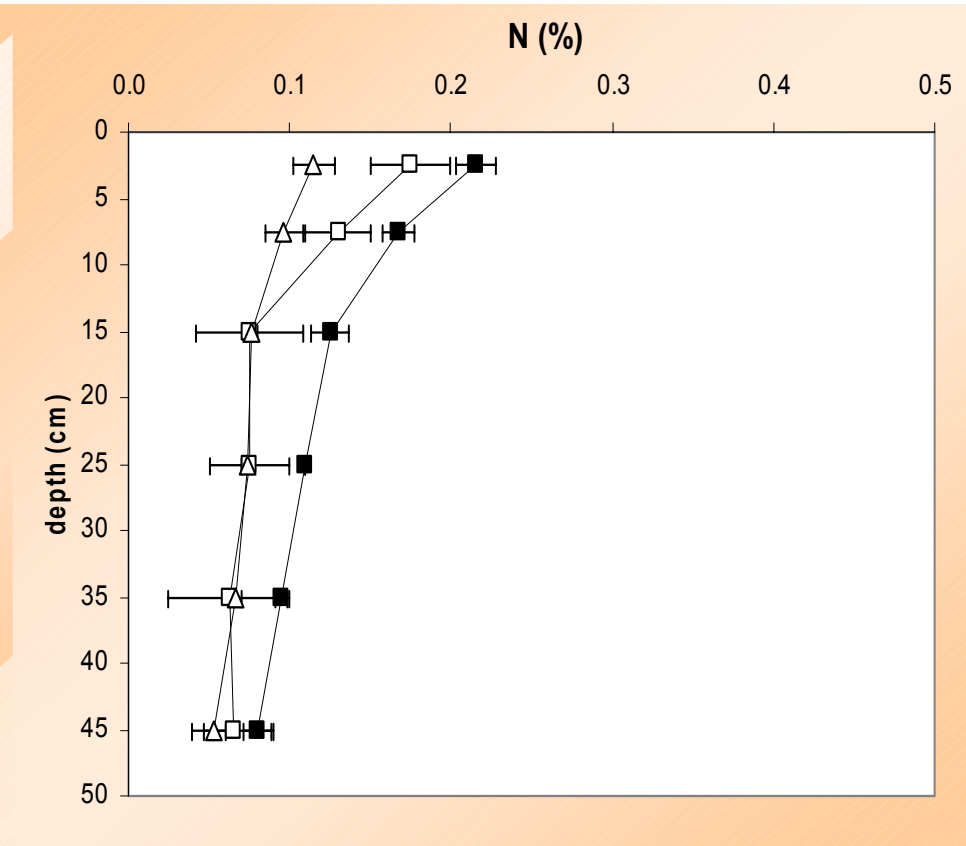
LBA efforts (most of the data)
Biota-Fapesp
Martinelli and Medina (unpublished data)

