

# The Functional Capacity of Soils in Ecosystems in Baltimore, Maryland

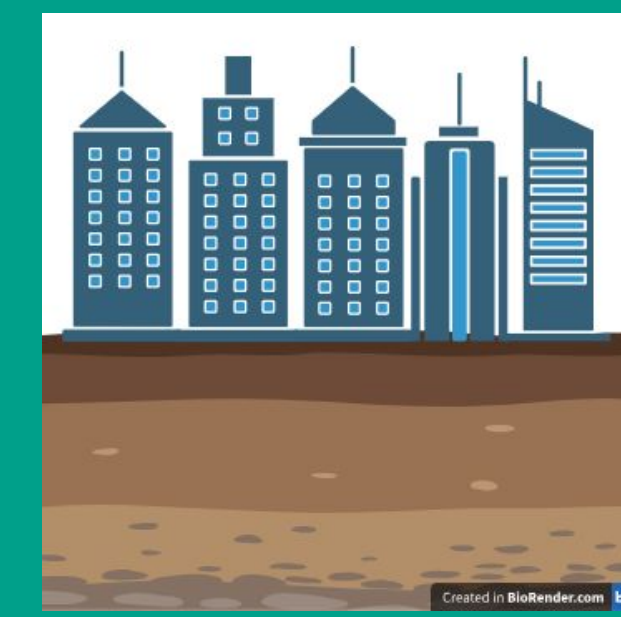
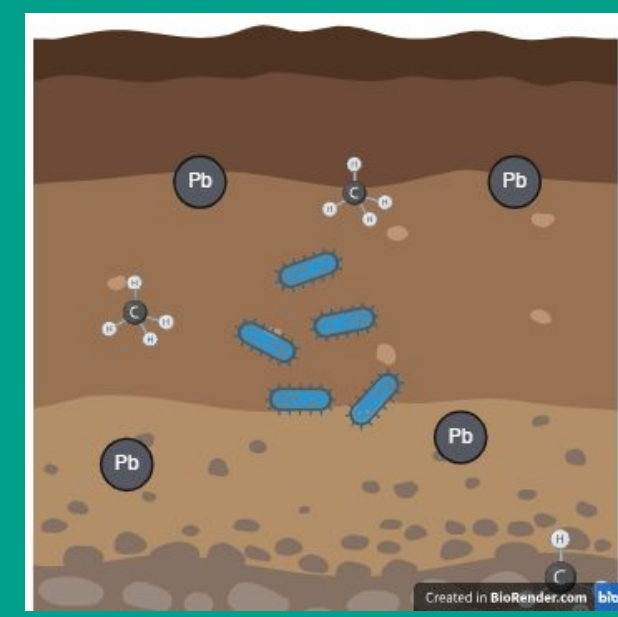
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## Background

The quality and content of soils is critical to ecosystem health.

Soils contain a record of human activities.

However, the dynamics of urban soils remain a mystery.

