

# Treasures of Neotropical Soils Microbiome

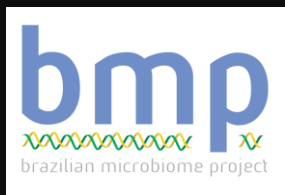
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Biological Institute of São Paulo

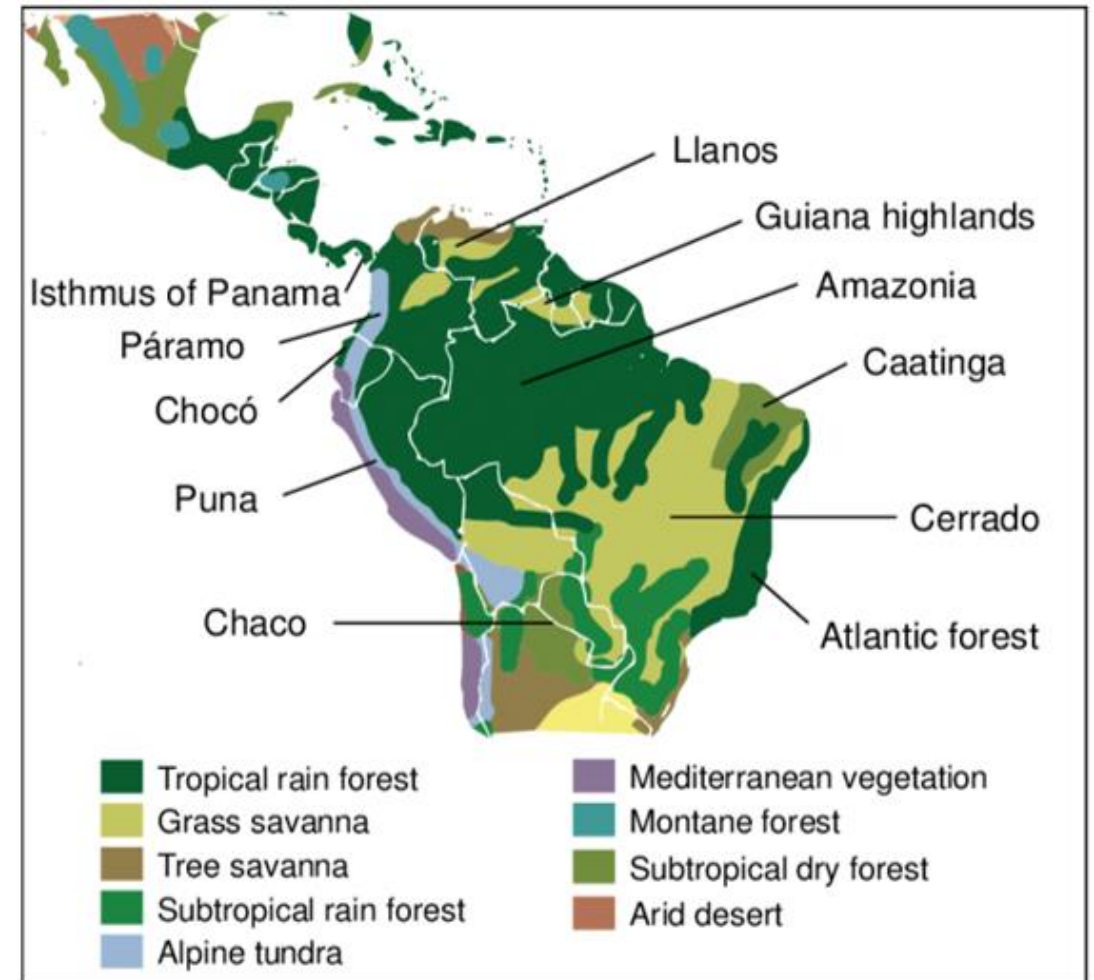
ESALQ – University of São Paulo

Brazil



# Neotropical region Importance

- The most species-rich realm on earth
- High climatic and environmental variability
- Suffers high pressure of anthropogenic activity
- Has the most diverse rainforest on earth



Antonelli & Sanmartín, Taxon. 2011

# PDD - Pantropical Diversity Disparity

- Explanations for moist forests diversity

PNAS  
2021

## Earth history events shaped the evolution of uneven biodiversity across tropical moist forests

Oskar Hagen<sup>a,b,c,1,2</sup>, Alexander Skeels<sup>a,b,1,2</sup>, Renske E. Onstein<sup>c</sup>, Walter Jetz<sup>d,e</sup>, and Loïc Pellissier<sup>a,b,2</sup>

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RESEARCH ARTICLE | BIOLOGICAL SCIENCES

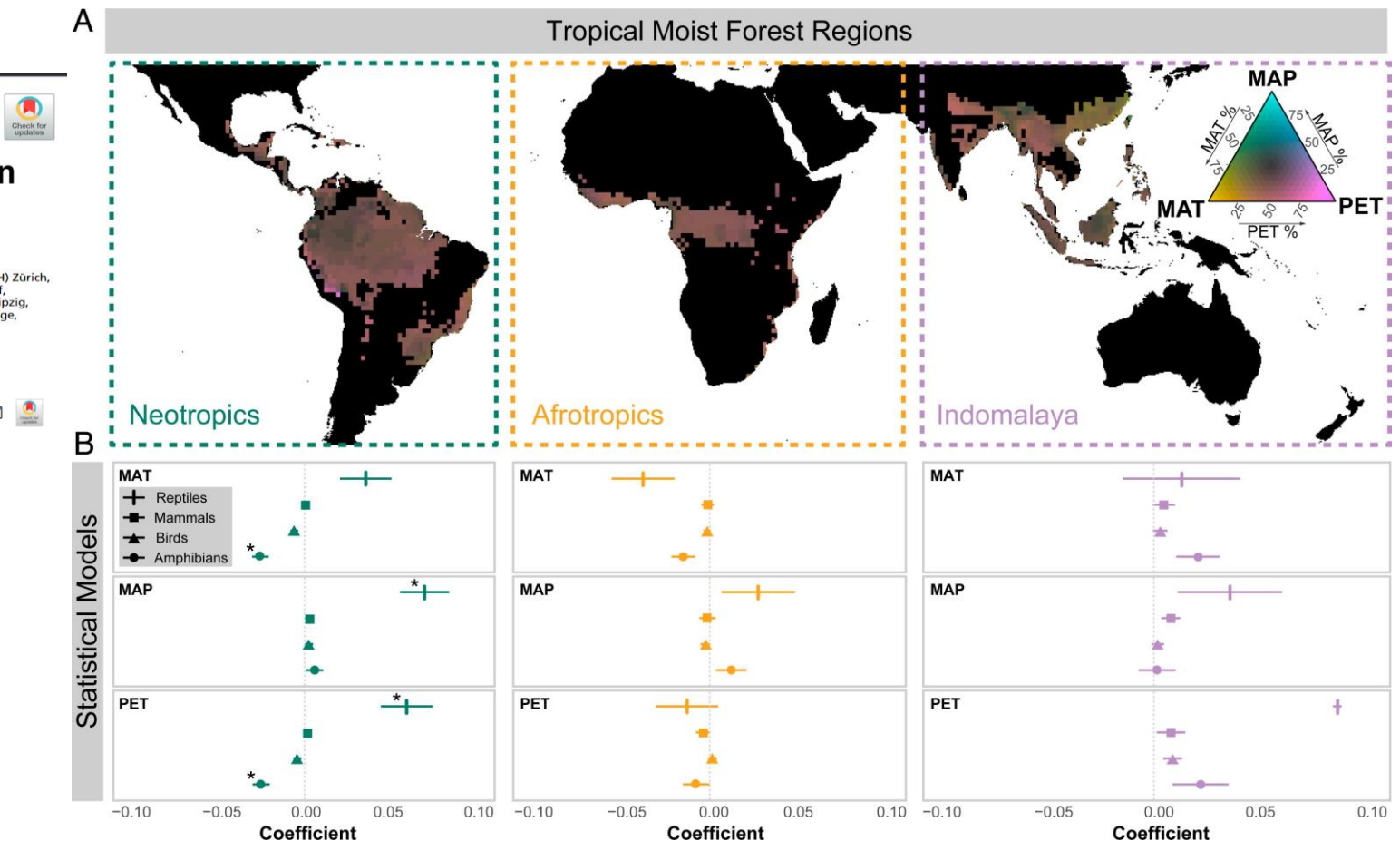
## Amazonia is the primary source of Neotropical biodiversity

