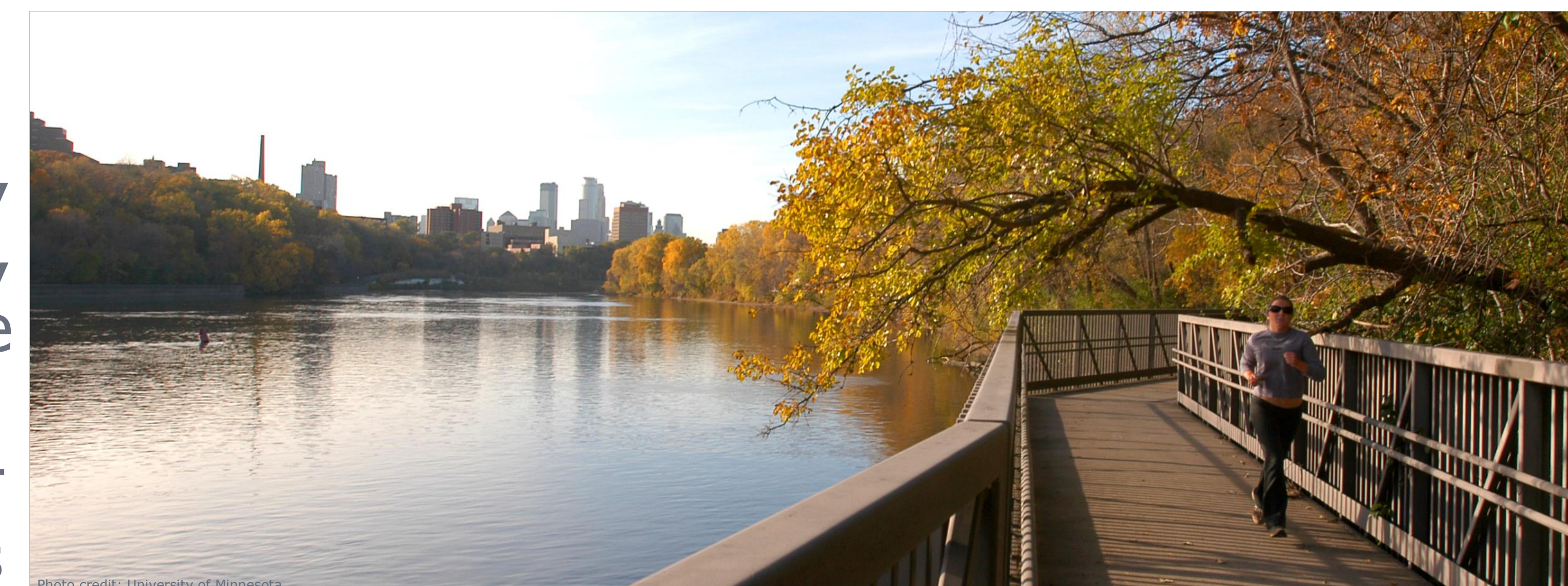


Can urban trees help protect our lakes and streams?

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Many cities' lakes & streams are threatened.

Excess nutrients (**nitrogen** and **phosphorus**) in our waters cause algae blooms, bad odor and taste, fish kills, and other problems.

nitrogen & phosphorus

surface runoff, leaching to groundwater, erosion, deposition

dust, fertilizer, vehicle exhaust, pet waste, leaves, grass clippings, industrial emissions

The urban forest is poised for rapid change.

Emerald ash borer will kill **one quarter** of the Twin Cities' trees in 15 years.

Renovation projects like the light rail create new spaces to plant trees in the urban core.

How will these changes affect our lakes and streams?

Leaching to Groundwater: Digging holes in Saint Paul's city parks

Tensiometers measure the flow rate of soil water. 30cm

Lysimeters collect soil water to analyze nutrient concentrations. 60cm depth

Flow rate x nutrient concentration = **nutrient leaching**

City parks have many species growing in the same environment.