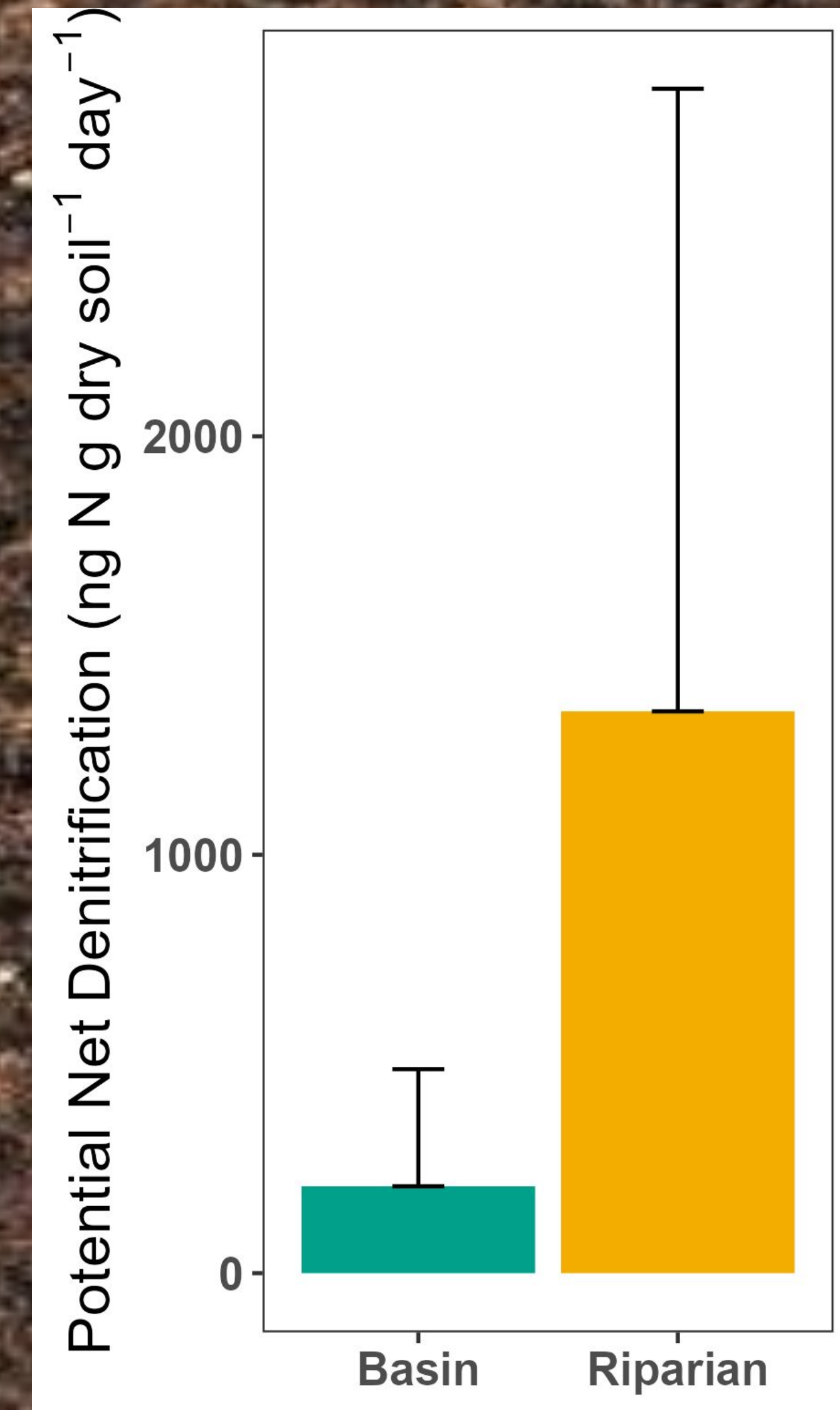