Alexandre Antonelli<sup>1</sup>, Alexander Zizka<sup>2</sup>, Fernanda Antunes Carvalho<sup>3</sup>, +3, and Fabien L. Condamine<sup>4</sup>

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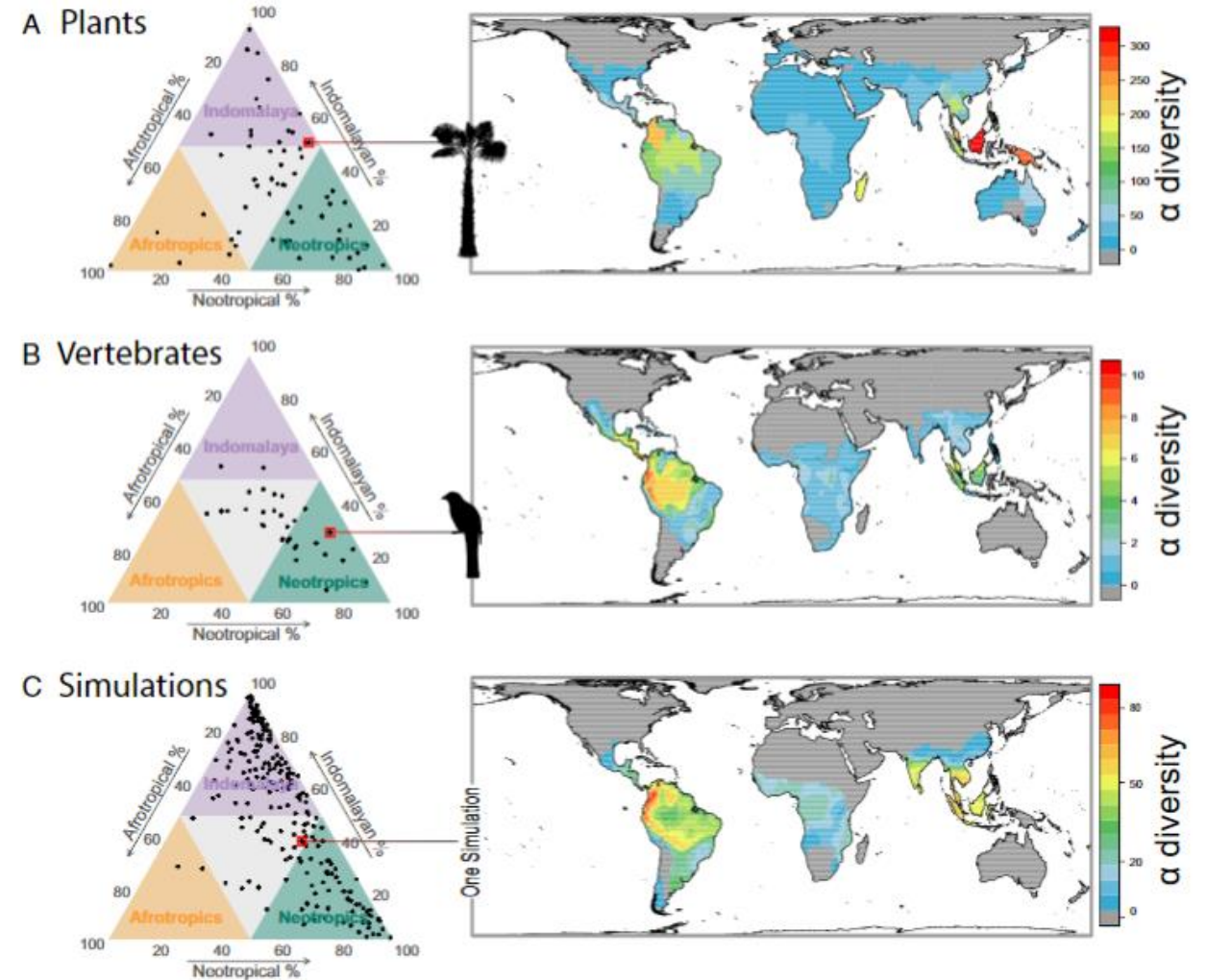
May 14, 2018 | 115 (23) 6034-6039 | <https://doi.org/10.1073/pnas.1713819115>