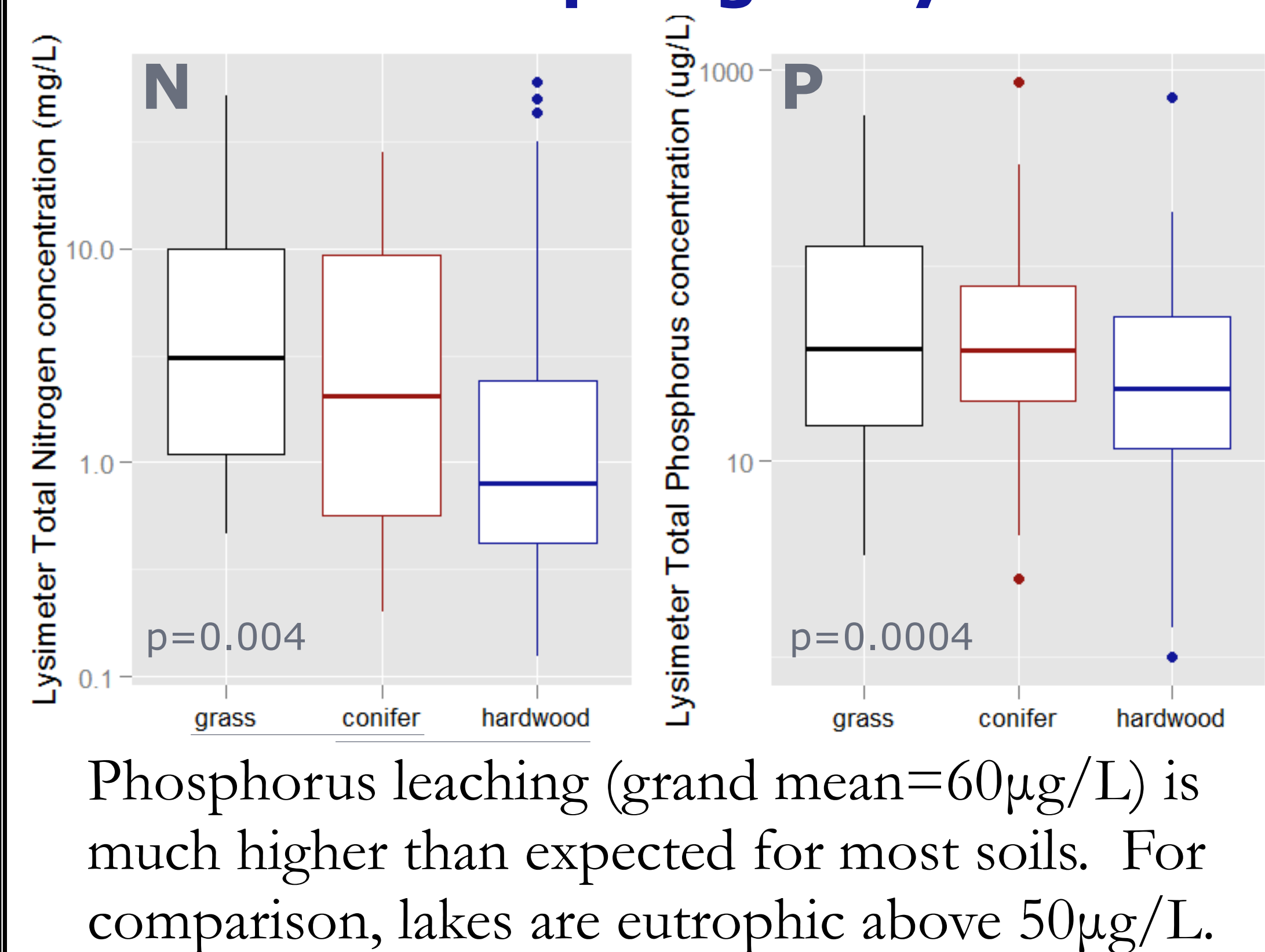
Sampling sites in Horton Park

T = trees, G = open grassy areas

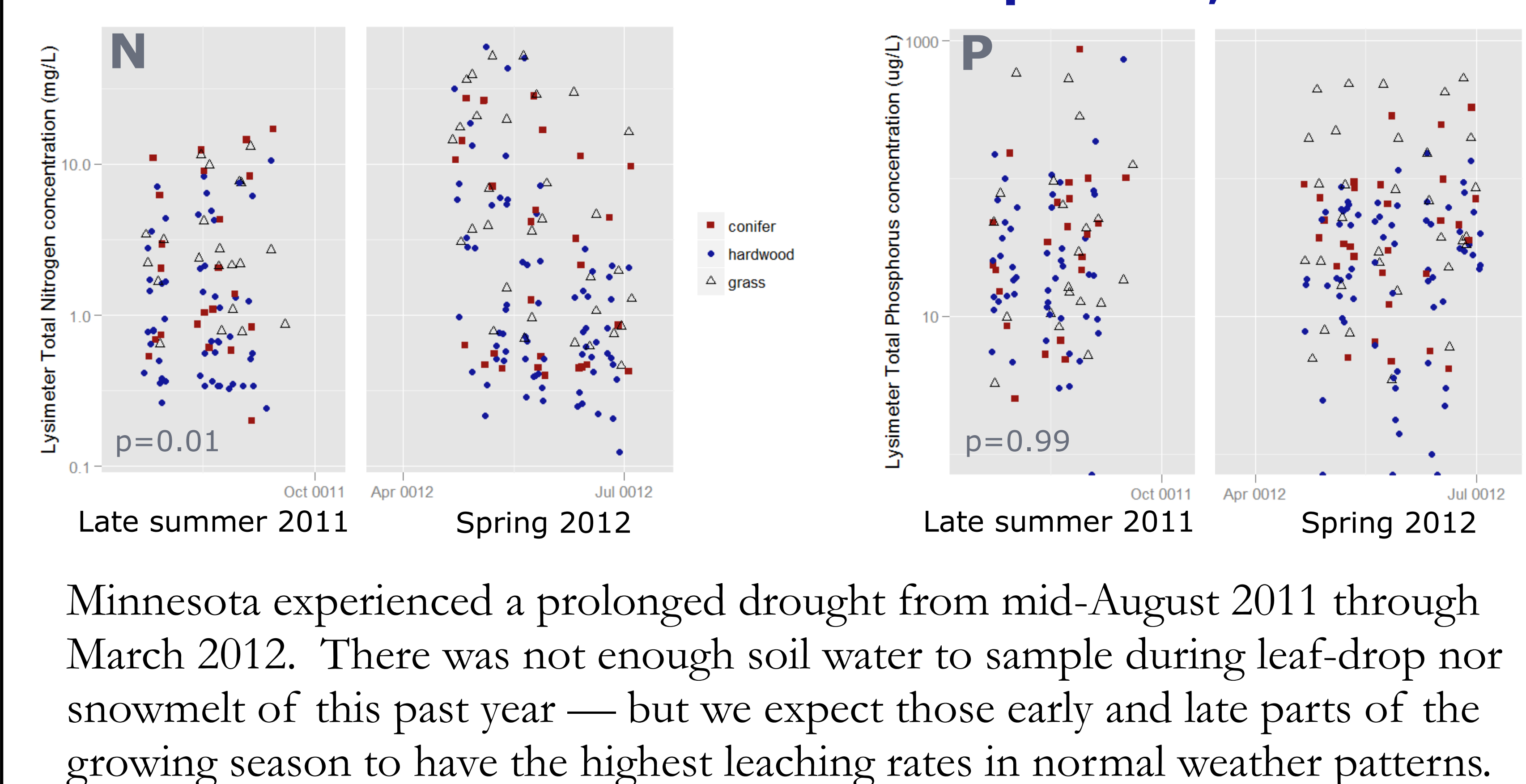
We compare **fourteen tree species** and **open grassy areas** all with:

- similar soils,
- same climate,
- no fertilizer or irrigation.