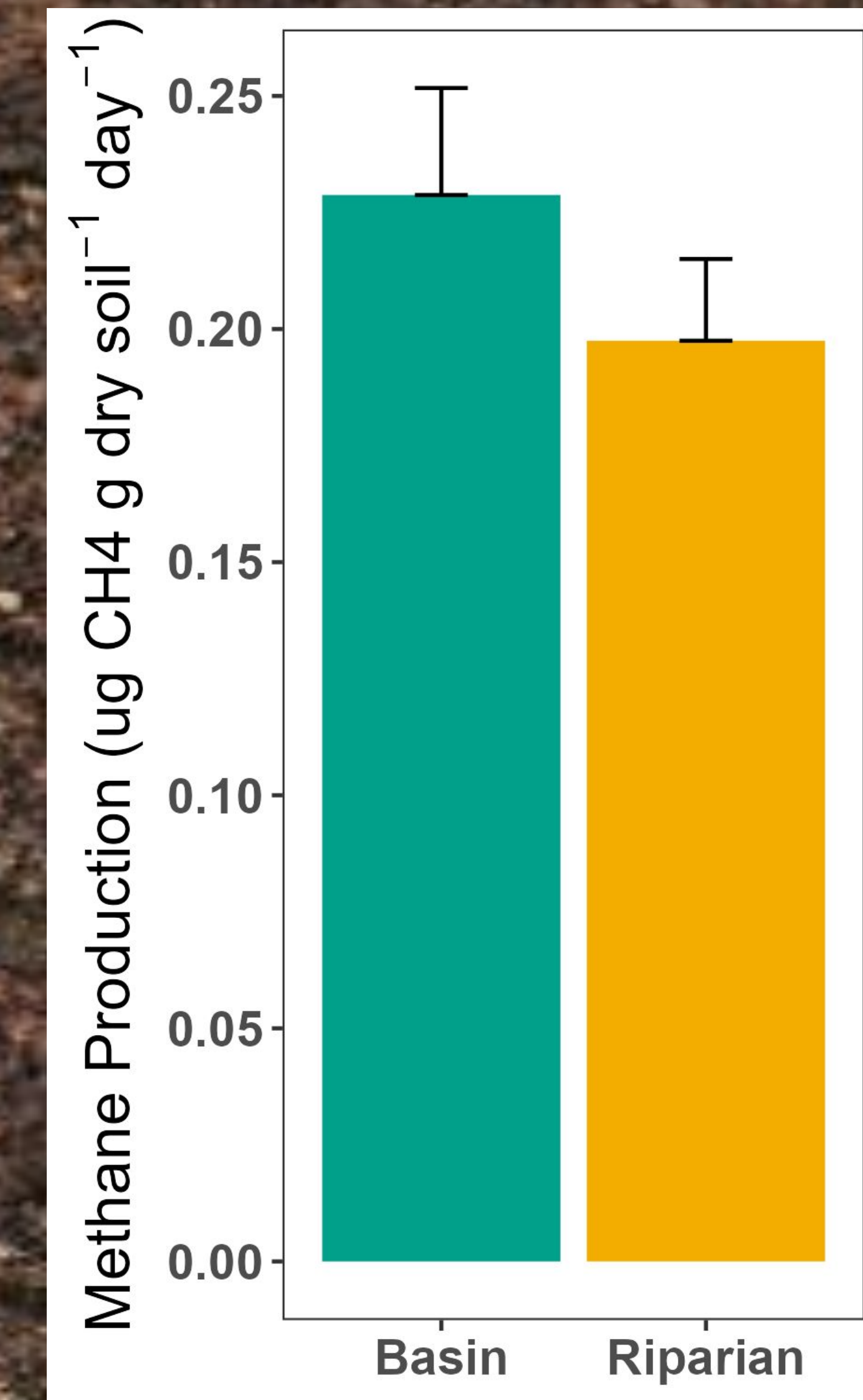