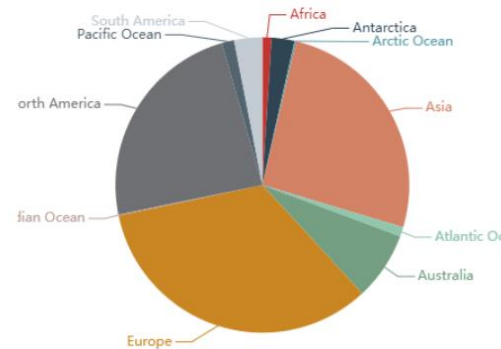
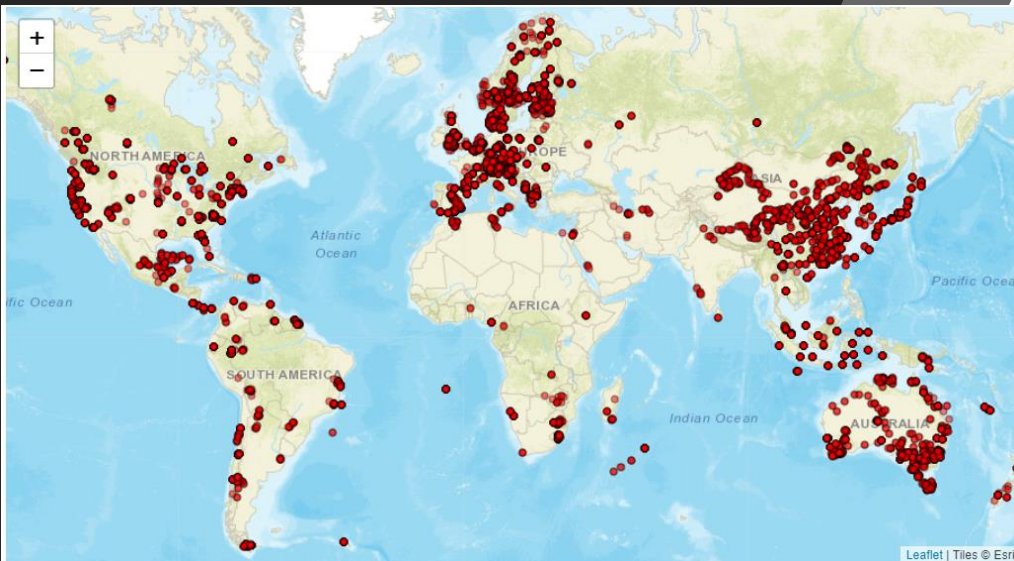
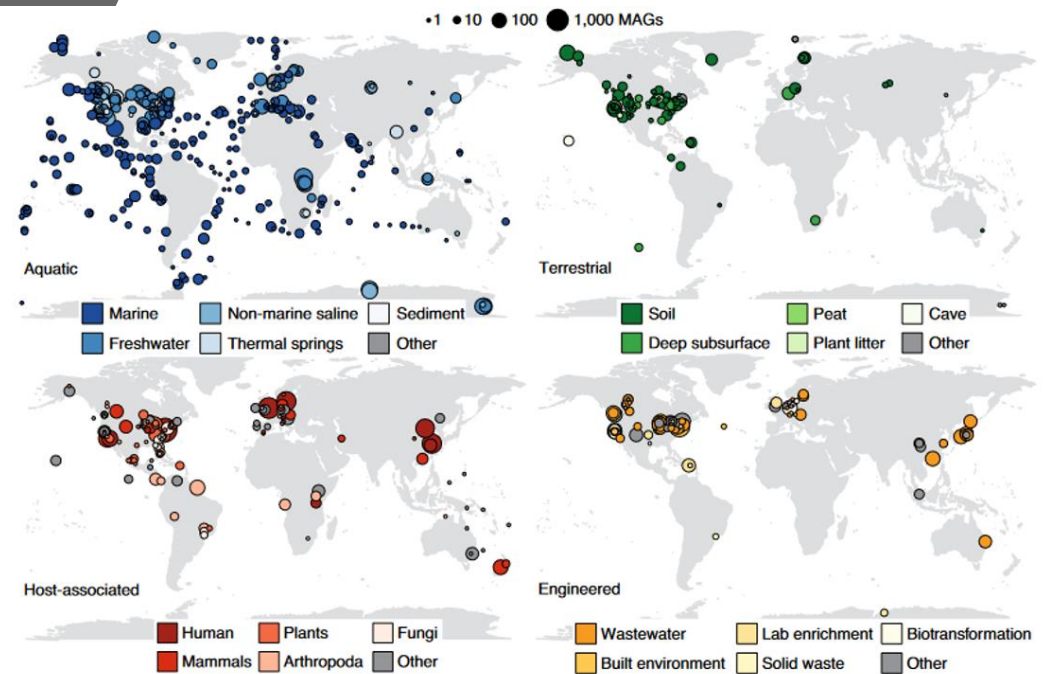
# Neotropics

- Higher diversity:
- Plants
- Vertebrates



**Fig. 1.** Evenness of diversity in tropical moist forests across biogeographic regions in pantropically distributed taxa. Ternary plots show the proportions of diversity per clade found in Neotropical, Afrotropical, and Indomalayan tropical moist forests (green, orange, and purple triangles, respectively) for (A, Left) plant families; (B, Left) mammal, bird, and amphibian orders and squamate infraorders; and (C, Left) mechanistic model simulations. Species richness maps highlight examples that show the PDD: (A, Right) *Arecaceae* (palms; richness measured across botanical countries), (B, Right) *Trogoniformes* (trogons and allies), and (C, Right) one simulation.

# Sampling effort



nature  
biotechnology

RESOURCE

<https://doi.org/10.1038/s41587-020-0718-6>

Check for updates

OPEN

## A genomic catalog of Earth's microbiomes

Stephen Nayfach<sup>1</sup>, Simon Roux<sup>1</sup>, Rekha Seshadri<sup>1</sup>, Daniel Udvarý<sup>1</sup>, Neha Varghese<sup>1</sup>,

Data Descriptor | [Open Access](#) | [Published: 13 July 2020](#)

## GlobalFungi, a global database of fungal occurrences from high-throughput-sequencing metabarcoding studies

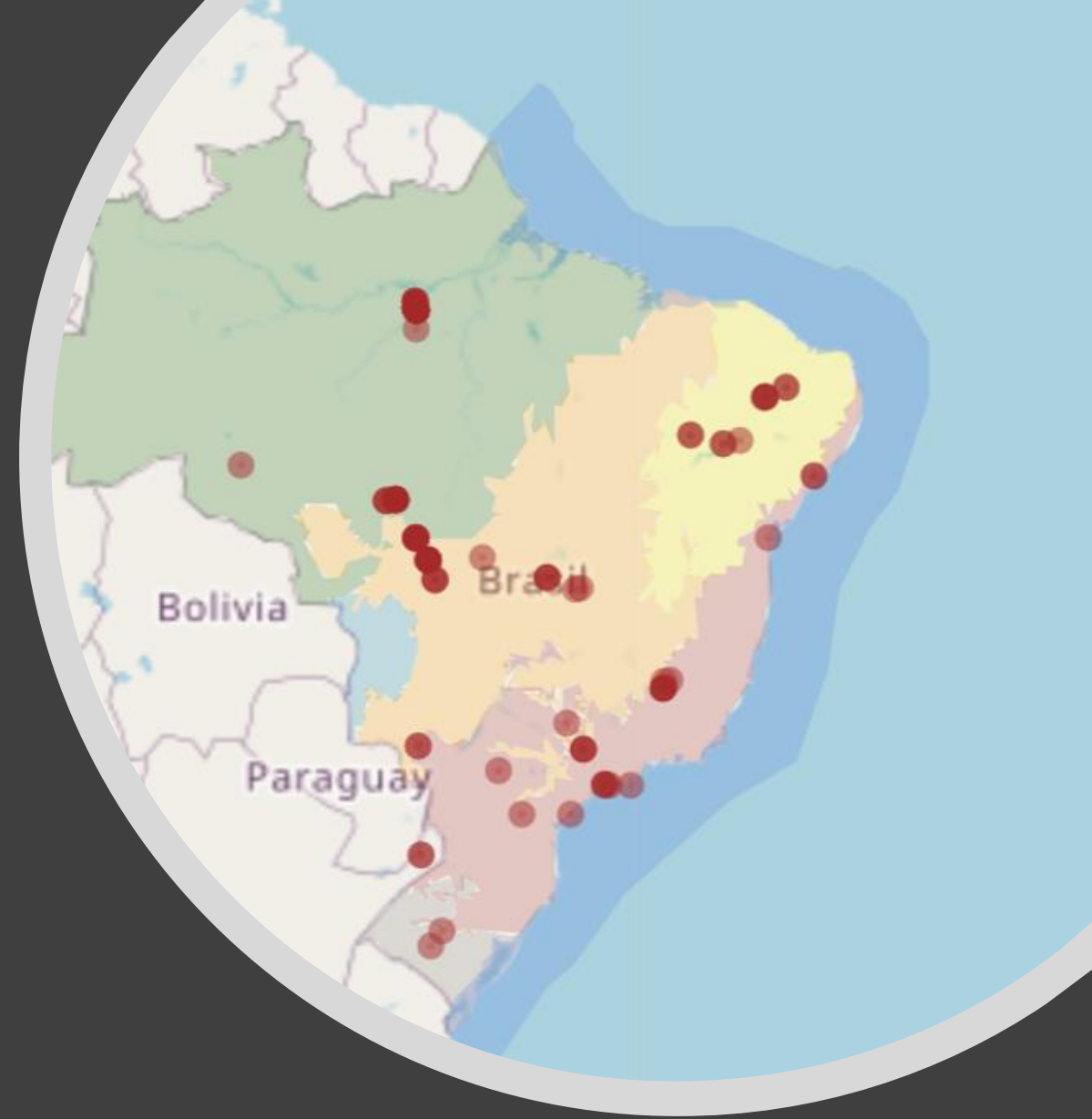
[Tomáš Větrovský](#), [Daniel Morais](#), ... [Petr Baldrian](#) [+ Show authors](#)

