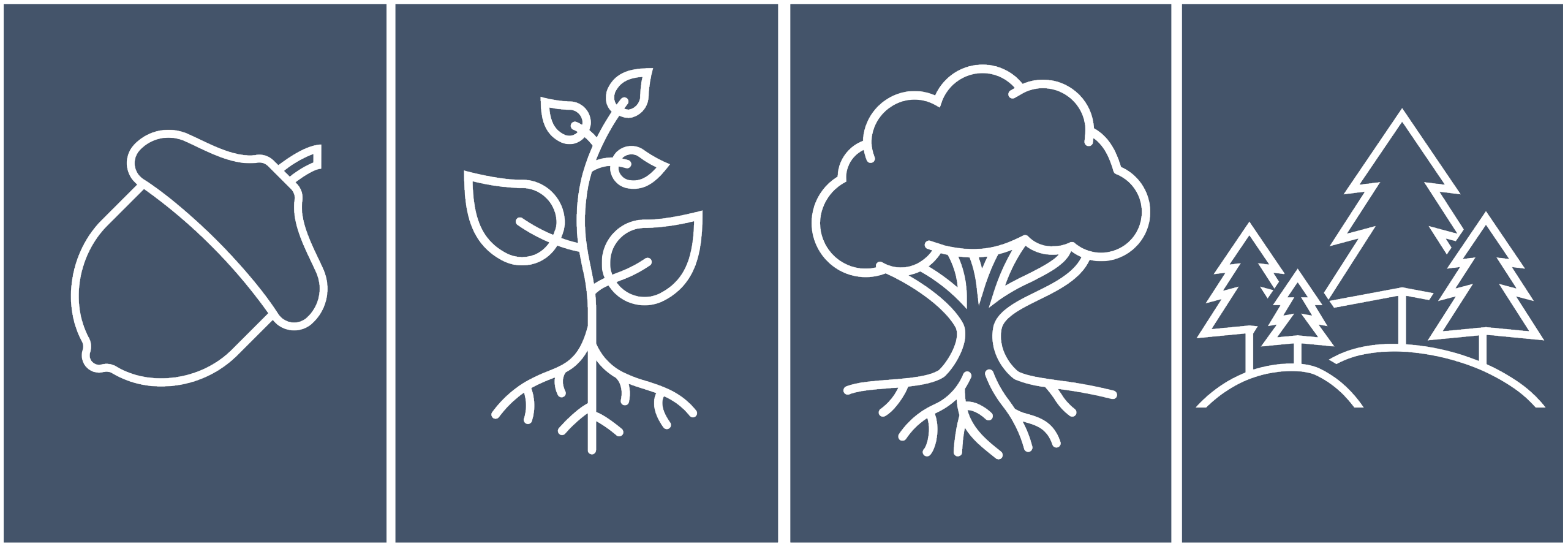


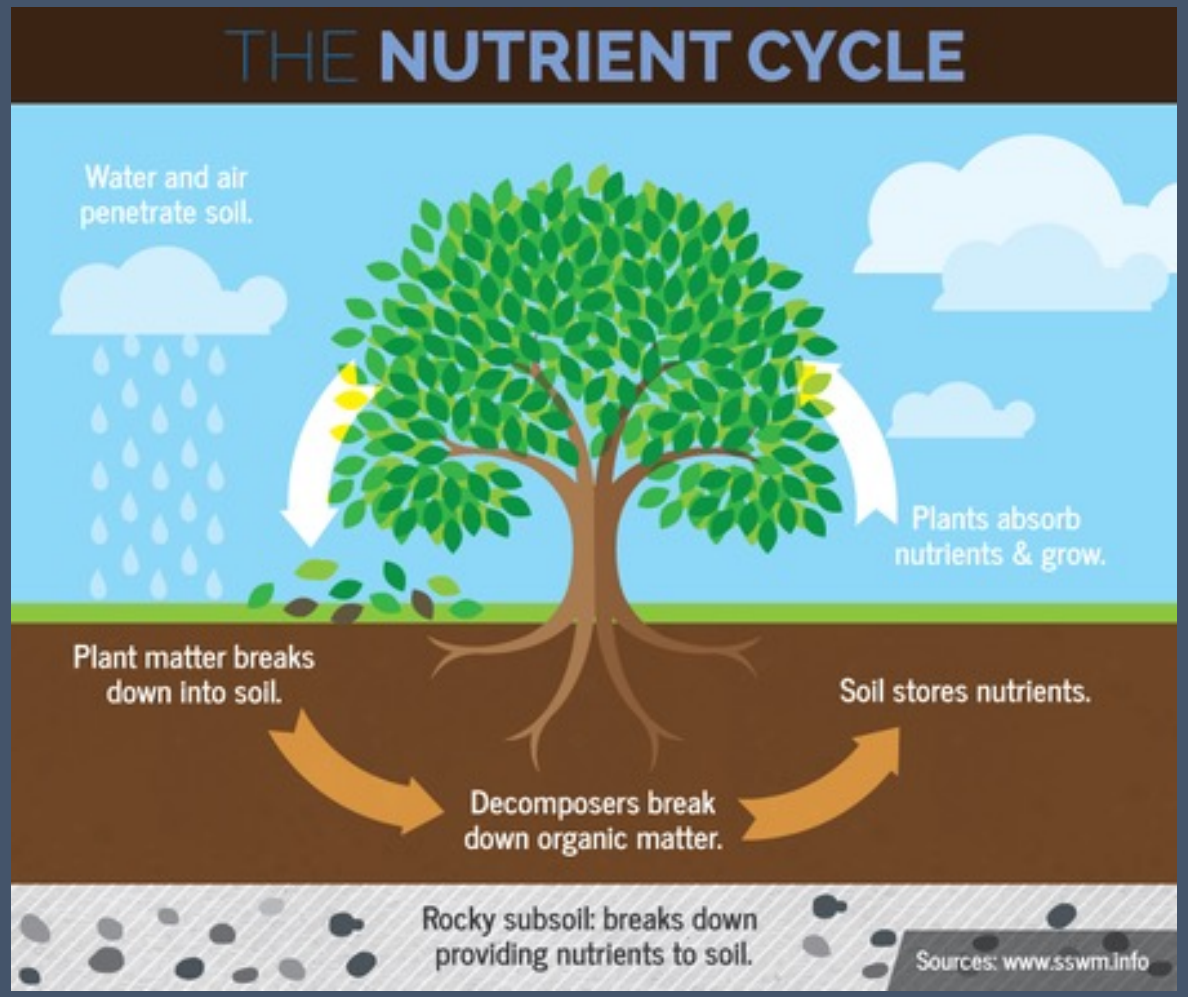
The effects of soil chemistry on foliar photosynthetic traits across biomes

Olivia Werba

Background

Why soil chemistry?

1. Critical for understanding environmental biogeochemical processes
2. Plant growth
3. Environmental contaminants



https://soil.evs.buffalo.edu/index.php/Main_Page

Plant foliar traits

1. Nutrient concentration
2. Lignin
3. Leaf water content
4. Chlorophyll

Sharron, E. (n.d.). *Northeast Temperate Network Ecosystems (U.S. National Park Service)*. National Parks Service. https://www.nps.gov/im/netn/ecosystems.htm