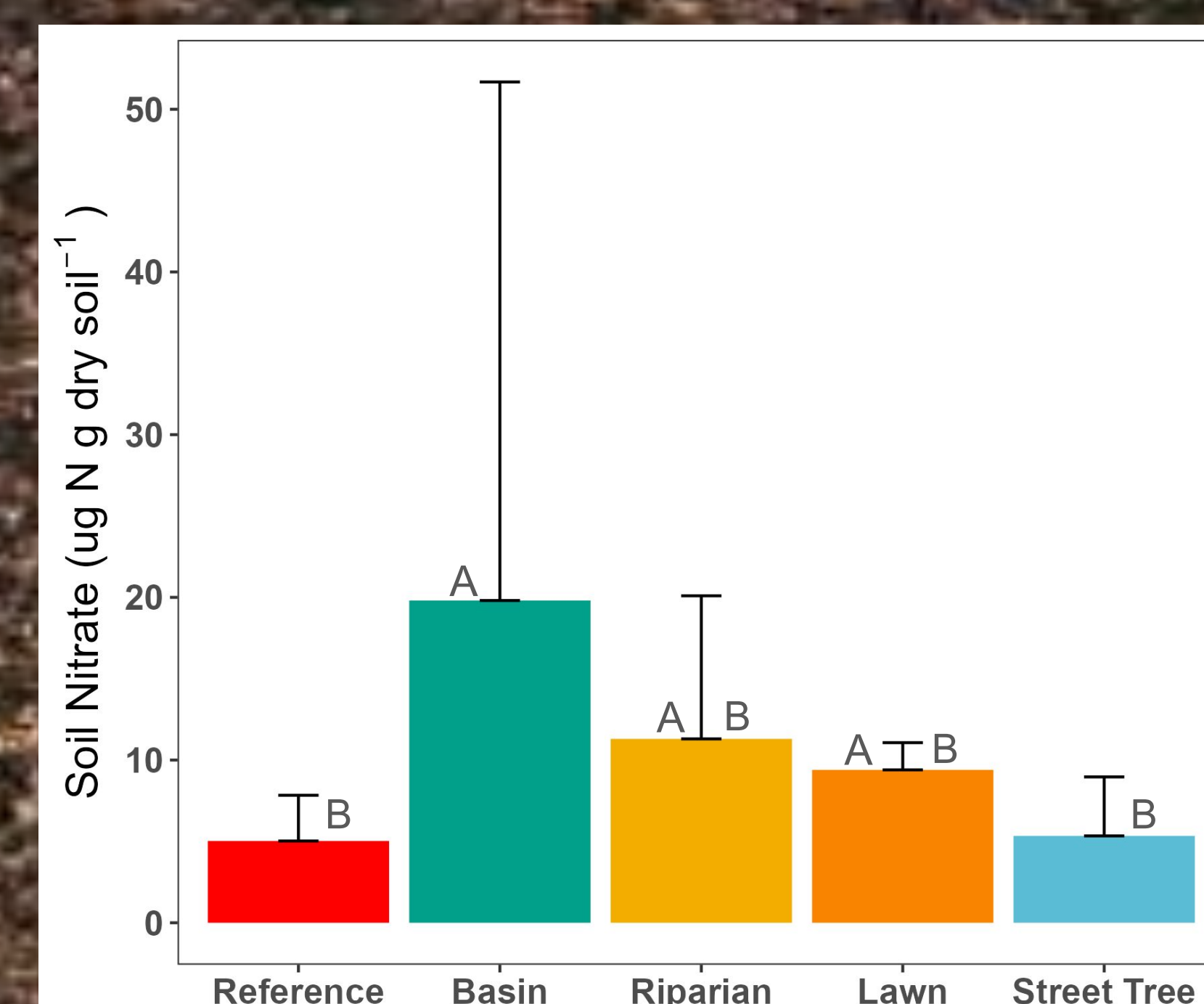
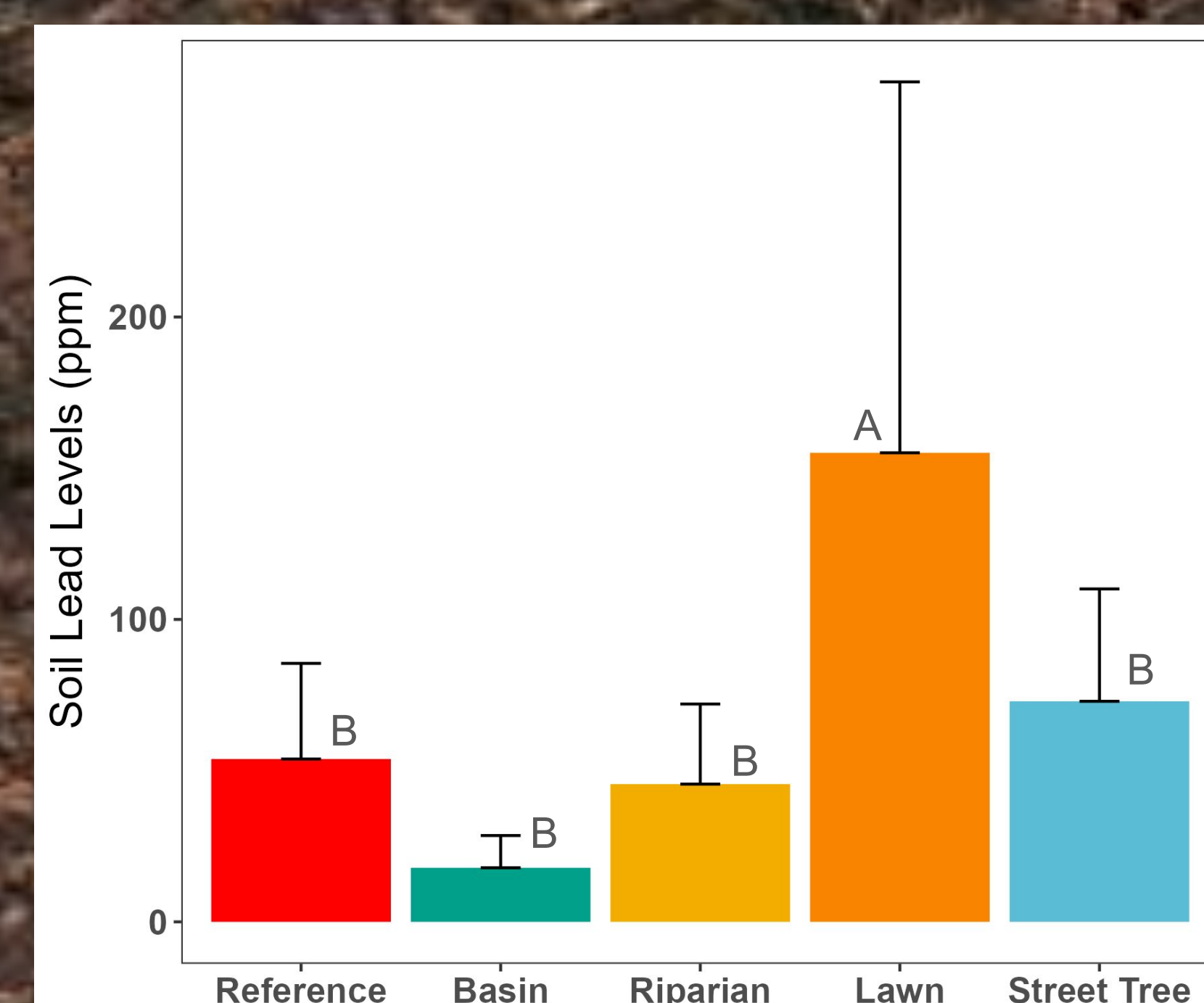