[Scientific Data](#) **7**, Article number: 228 (2020) | [Cite this article](#)

14k Accesses | 43 Citations | 135 Altmetric | [Metrics](#)

# Current Soil Microbiome Data

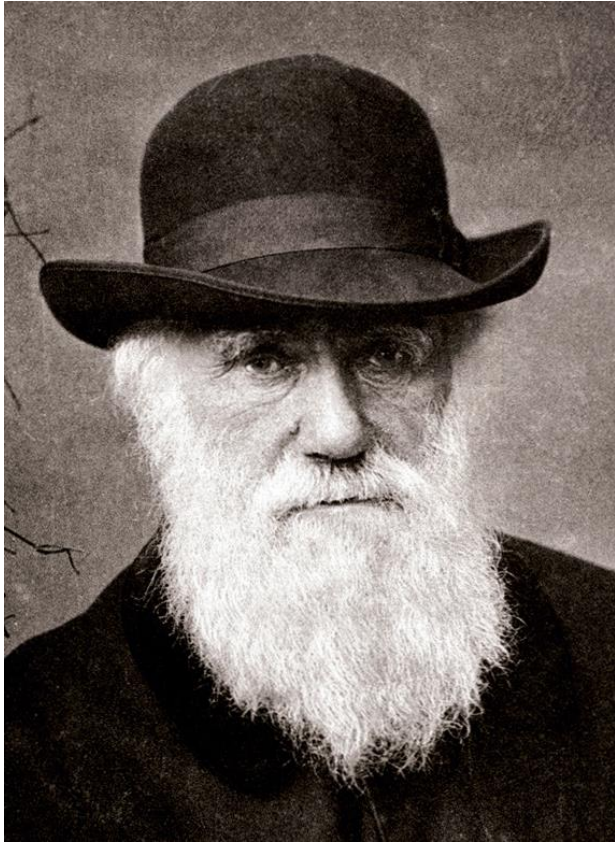
- 315 samples and 94 sites
- High definition information about:
  - pH
  - Soil carbon content
  - Water content
  - Soil texture
- Data taken from MG-RAST and SRA, using the Terrestrial Metagenome DB and filters at the DB websites





# Why Brazil as the main sampling effort

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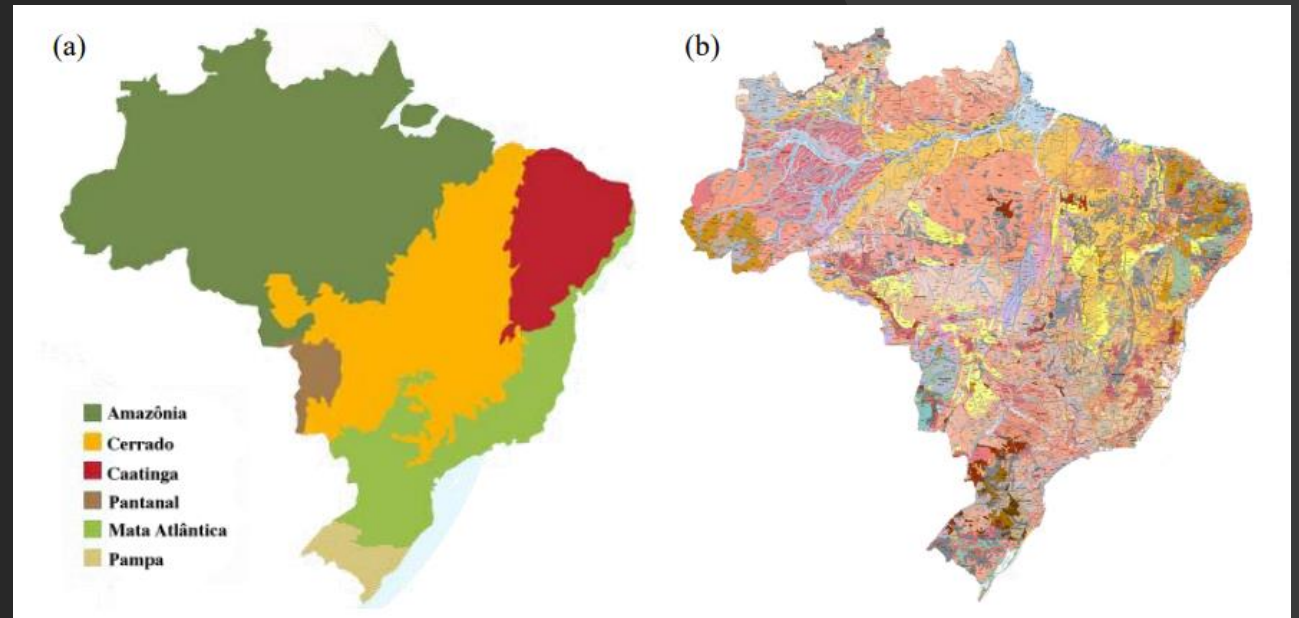