Ecoclimatic Zones

1. Vegetation
2. Landforms
3. Ecosystem dynamics
4. 20 in the US

Impacts

1. Understanding plant-soil relationships
2. View across biomes
3. Inform larger models

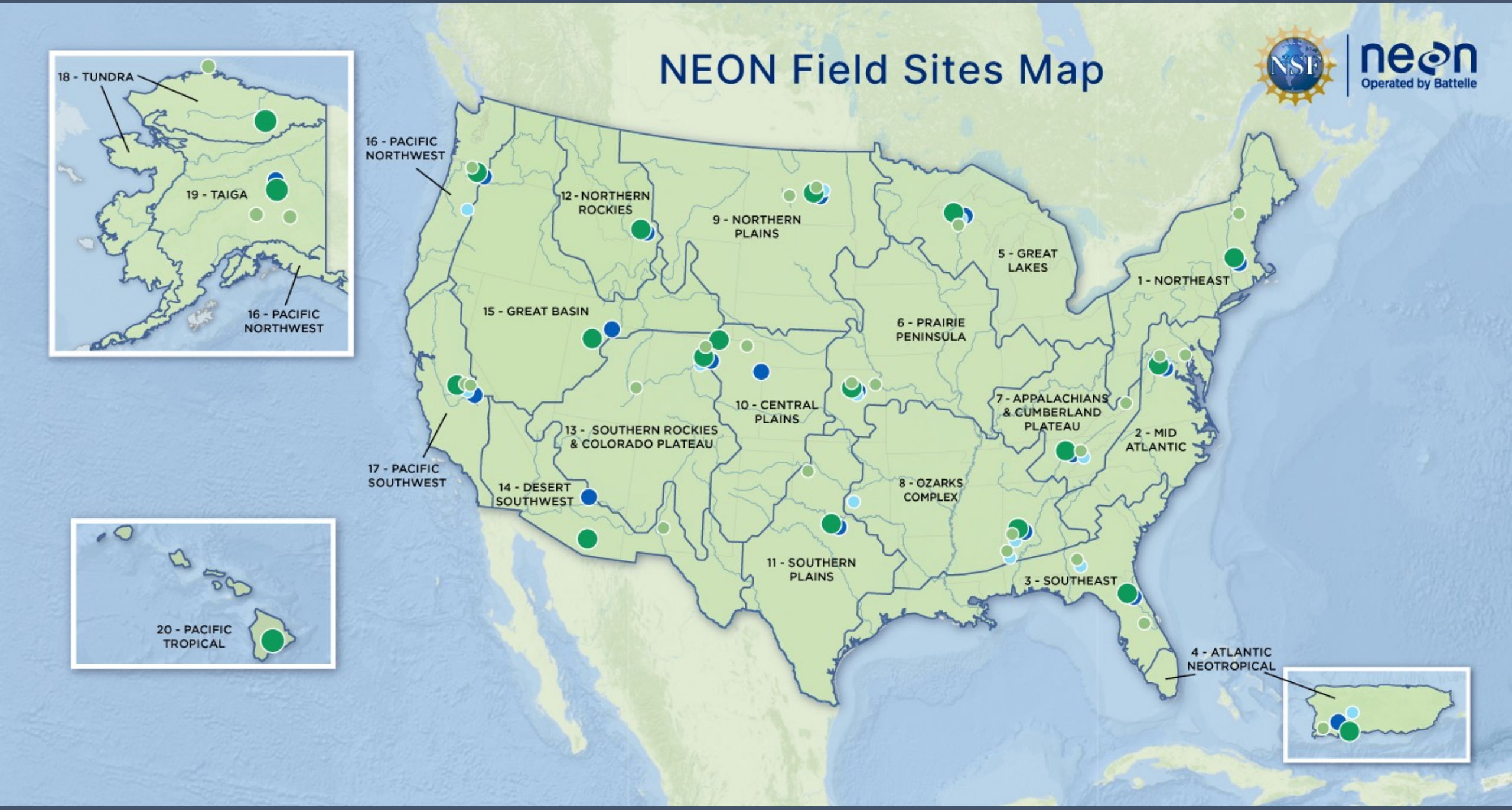
Data

Data

- Data from National Science Foundation's National Ecological Observatory Network (NEON)
- Ecosystem monitoring across the US
- 47 terrestrial field sites
- Spatial and temporal data

Lunch, C. K. (n.d.). *Neon domain and site shapefiles and maps*. NEON Domain and Site Shapefiles and Maps | NSF NEON | Open Data to Understand our Ecosystems. https://www.neonscience.org/resources/learning-hub/tutorials/neon-maps

NEON Field Sites Map



Approach

Guiding Work Section I

1. Plant-soil relationships influence observed trends between manganese and carbon across biomes

2. Global effects of soil and climate on leaf photosynthetic traits and rates

Santos, F., & Herndon, E. (2023). Plant-soil relationships influence observed trends between manganese and carbon across biomes. *Global Biogeochemical Cycles*, *37*(1). https://doi.org/10.1029/2022gb007412

Maire, V., Wright, I. J., Prentice, I. C., Batjes, N. H., Bhaskar, R., van Bodegom, P. M., Cornwell, W. K., Ellsworth, D., Niinemets, Ü., Ordonez, A., Reich, P. B., & Santiago, L. S. (2015). Global effects of soil and climate on leaf photosynthetic traits and rates. *Global Ecology and Biogeography*, *24*(6), 706–717. https://doi.org/10.1111/geb.12296

Methodology – Section I

1. Adapt Santos methodology to Python

2. Examine relationships explored in Maire using a cohesive dataset

Guiding Work Section II

1. Surface soil properties are linked with climatic and biota properties on a global scale

Zhao, X., Yang, Y., Shen, H., Geng, X., and Fang, J.: Global soil–climate–biome diagram: linking surface soil properties to climate and biota, Biogeosciences, 16, 2857–2871, https://doi.org/10.5194/bg-16-2857-2019, 2019.