Trees have lower nutrient concentrations than open grassy areas.

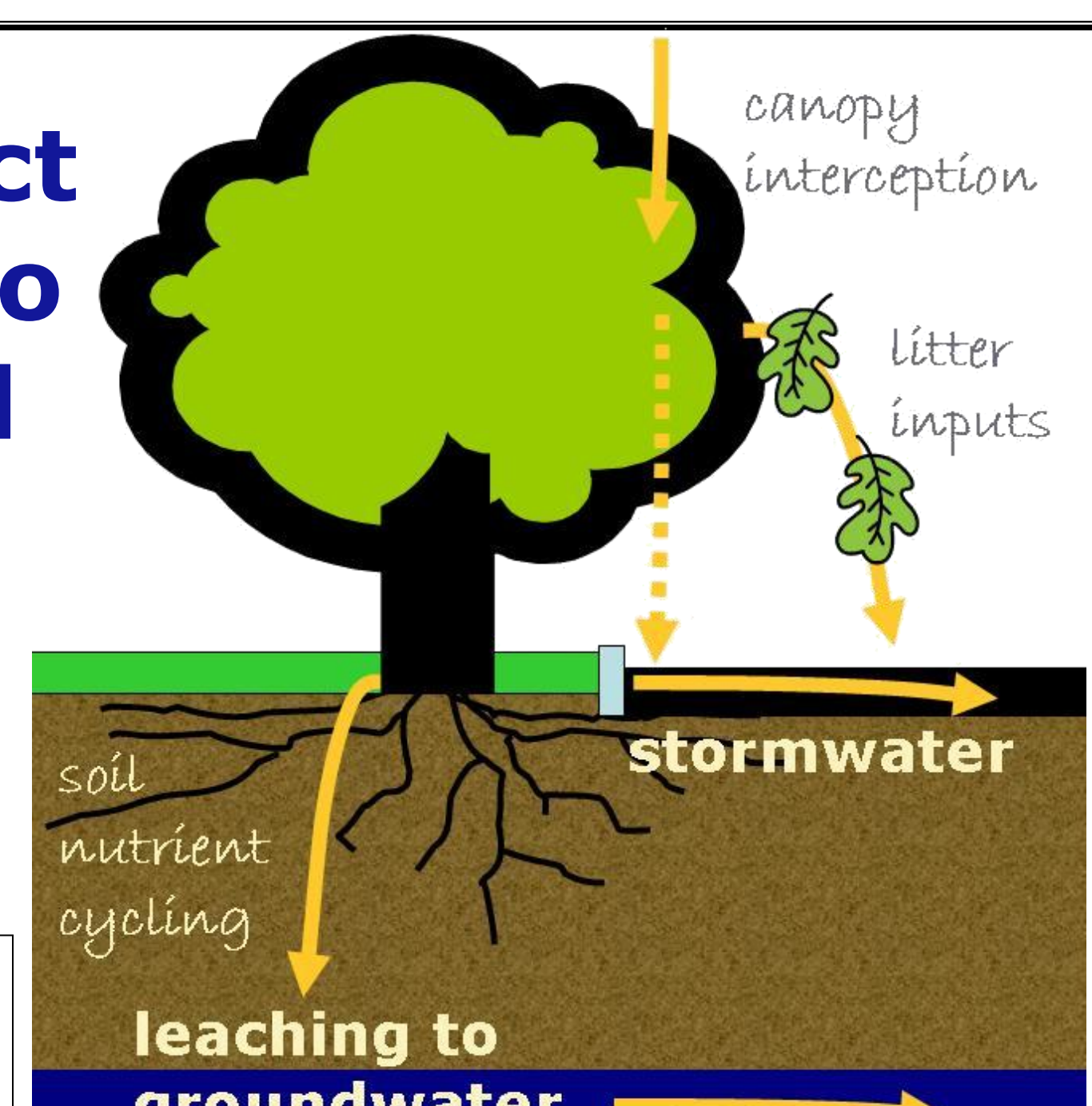
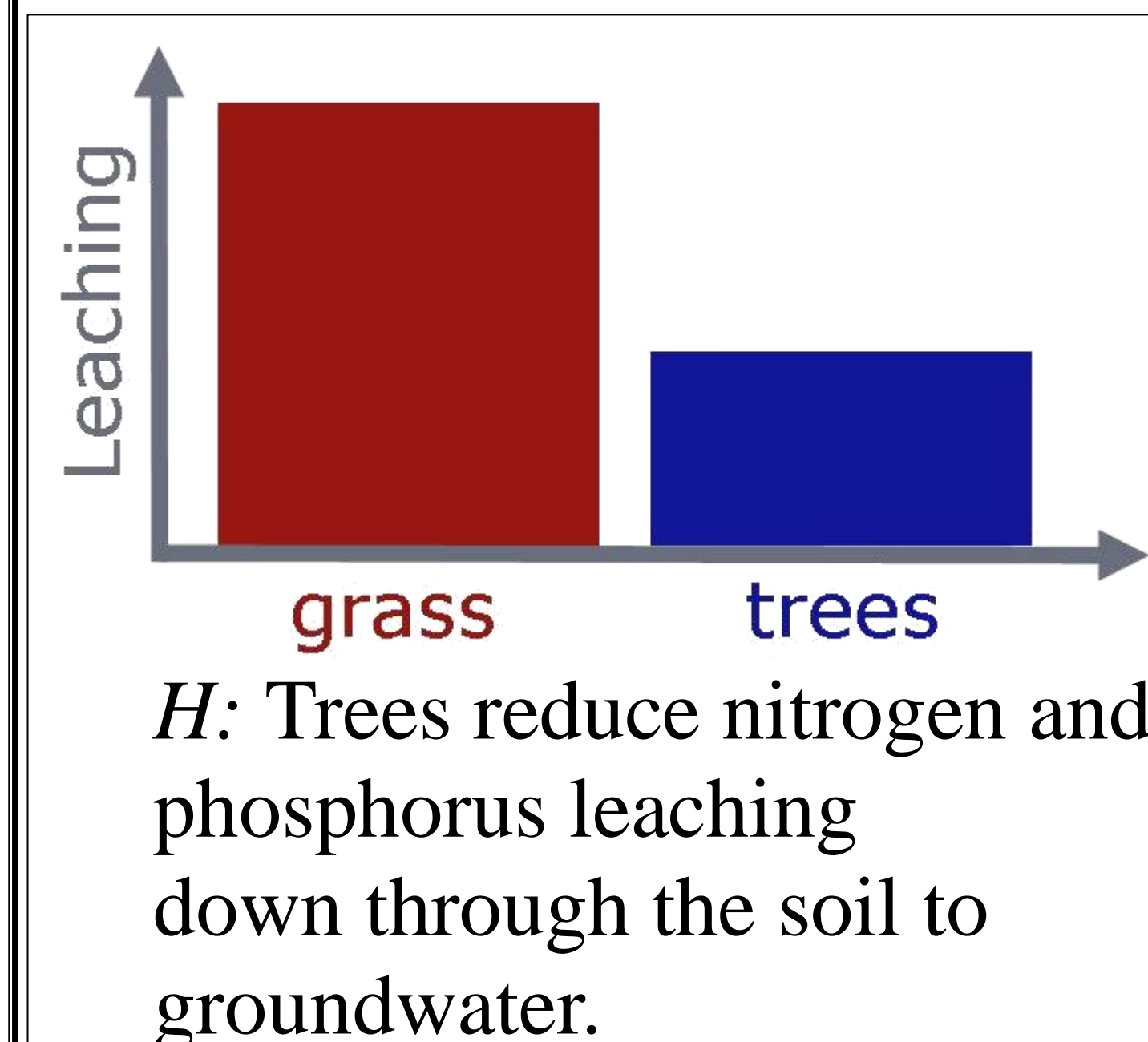