*In England any person fond of natural history enjoys in his walks a great advantage, by always having something to attract his attention; but in these fertile lands teeming with life, the attractions are so numerous, that he is scarcely able to walk at all.*

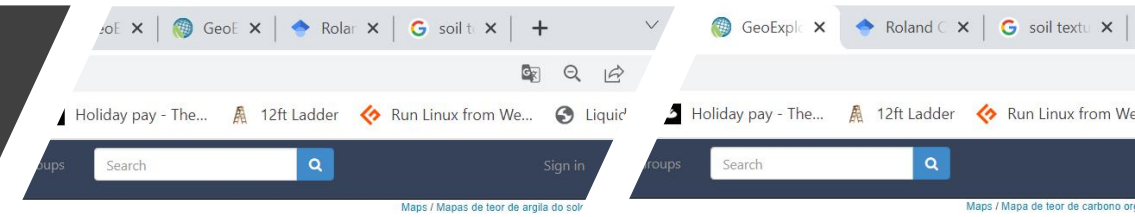
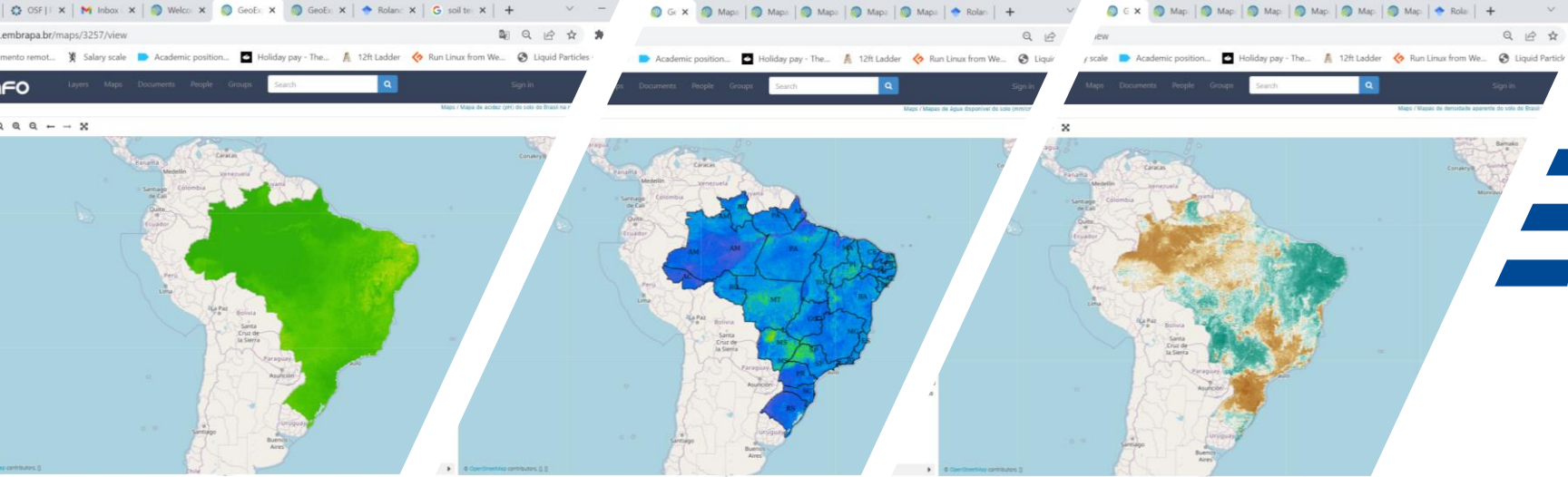
Charles R. Darwin, 19 Apr. 1839,  
after leaving Brazil on board of HMS Beagle.

# Unique climatic and geologic conditions

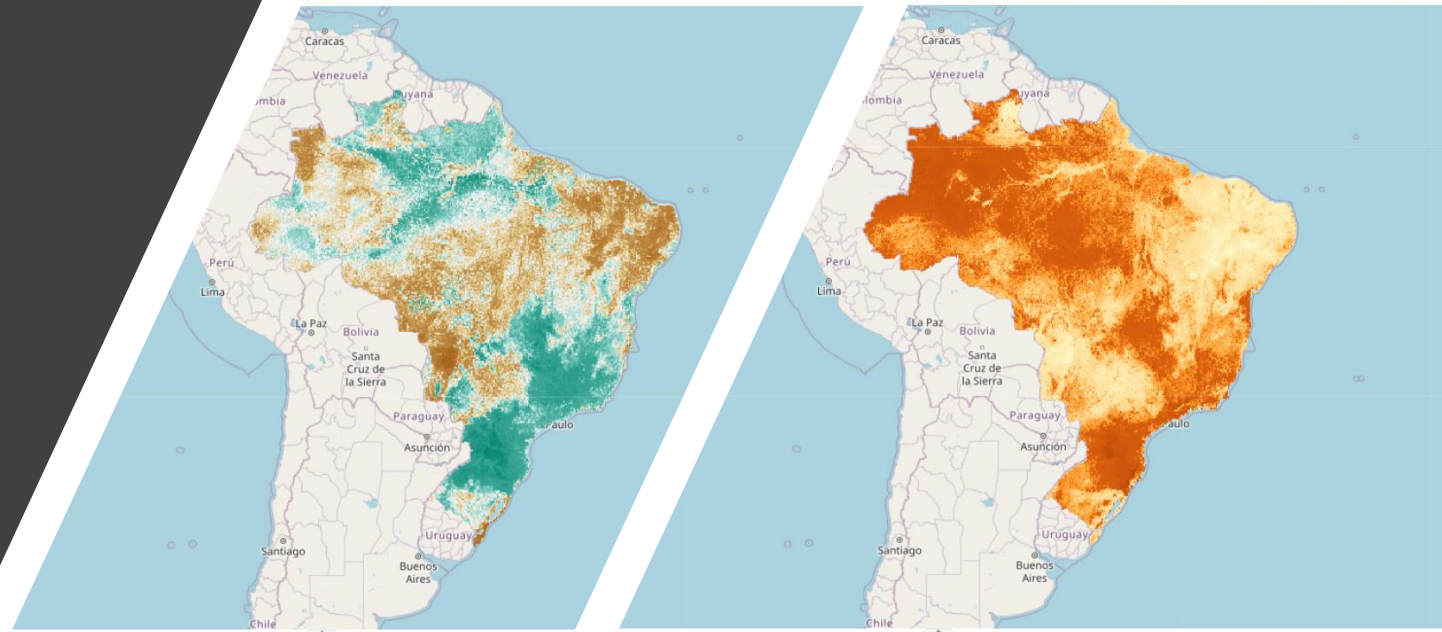
- Latossol is the most prevalent soil in Brazil
  - Highly weathered soils
  - Distrofic
  - Acidic
  - Low fertility
- We have a desert in formation right now in Brazil
- Until the 60's the Brazilian Savanas were considered impossible to grow crops and nowadays is where most of Brazilian agricultural production is concentrated
- High precipitation and mean annual temperature favour the weathering processes
- We are rapidly losing our natural environments due to improper or ilegal agricultural practices