Methodology – Section II

1. Fit the data to different ML classification models

2. Evaluate the models based on accuracy

Challenges

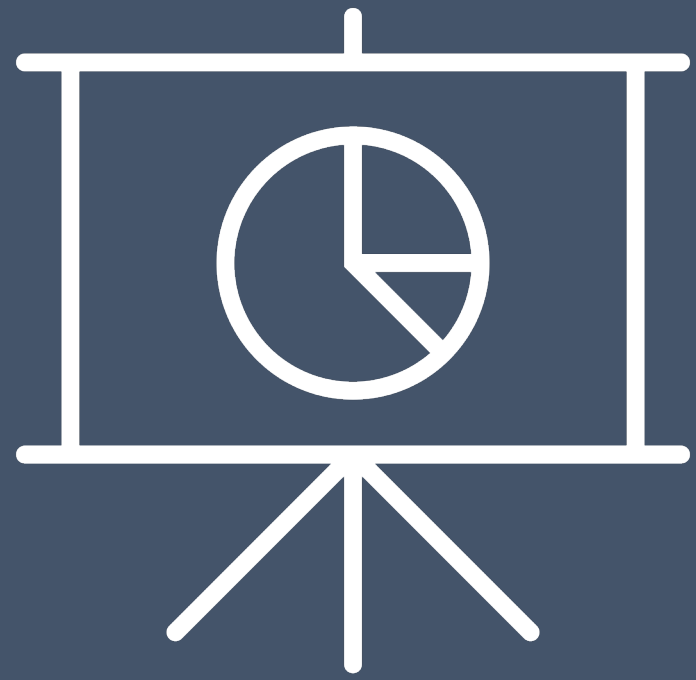
Challenges

1. Grouping data by site
2. Scope shift
3. Domain specific knowledge
4. Computing Resources

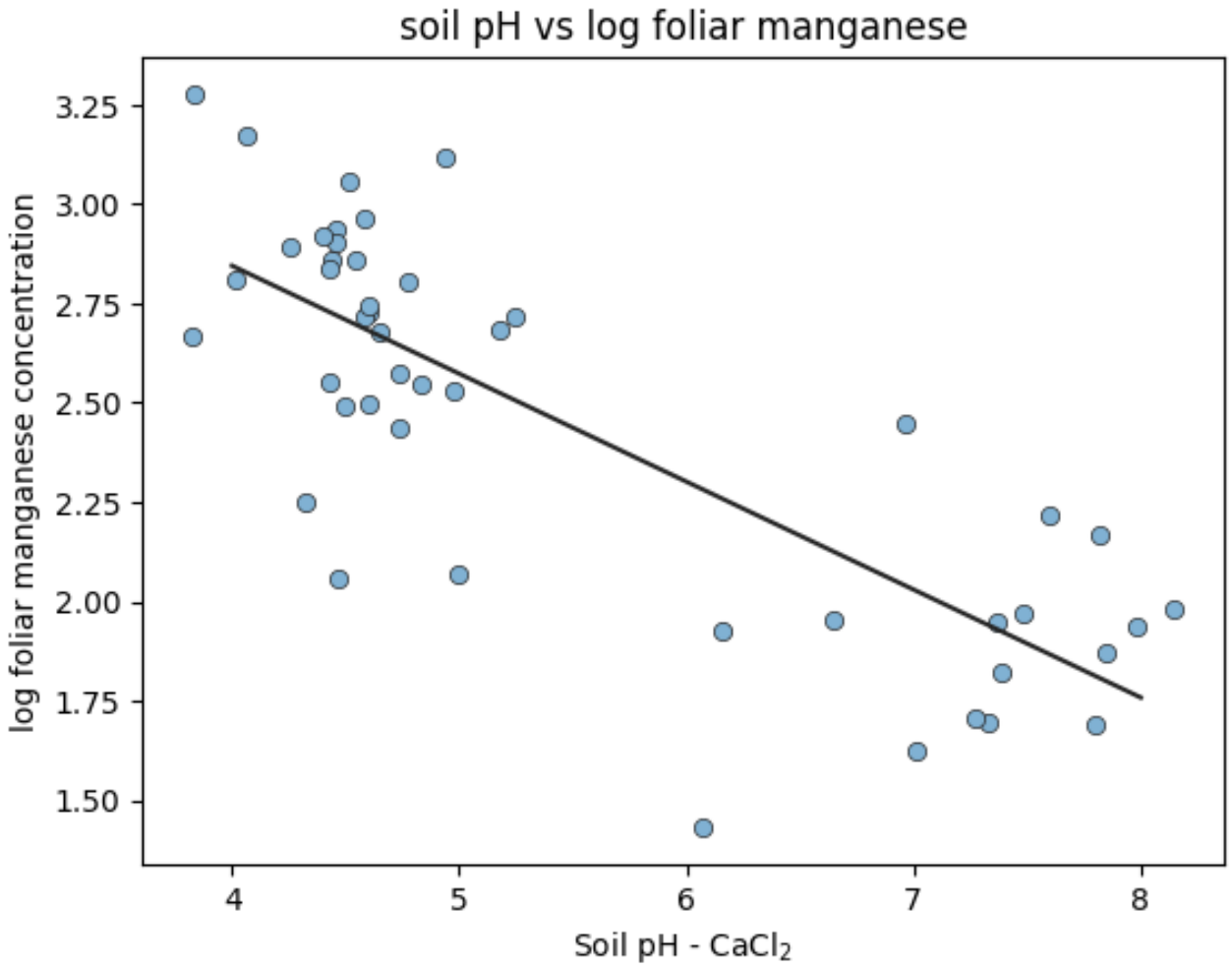
Results

Results

1. Confirm Santos Methodology