Soil

$\delta^{15}N$ and total N in the soils

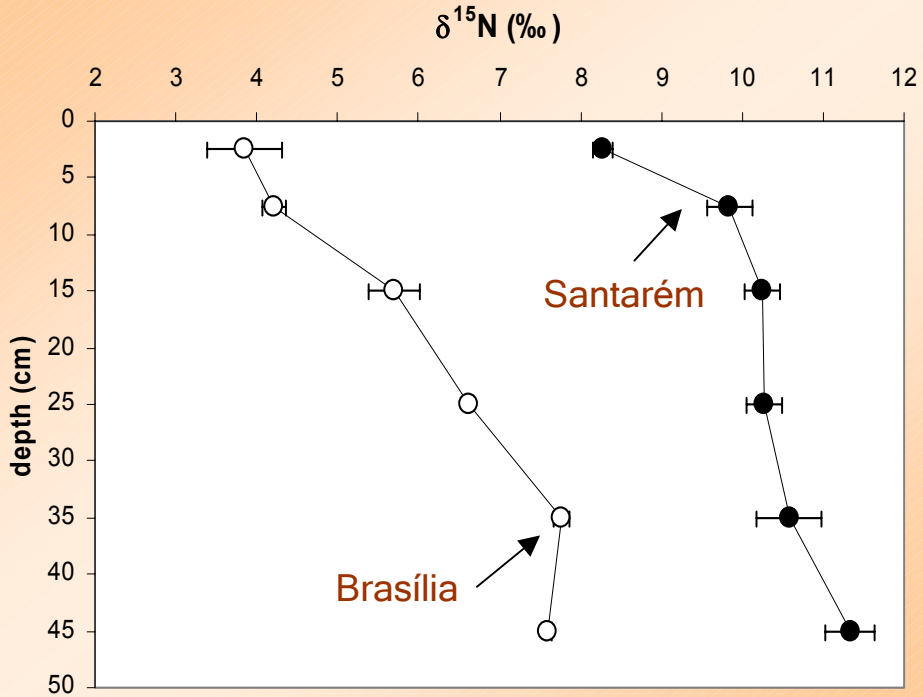
Manaus region

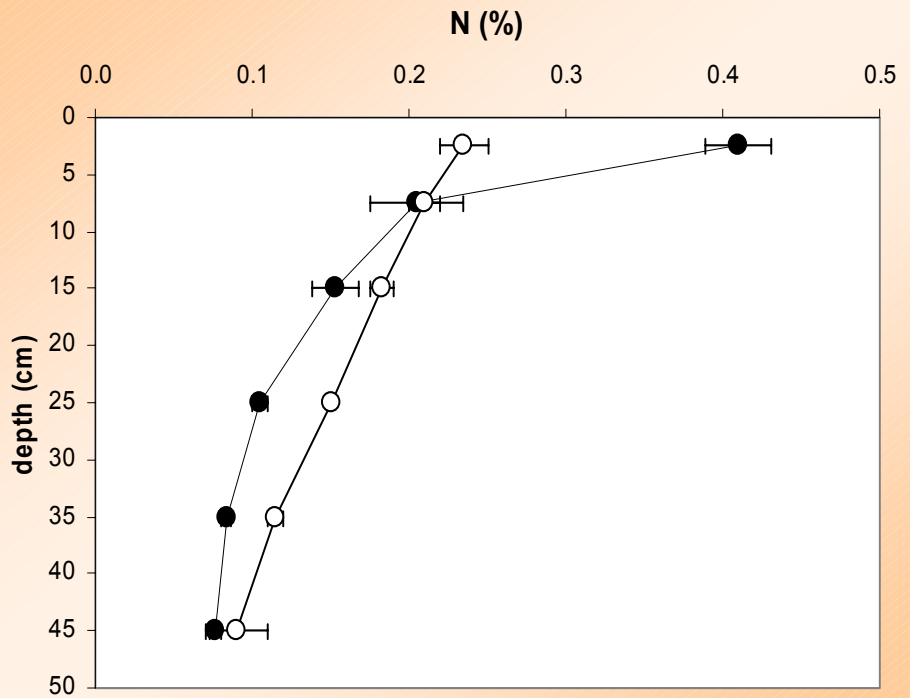