N concentrations show a seasonal pattern, but not P.

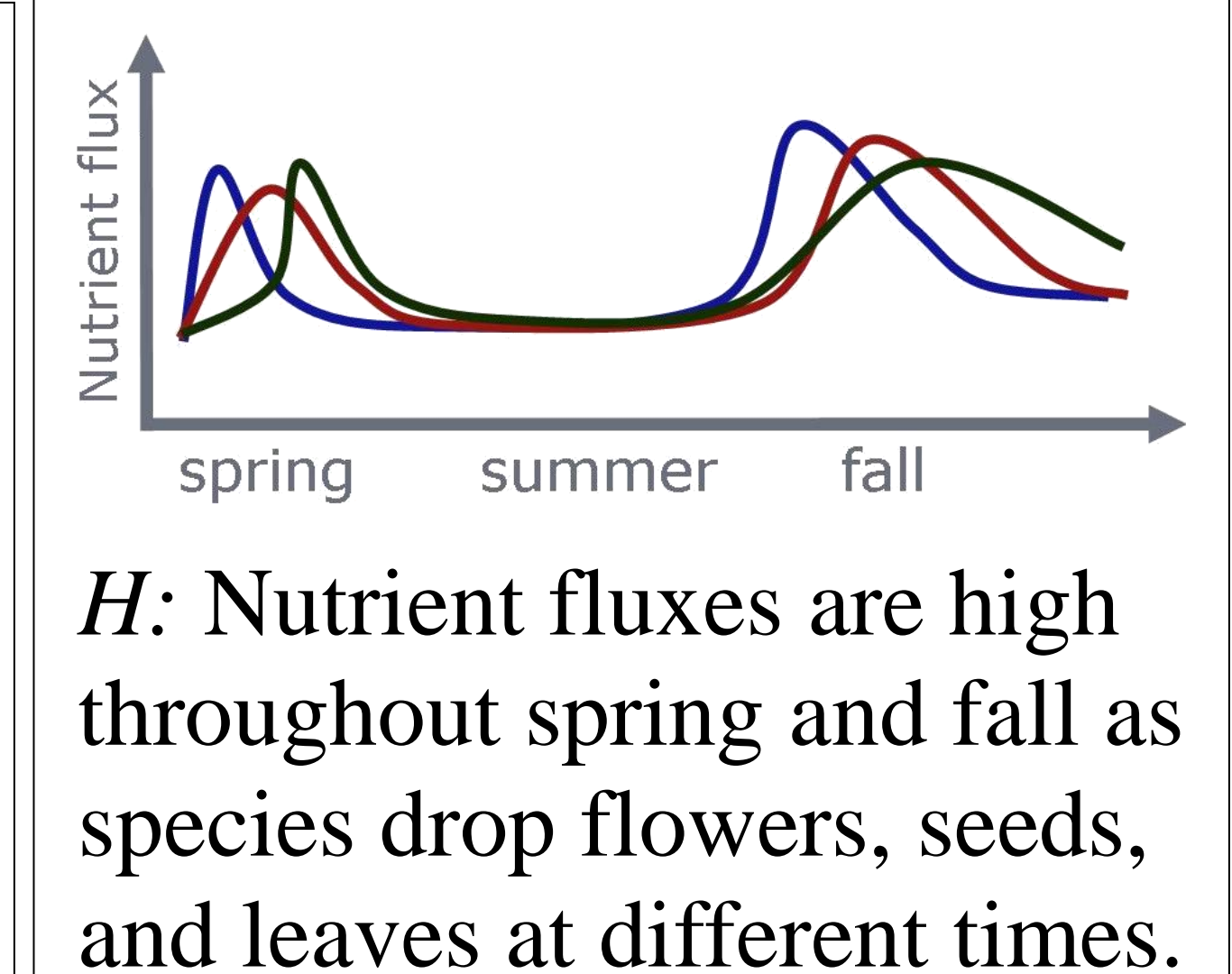