2. Soil chemistry & plant photosynthetic traits
3. Classification of ecoclimatic zones

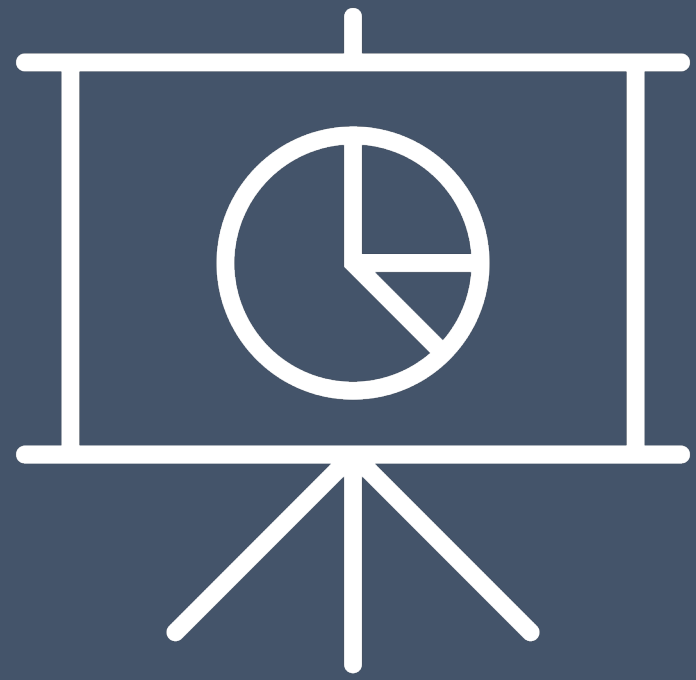


Confirmation of Santos Methodology

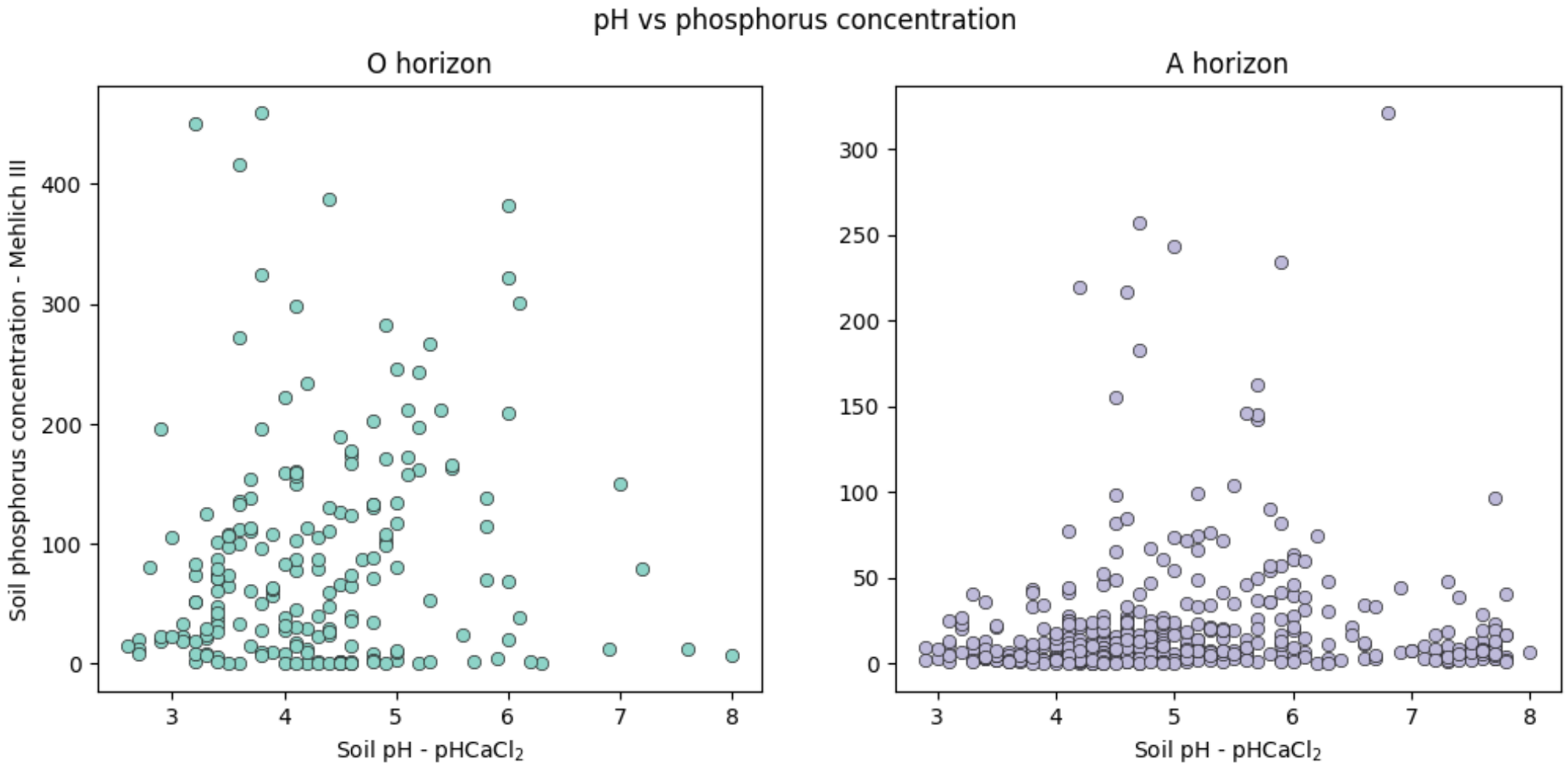


Results

1. Confirm Santos Methodology
2. **Soil chemistry & plant photosynthetic traits**
3. Classification of ecoclimatic zones



Soil chemistry and plant photosynthetic traits



Results