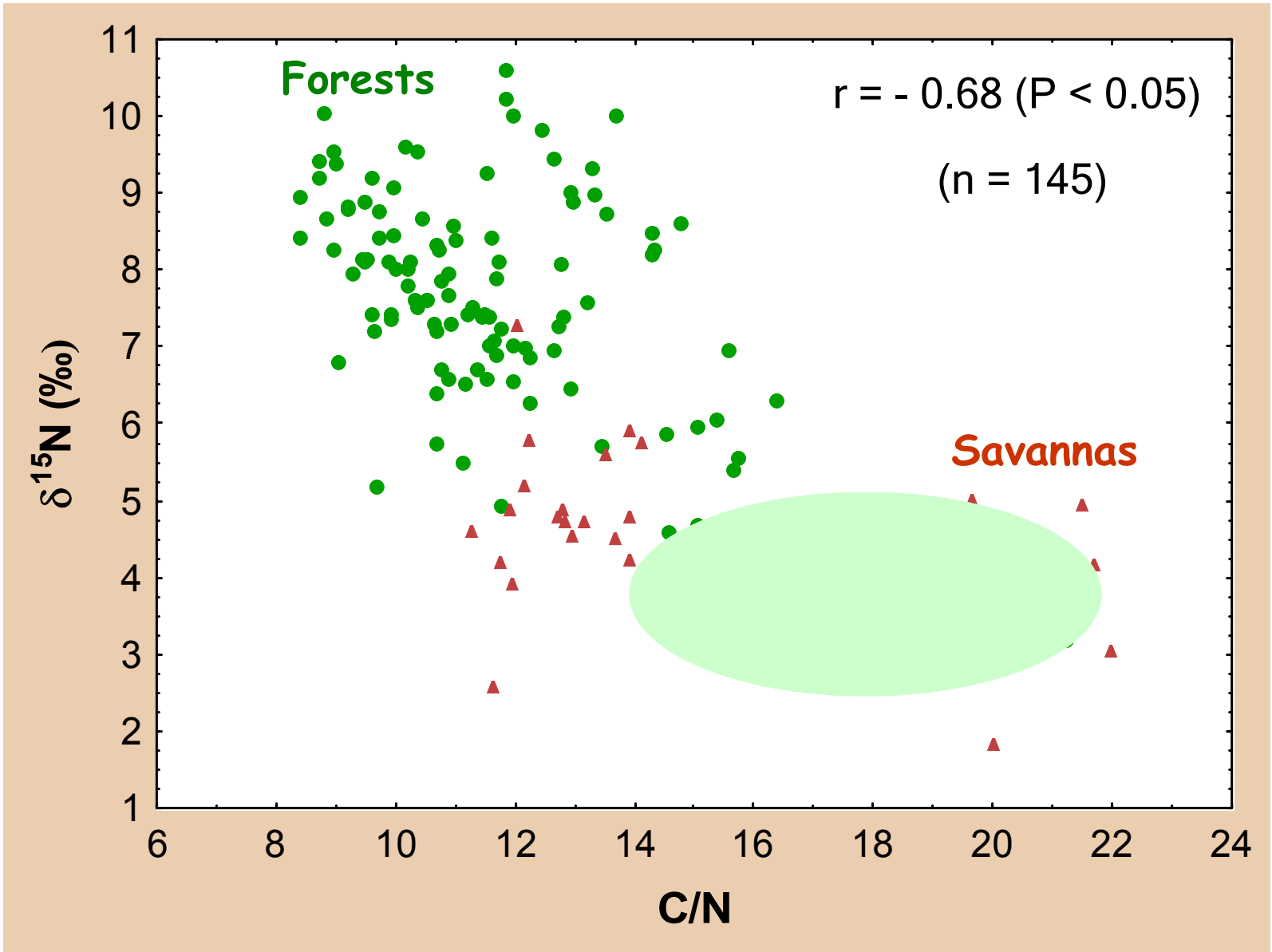
$\delta^{15}N$ and total N in the soil

terra-firme forest x cerrado s.s.