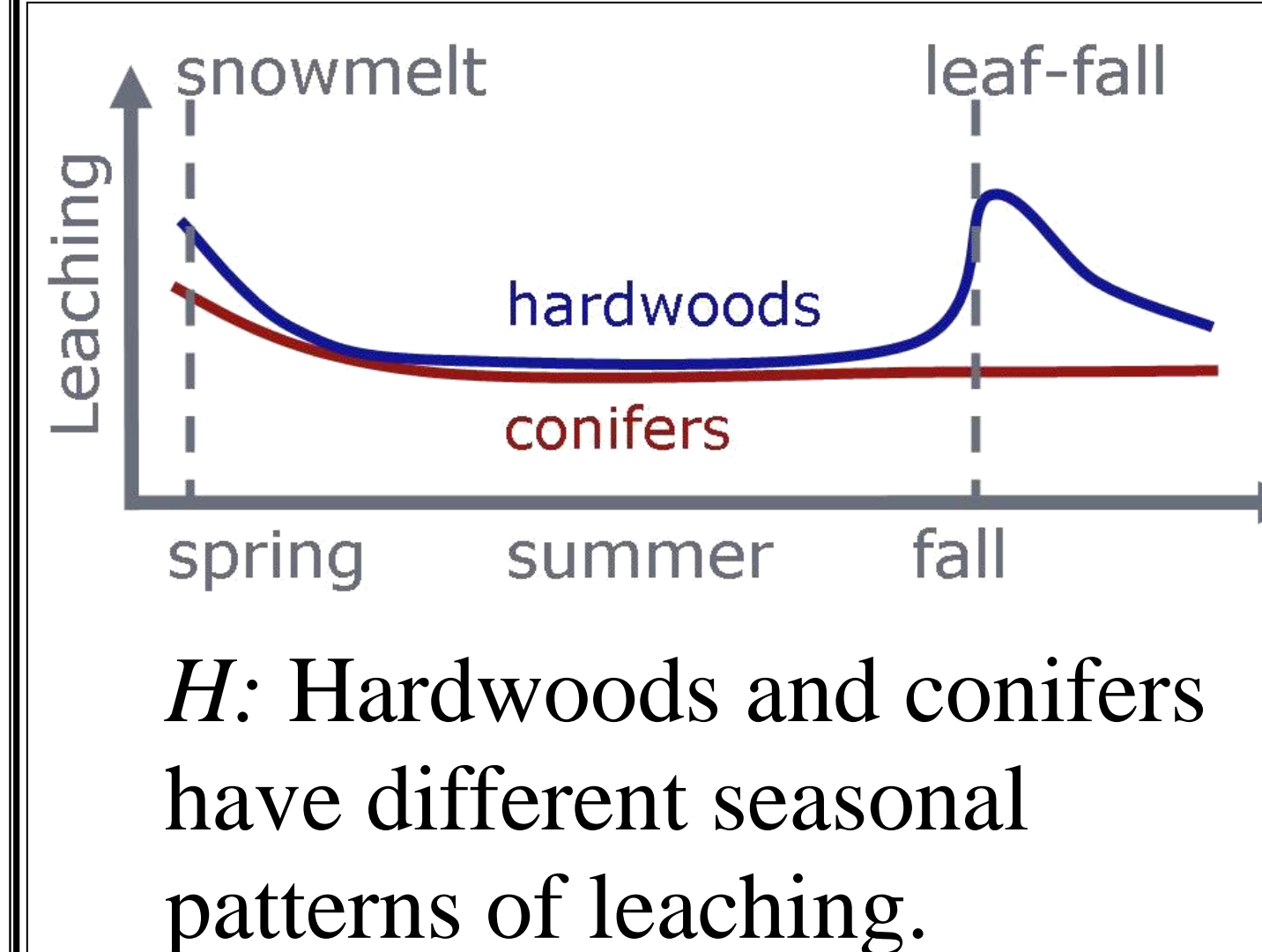
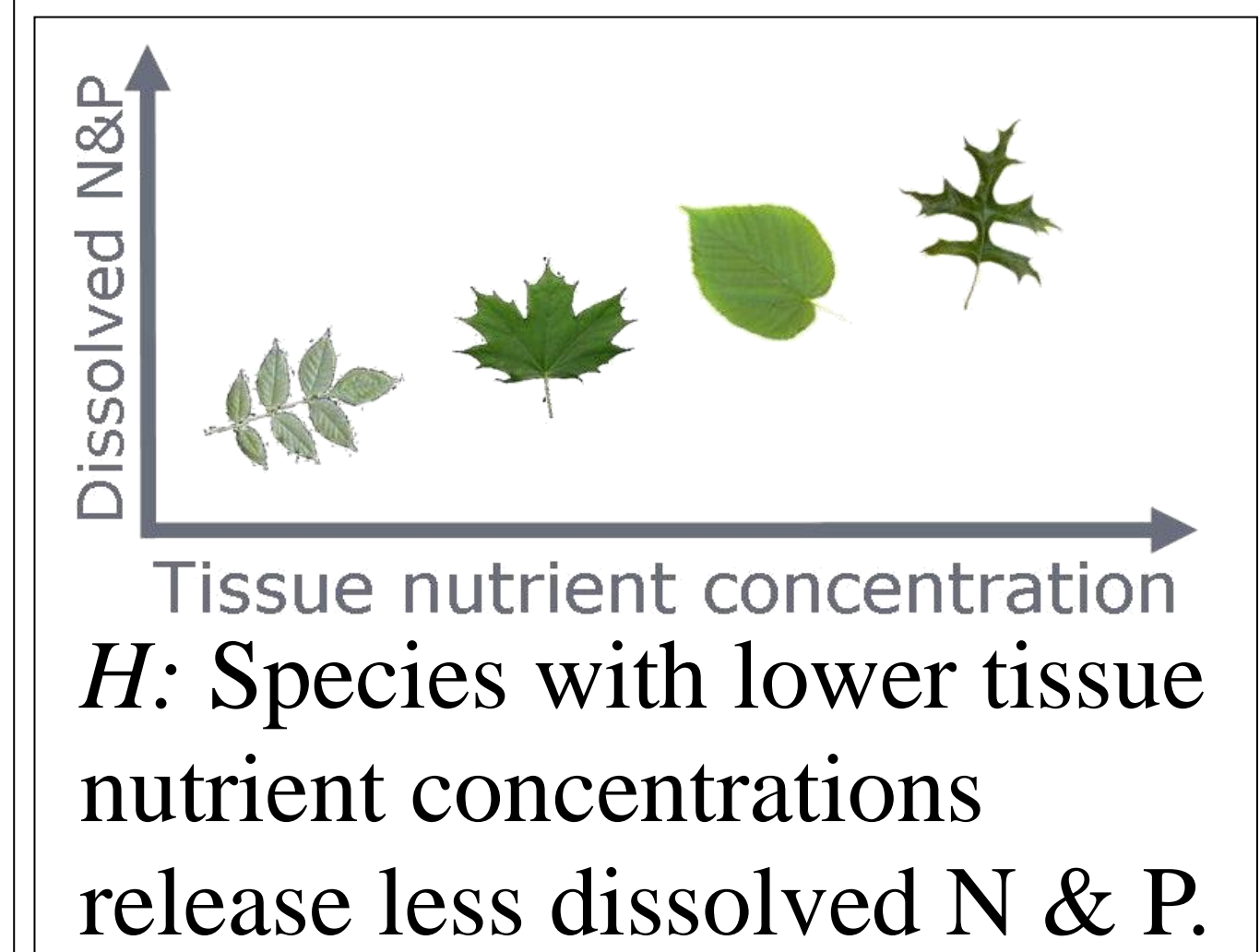