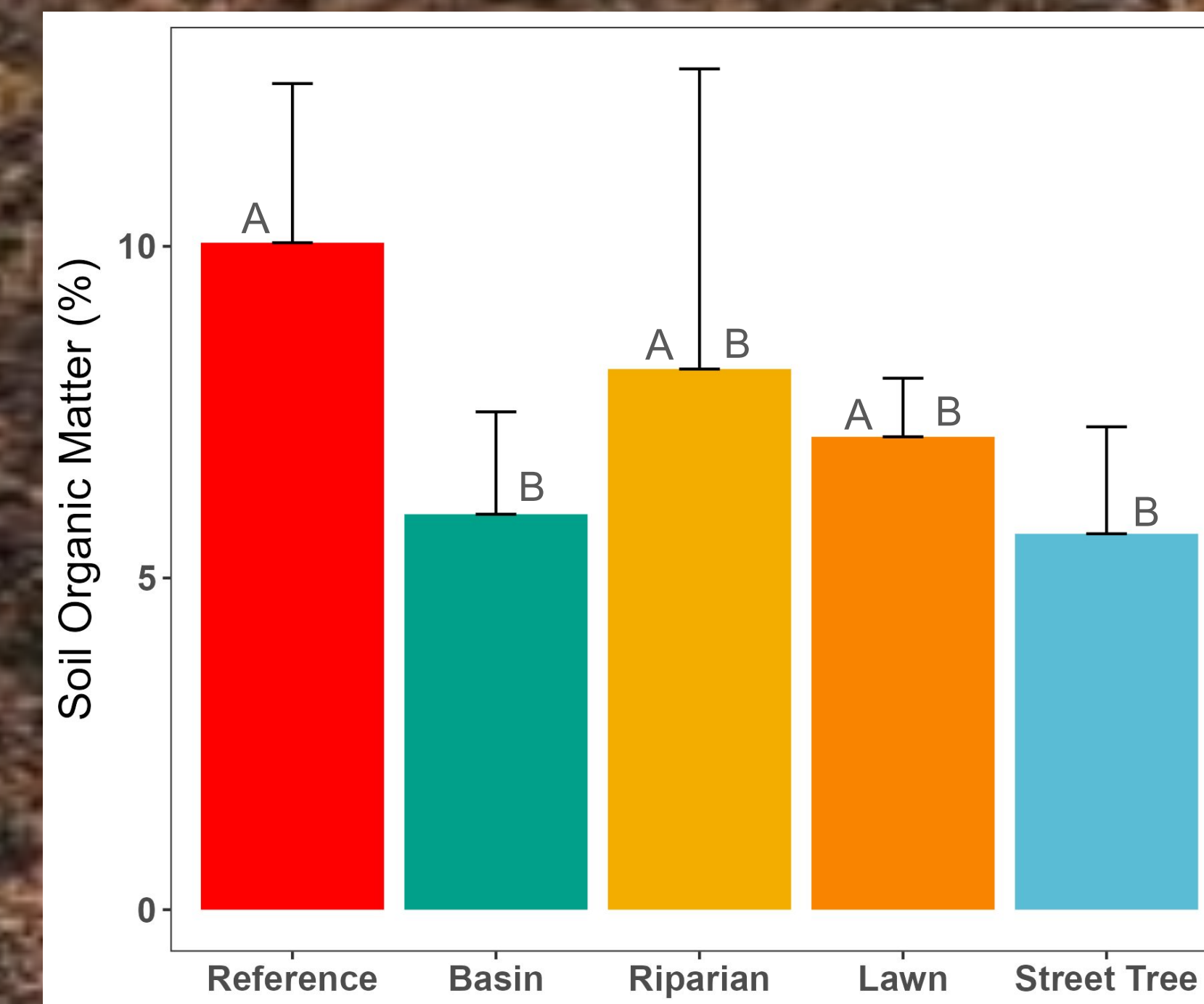