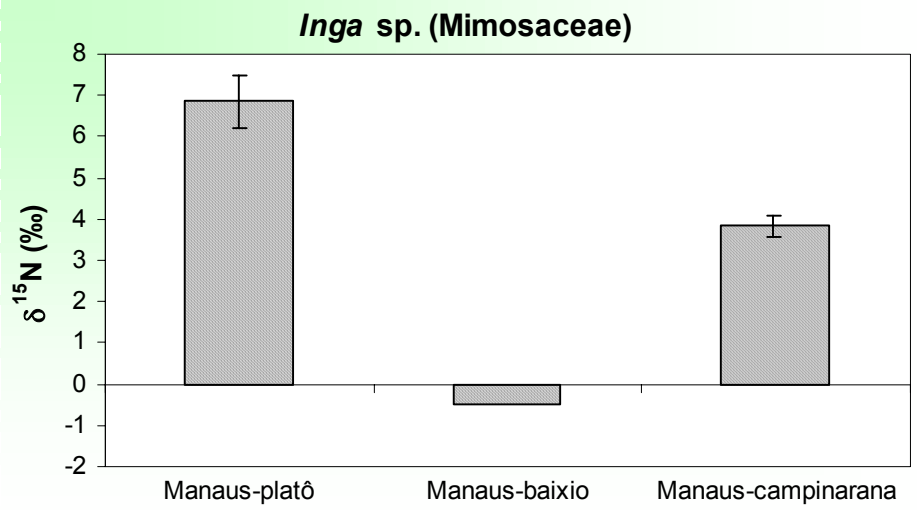


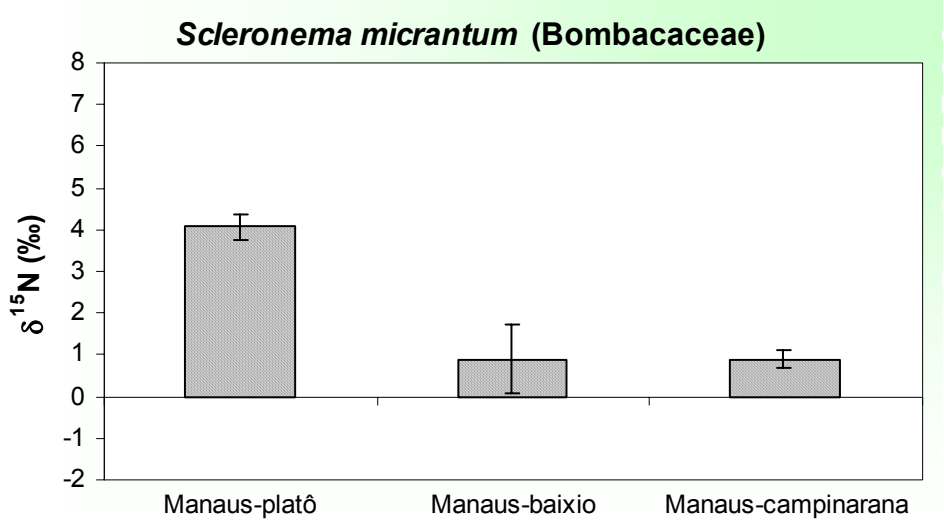
Soil (0-10 cm depth)