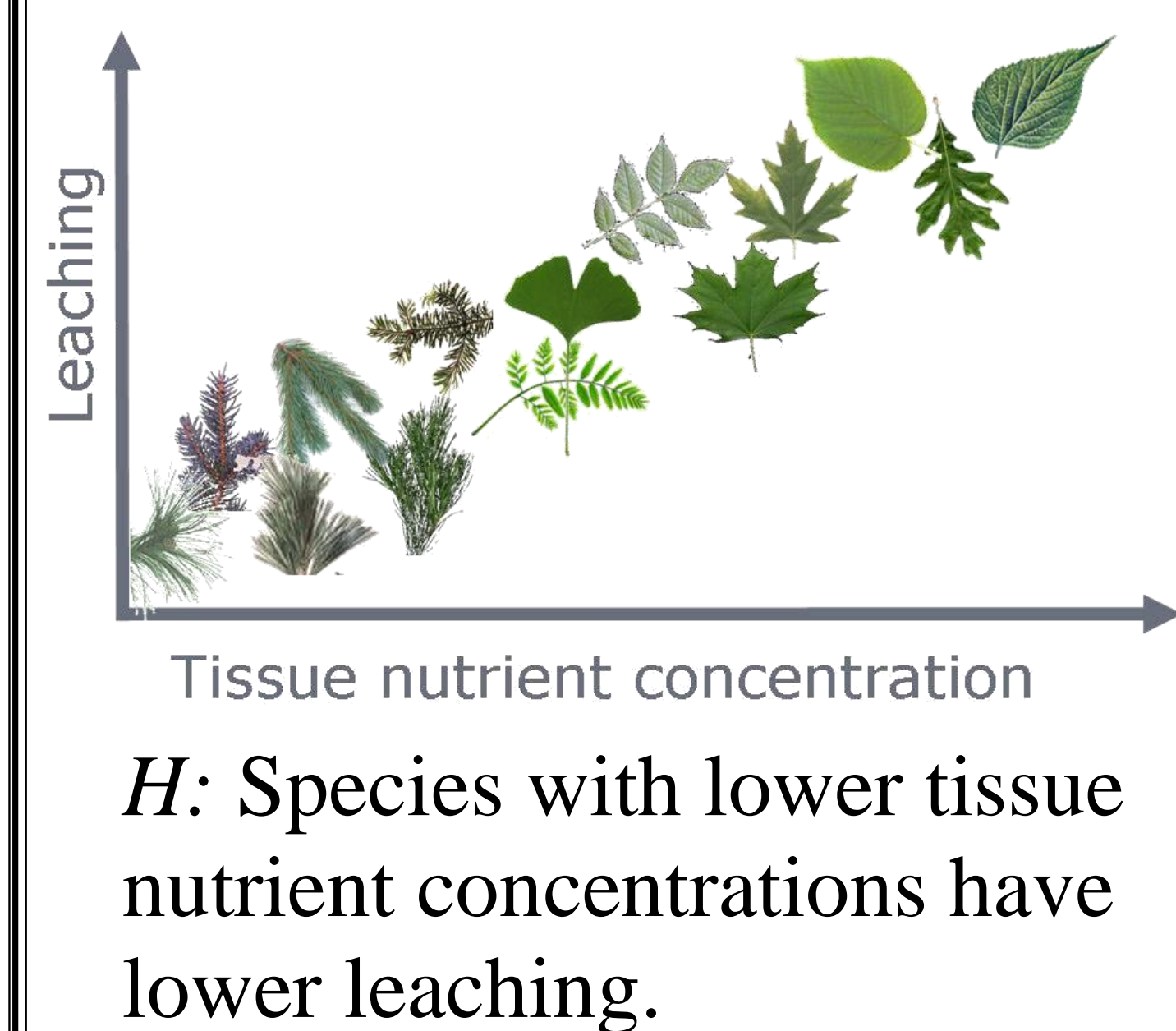
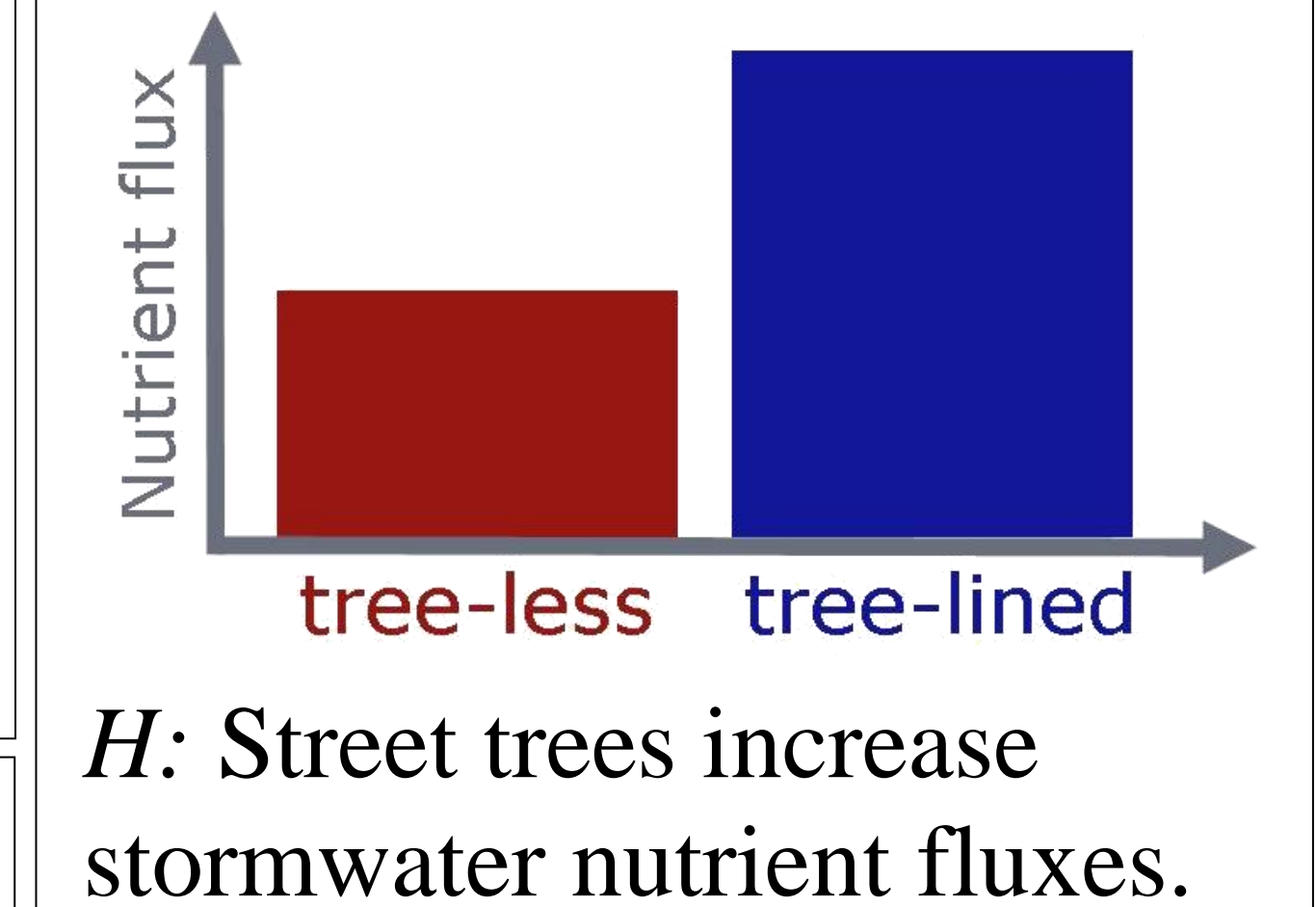