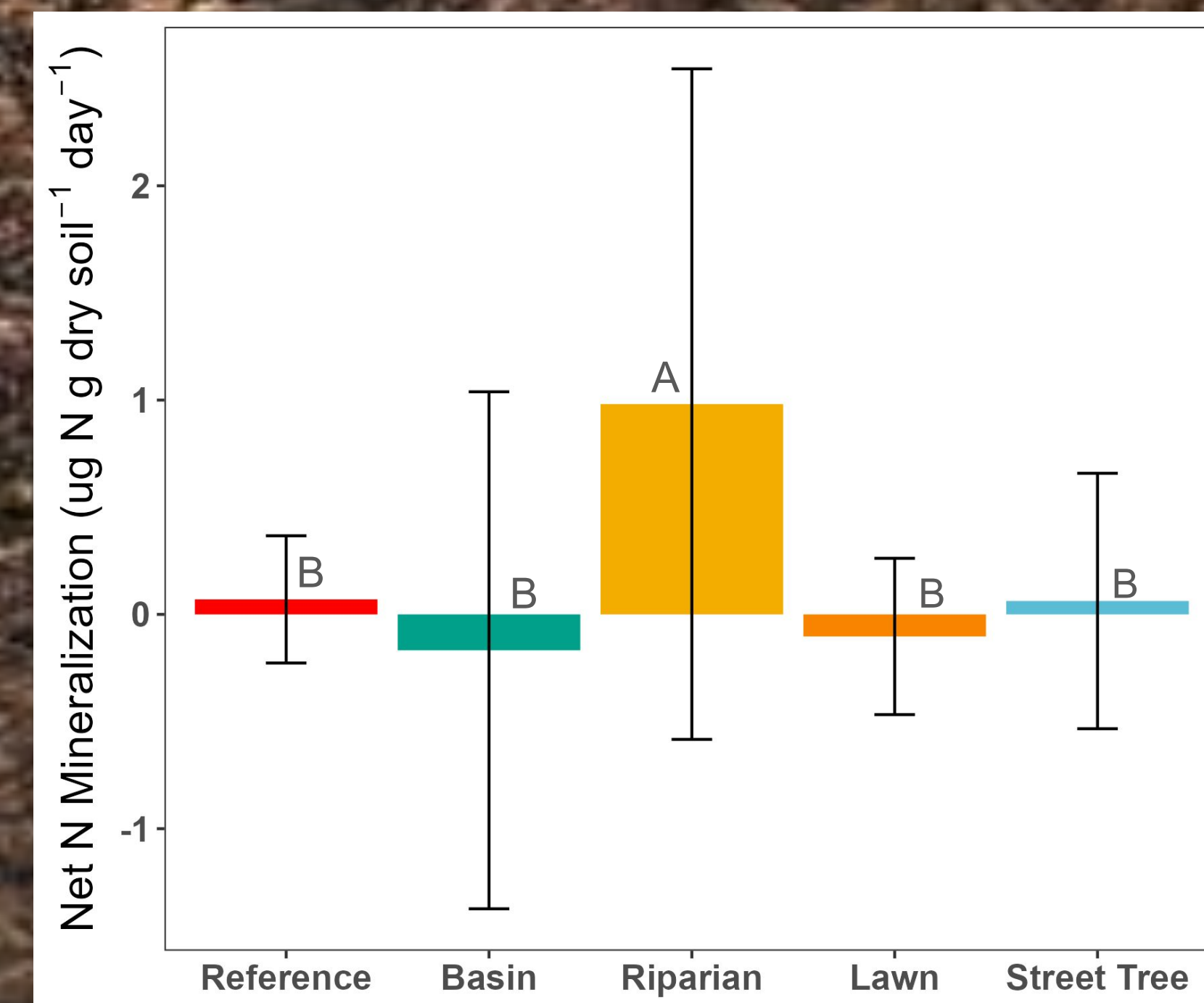