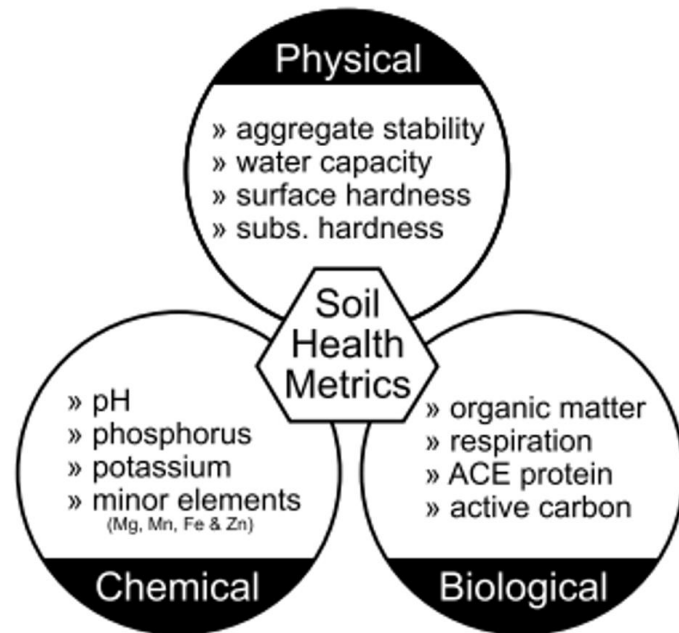




- Soil Bulk Density
  - Soil Water Availability
  - Soil Texture
  - Soil Acidity
  - Soil Organic Carbon Stocks
- <http://geoinfo.cnps.embrapa.br/>



# Prediction of Soil Health



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Soil Biology and Biochemistry

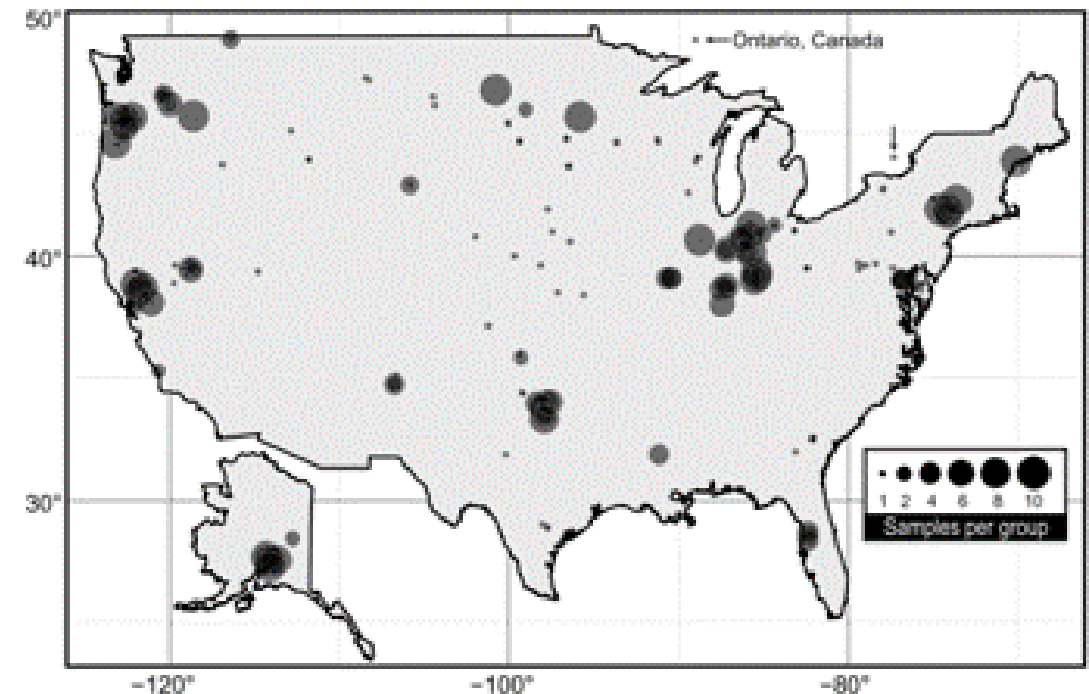
journal homepage: [www.elsevier.com/locate/soilbio](http://www.elsevier.com/locate/soilbio)



Predicting measures of soil health using the microbiome and supervised machine learning