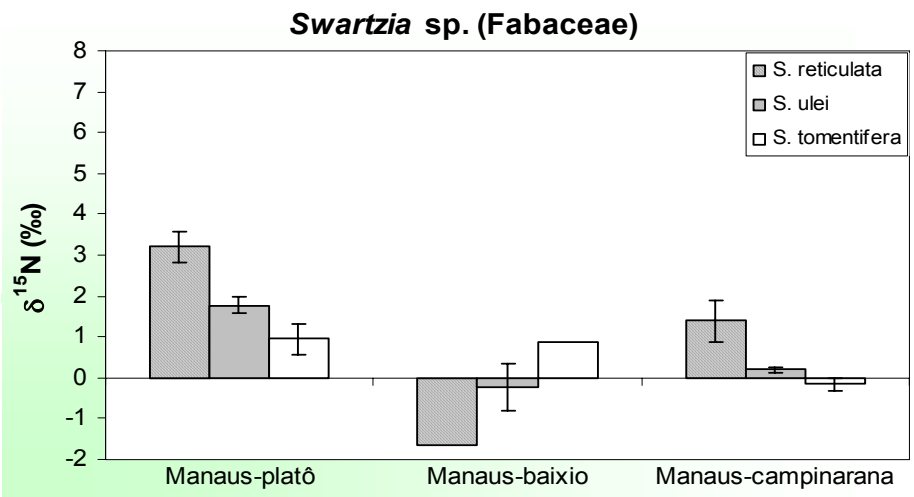


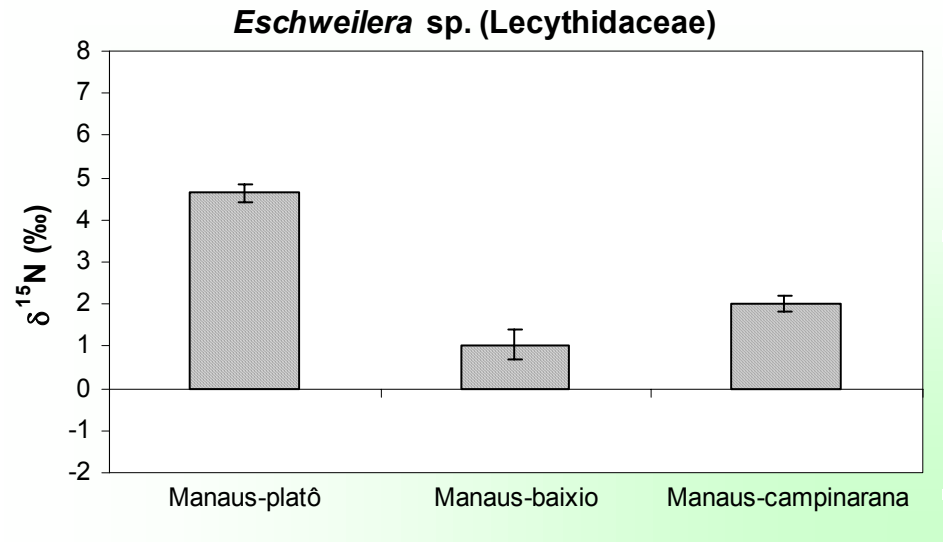
Vegetation