## Questions

- Are urban soils fertile enough to support the growth of plants that are important for multiple ecosystem functions and services?
- Are urban soils contaminated with high levels of lead and nitrate?
- Can urban soils be engineered to replace functions reduced by urbanization (e.g., denitrification, a process that removes nitrate pollution)? Does this engineering create disservices (e.g., increased greenhouse gas emissions)?

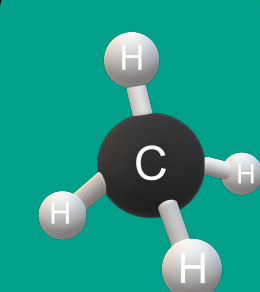
## Methods

- Soil samples were collected from different land use types (lawns, street trees, riparian zones, forested reference sites and detention basins) in Baltimore.
- Samples were analyzed through the following methods:
  - DEA (denitrification potential)
  - Laboratory incubations to measure nitrogen fertility and greenhouse gas emissions. (Image 1)
  - Loss on Ignition (LOI) analysis was used to determine the soil organic matter (SOM) content (%OM) of each soil sample. (Image 2)
  - Heavy Metal test using XRF X-Ray Fluorescence

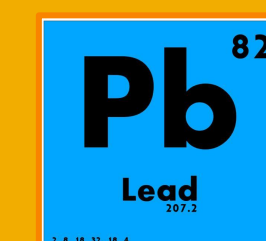


## Results

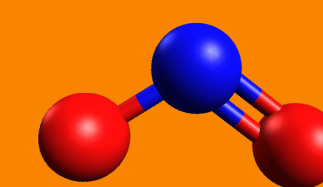
**Riparian vs. Basin**  
 Natural riparian zones have **higher** DEA and **lower** methane flux than basin sites.



**Metals**  
 Soil lead levels are **highest** in lawns and in street tree pits.



**Mineralization and Nitrification**  
 Reference and riparian sites have **higher** mineralization and nitrification than more intensively altered urban soils.



**SOM**  
 SOM was **highest** in reference and riparian sites. SOM is the source of energy for microbial processes. There are **high** and **significant** correlations between SOM and many variables.



## Take Home Messages

- Detention basins created to fulfill the function of the degraded riparian areas are less beneficial than intact riparian areas. They also have higher greenhouse gas emissions than natural riparian areas.
- Lead levels in lawns and street trees were the highest of all land use types sampled, but neither was dangerously high. Further work is needed on the sources and effects of metals in urban soils.
- Lawns are less fertile and have lower nutrient cycling than the sampled riparian areas. These lawns do not appear to be “hotspots” of nitrogen pollution.