Roland C. Wilhelm, Harold M. van Es, Daniel H. Buckley \*

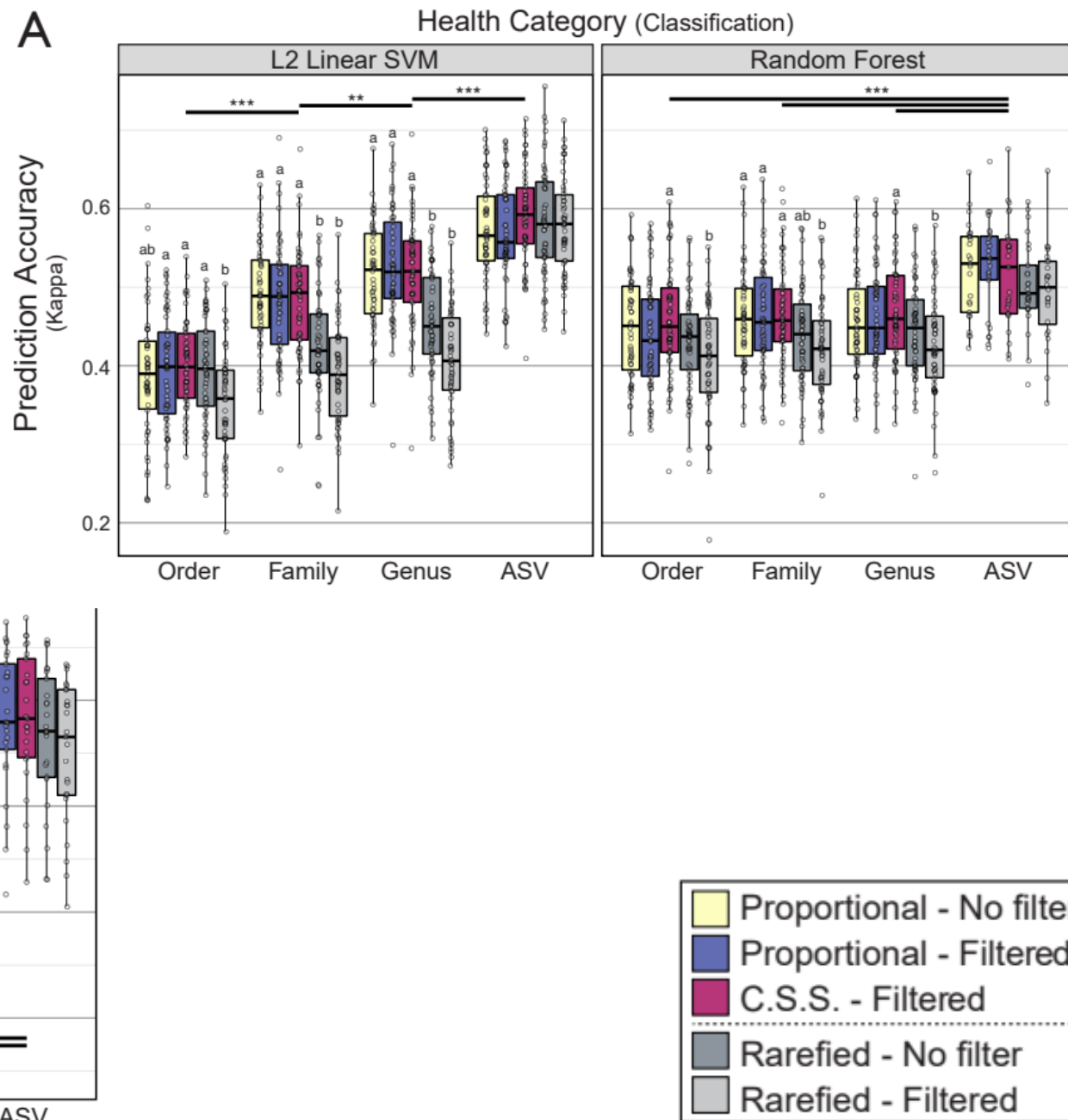
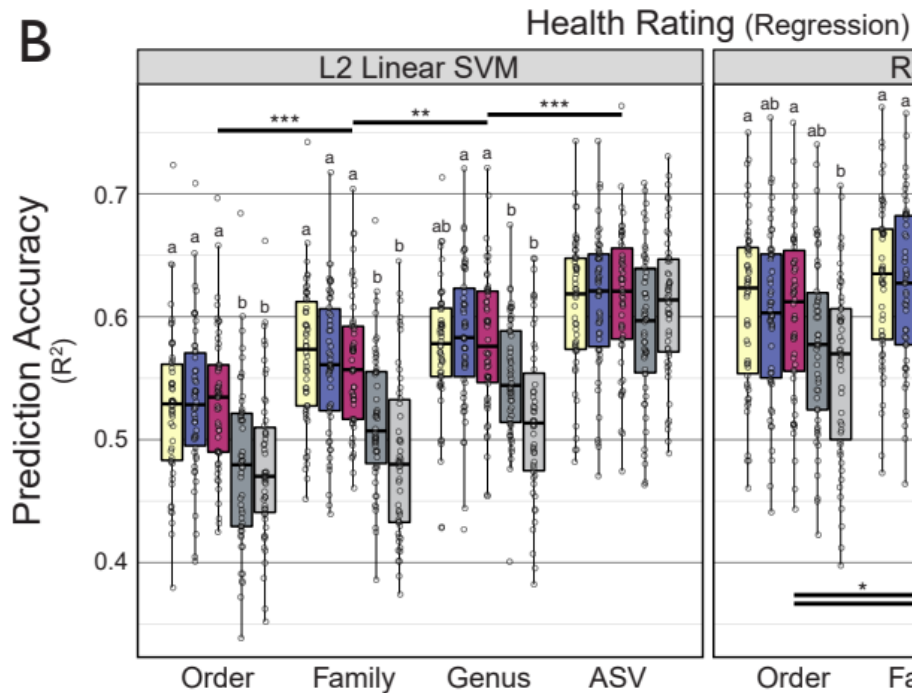
*School of Integrative Plant Science, Bradfield Hall, Cornell University, Ithaca, NY, 14853, USA*



# Predicting measures of soil health using the microbiome and supervised machine learning

Roland C. Wilhelm, Harold M. van Es, Daniel H. Buckley\*

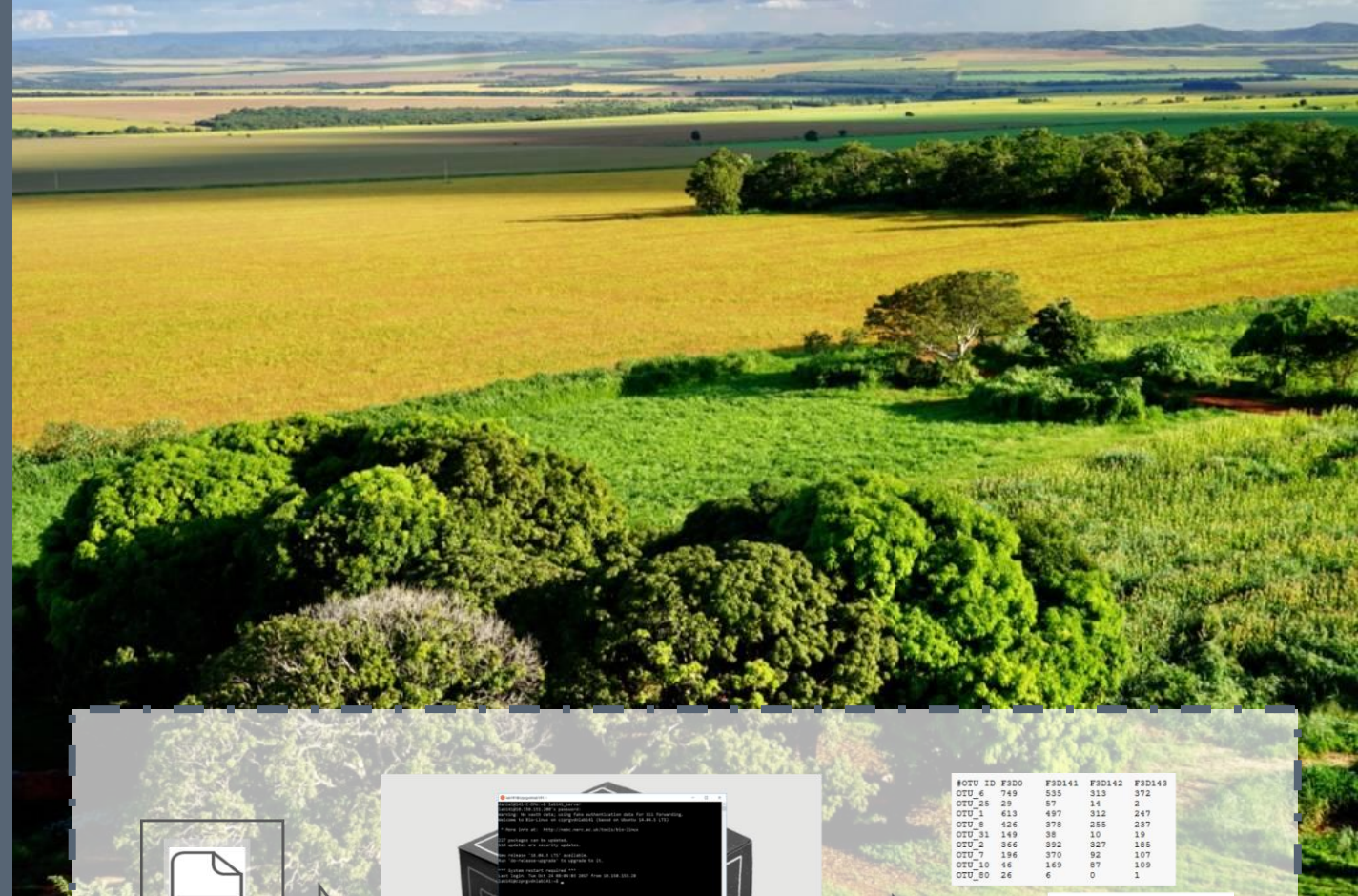
School of Integrative Plant Science, Bradfield Hall, Cornell University, Ithaca, NY, 14853, USA