Manaus region

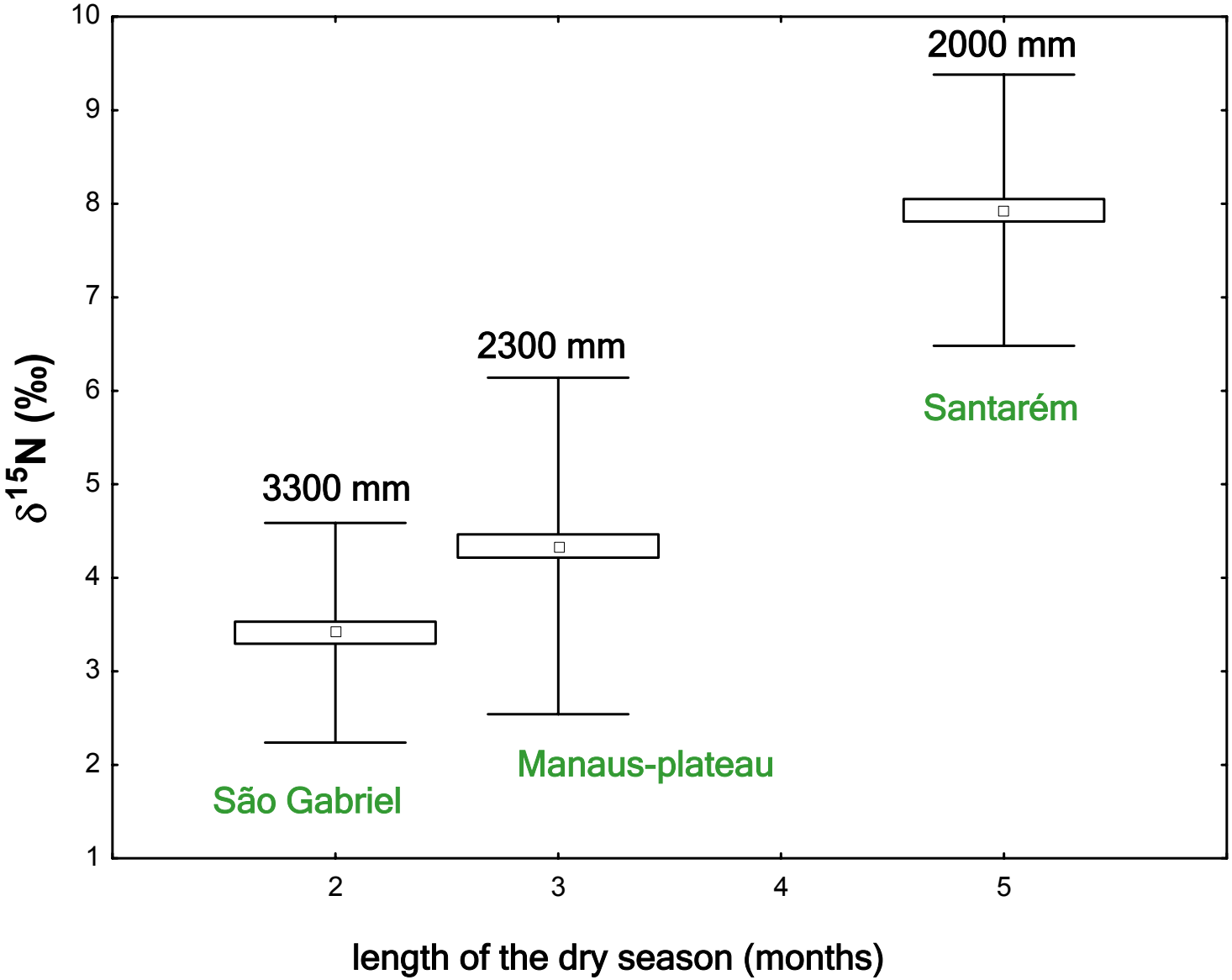




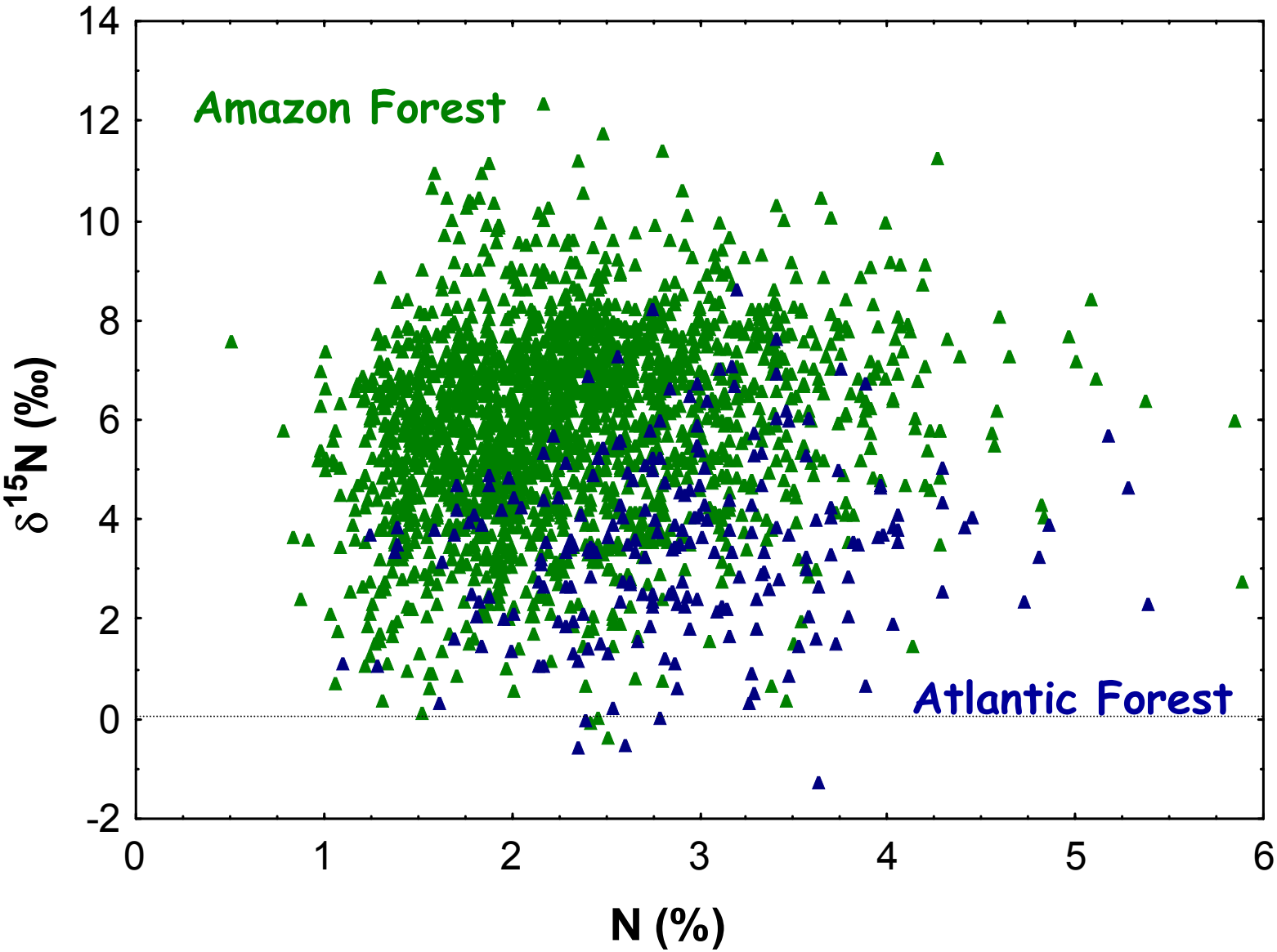