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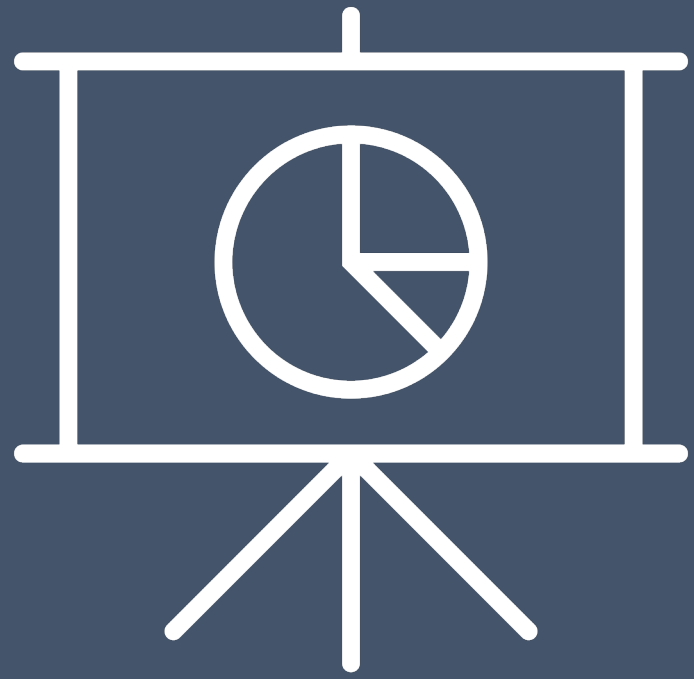

Classification of ecoclimatic zones

Method	Accuracy
Random Forest Classifier	94%
Support Vector Classifier (linear kernel)	85%
Decision Tree Classifier	80%
Support Vector Classifier (radial kernel)	70%
Support Vector Classifier (polynomial kernel)	50%
Neural Network	37%
Ridge Classifier	18%

Thank you!