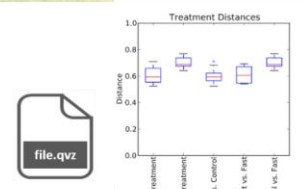


# Microbioma dos solos Brasileiros

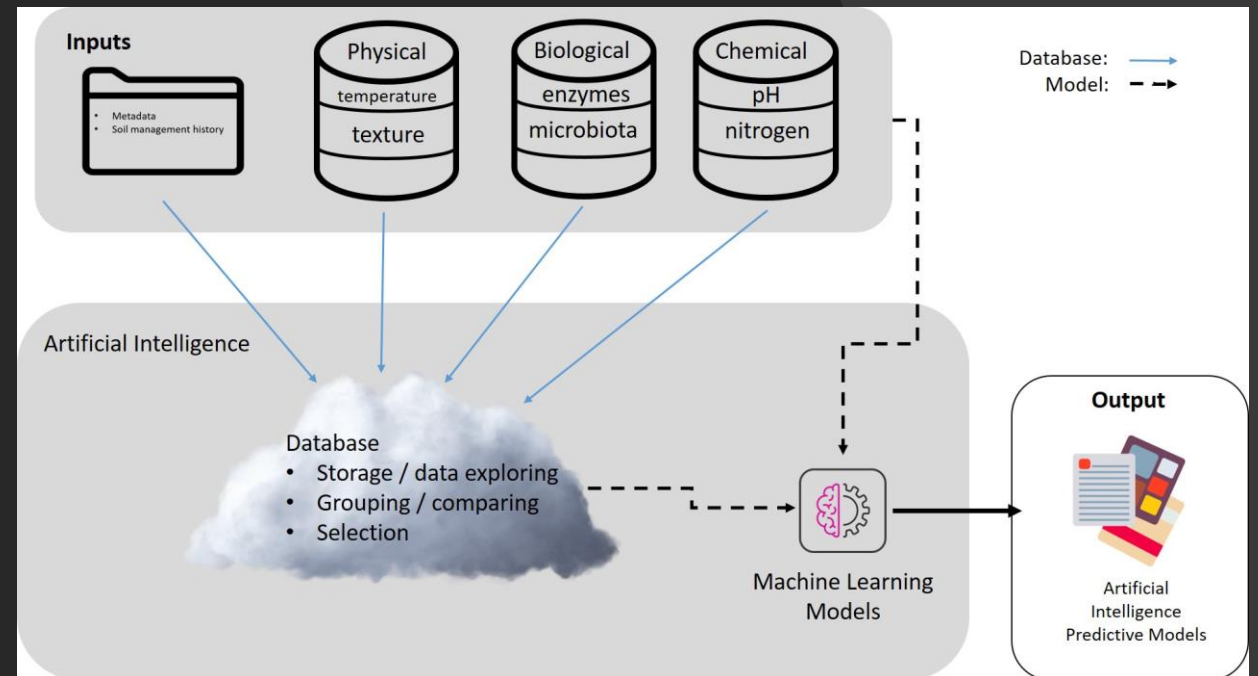
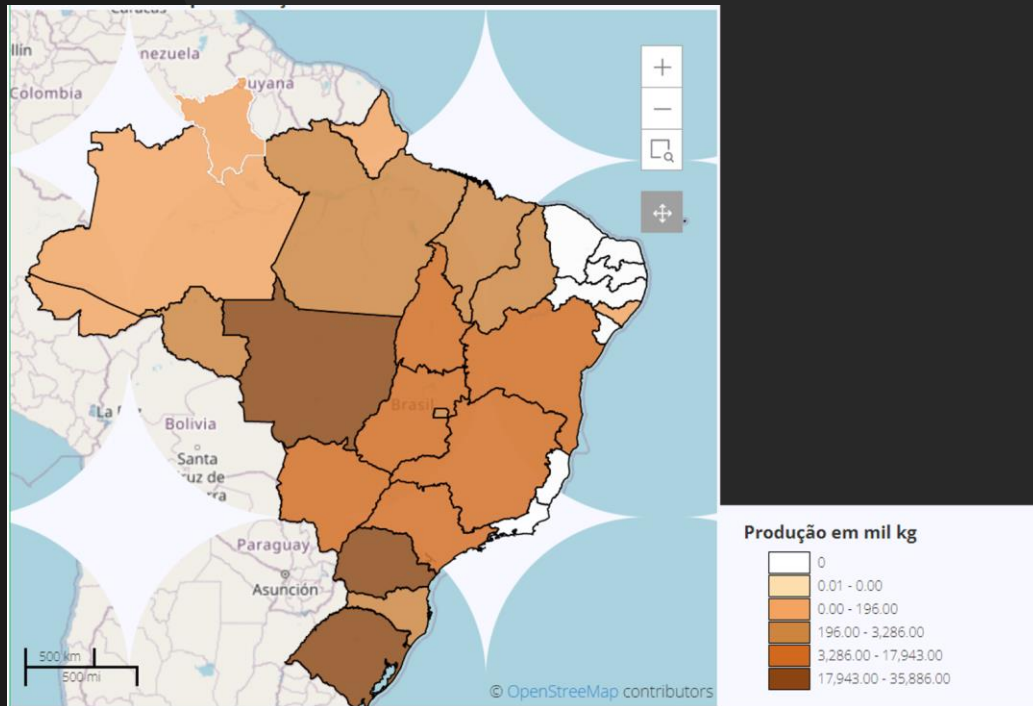
- To map the soil microbiological diversity
- Understand how anthropic activity degrade soil quality (conversion forest x crop)
- Create a new soil quality index
- Identify alteration patterns in the main Brazilian Biomes



OTU ID	F3D0	F3D141	F3D142	F3D143
OTU_6	749	535	313	372
OTU_25	29	57	14	2
OTU_1	613	497	312	247
OTU_8	426	379	255	237
OTU_31	149	38	10	19
OTU_2	366	392	327	185
OTU_7	196	370	92	107
OTU_10	46	169	87	109
OTU_80	26	6	0	1



# Collection of samples and creation of a predictive database



<https://portaldeinformacoes.conab.gov.br/produtos-360.html>





# Lets Dig Neotropical Soils Treasures!

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Brazil



Dr. Victor Pylro  
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