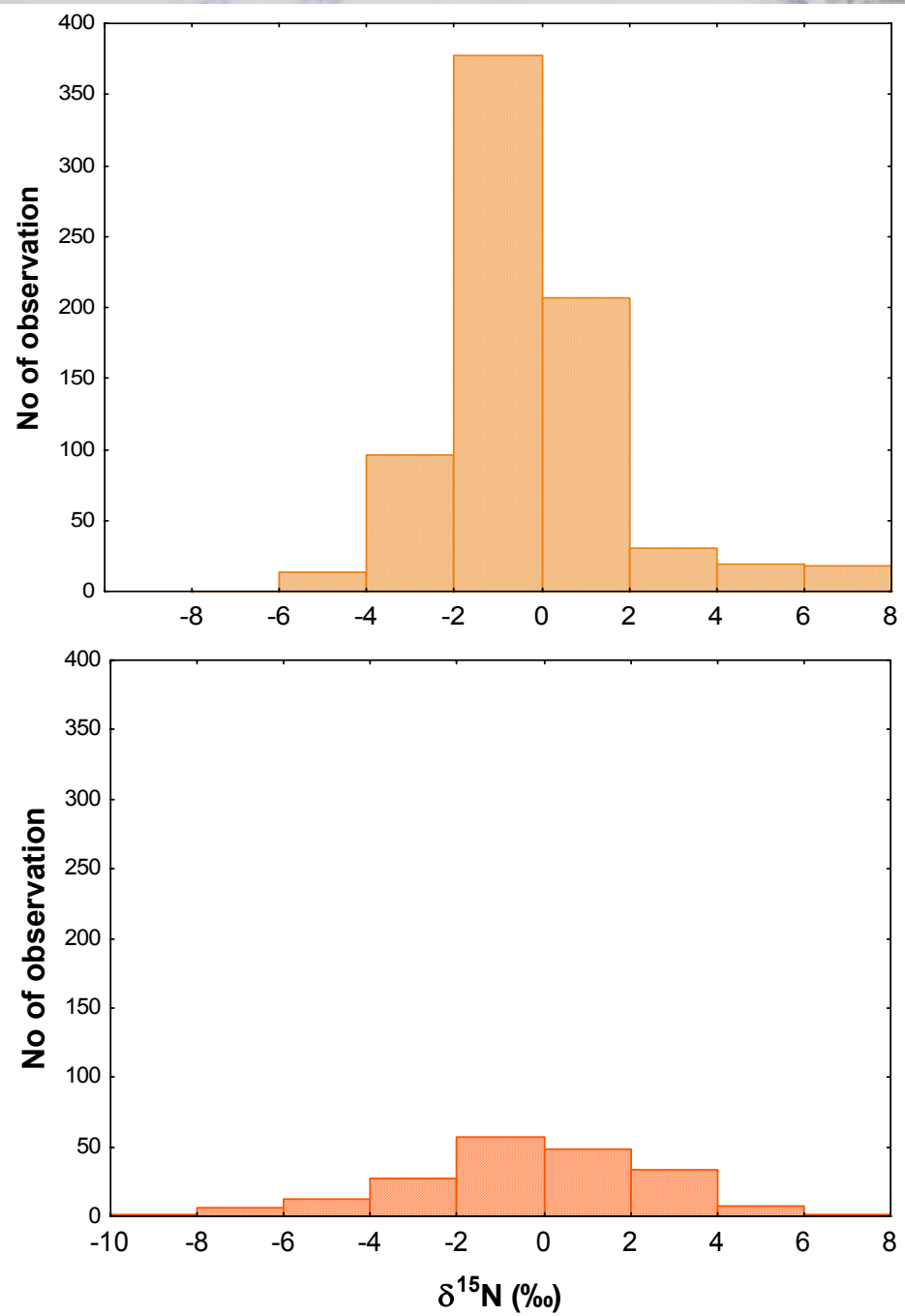
Terra-firme forests along the Brazilian Amazon



Amazon Forest x Atlantic Forest



Brazilian savannas



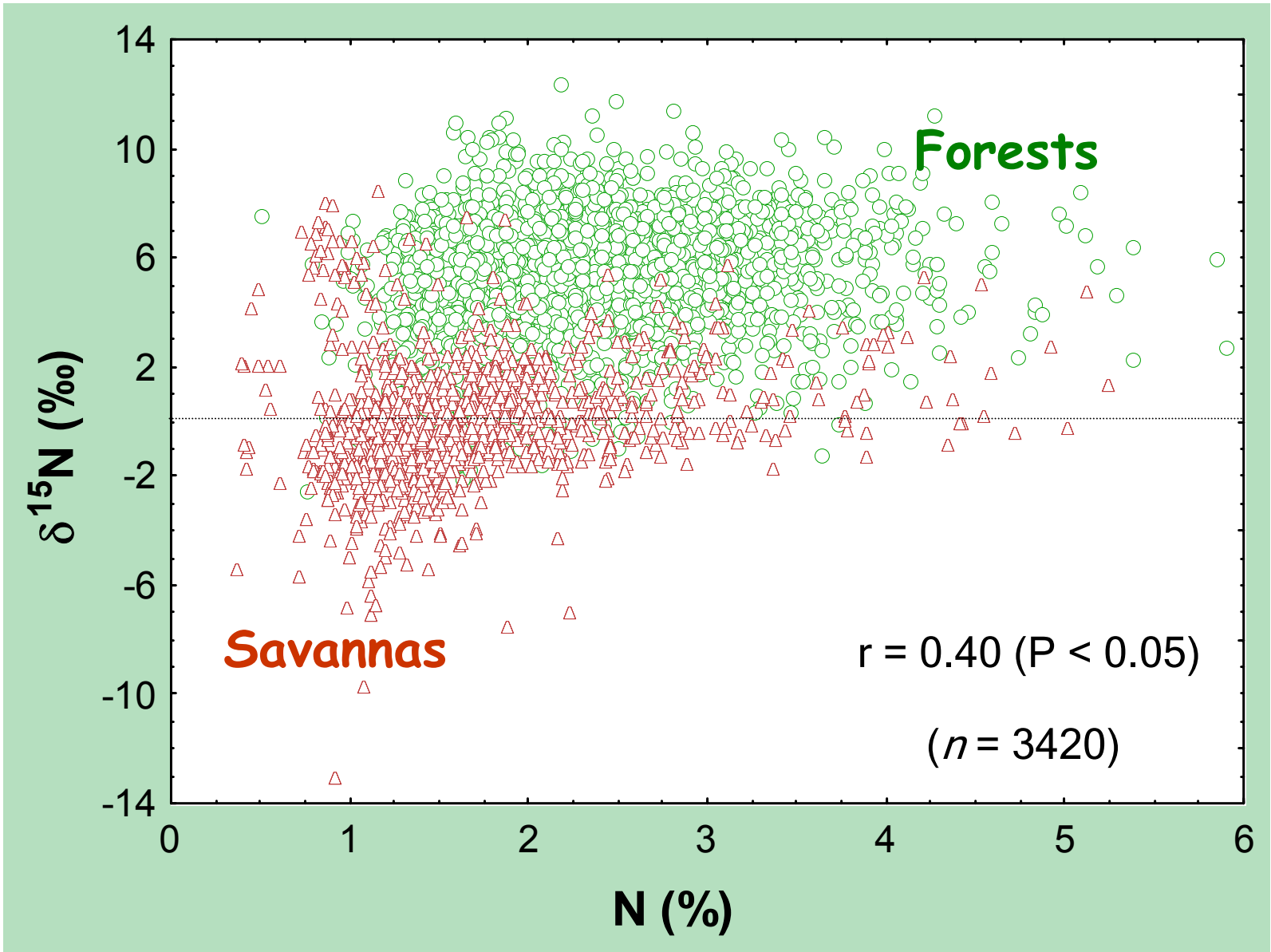
→ Cerrado

n = 760

→ Amazonian savannas

n = 250

Vegetation


Forests
Savannas
r = 0.40 (P < 0.05)
(n = 3420)
δ15N (‰)
N (%)
14
10
6
2
-2
-6
-10
-14
0
1
2
3
4
5
6

Forests on fertile soils are enriched in N-15 relative to those on poorer soils:

• differences in plant versus soil N-15;

• differences in the openness of the N cycle (the magnitude of **inputs** and **outputs** versus the quantity of N within systems) or,

• differences in fractionation during N loss.

- Forested Brazilian ecosystems (Amazon and Atlantic forests) are generally N-rich (open N-cycle) showing a lower difference on $\delta^{15}N$ between soil and leaves

- The difference between foliar and soil $\delta^{15}N$ is higher in ecosystems with more open canopies – Brazilian savannas - appearing to be more efficient in conserving and recycling mineral N

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