Urban trees can affect nutrient movement to both stormwater and groundwater.

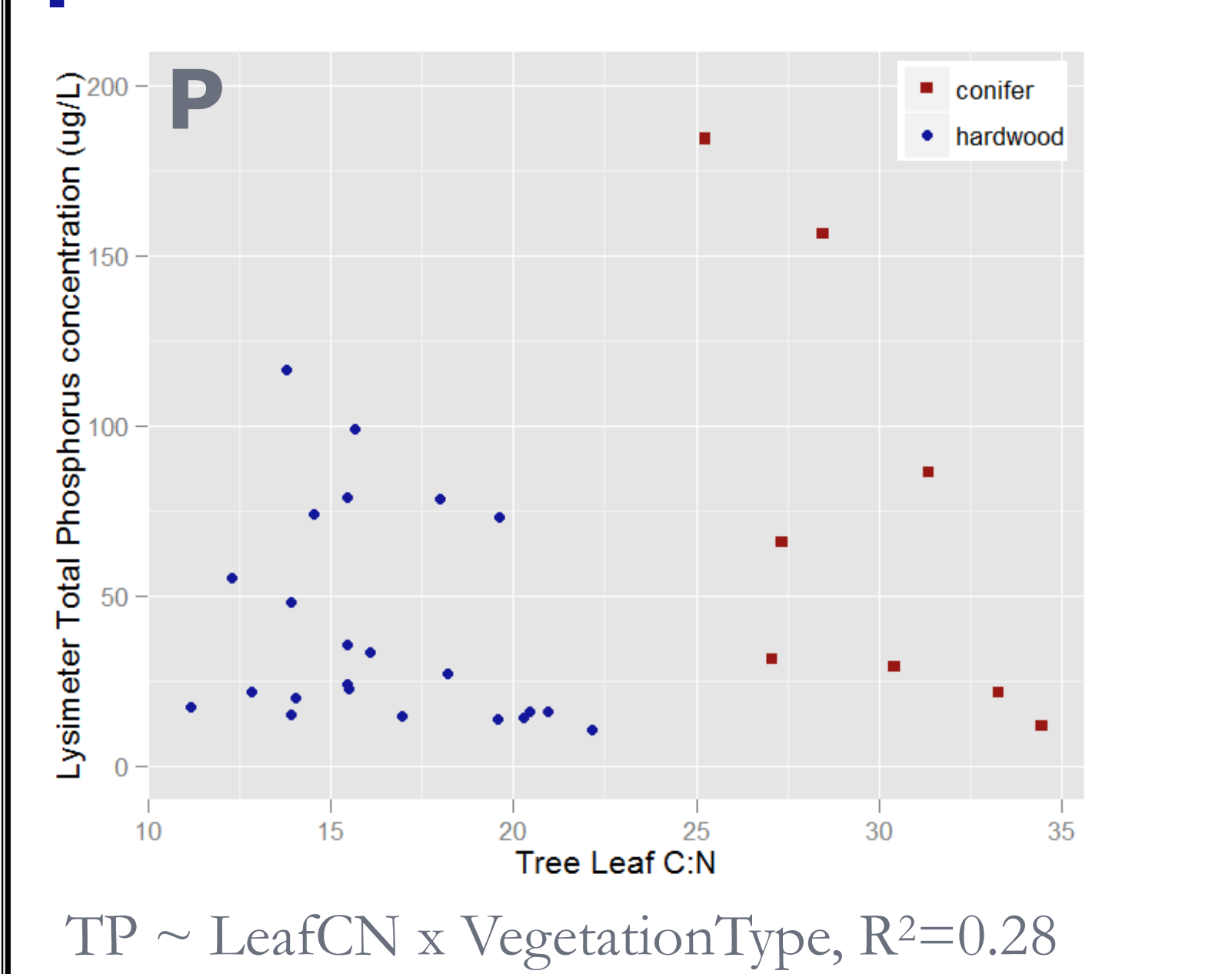
Hypotheses: Leaching to groundwater



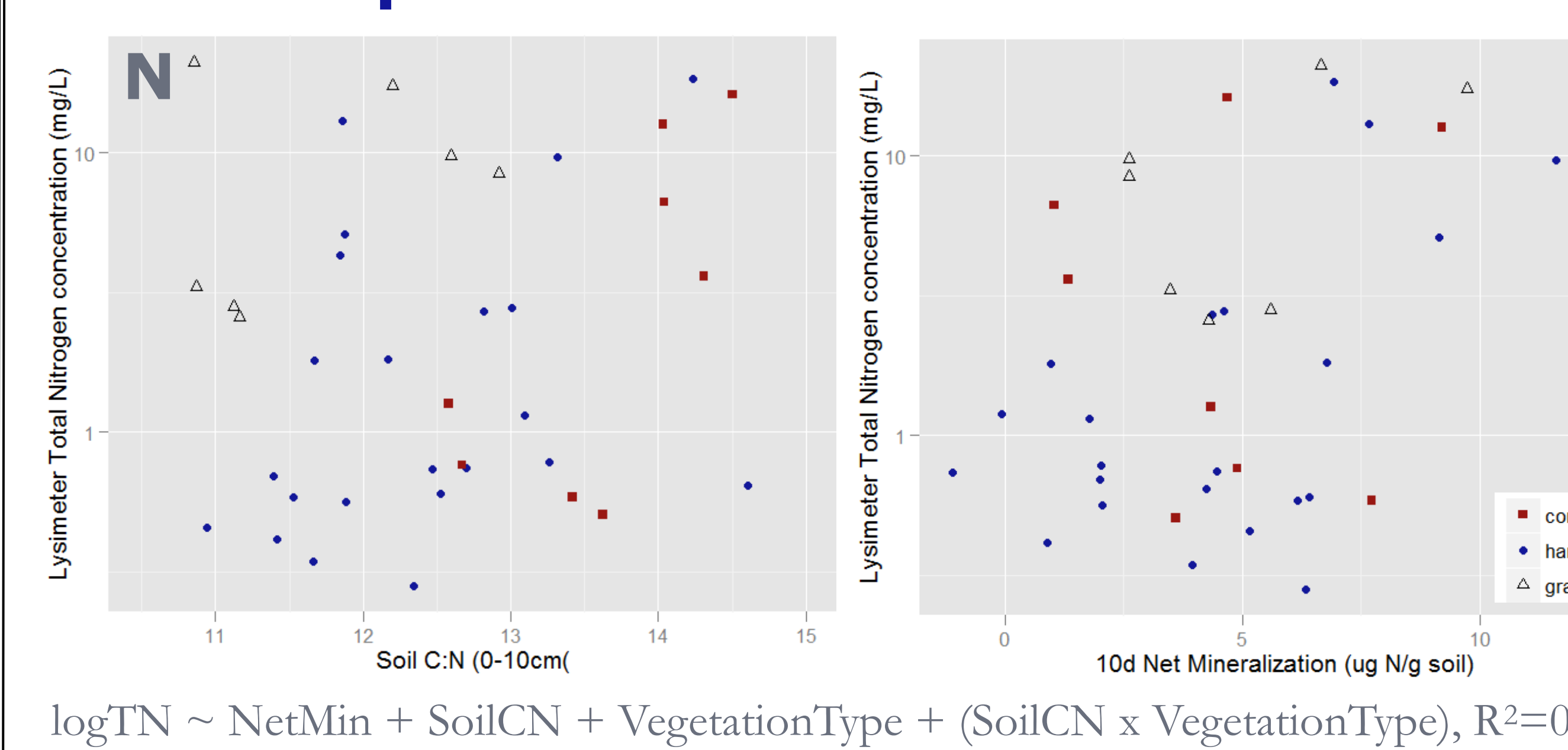
Hypotheses: Street trees and stormwater



Tree leaf C:N, not leaf P, predicts P concentrations.

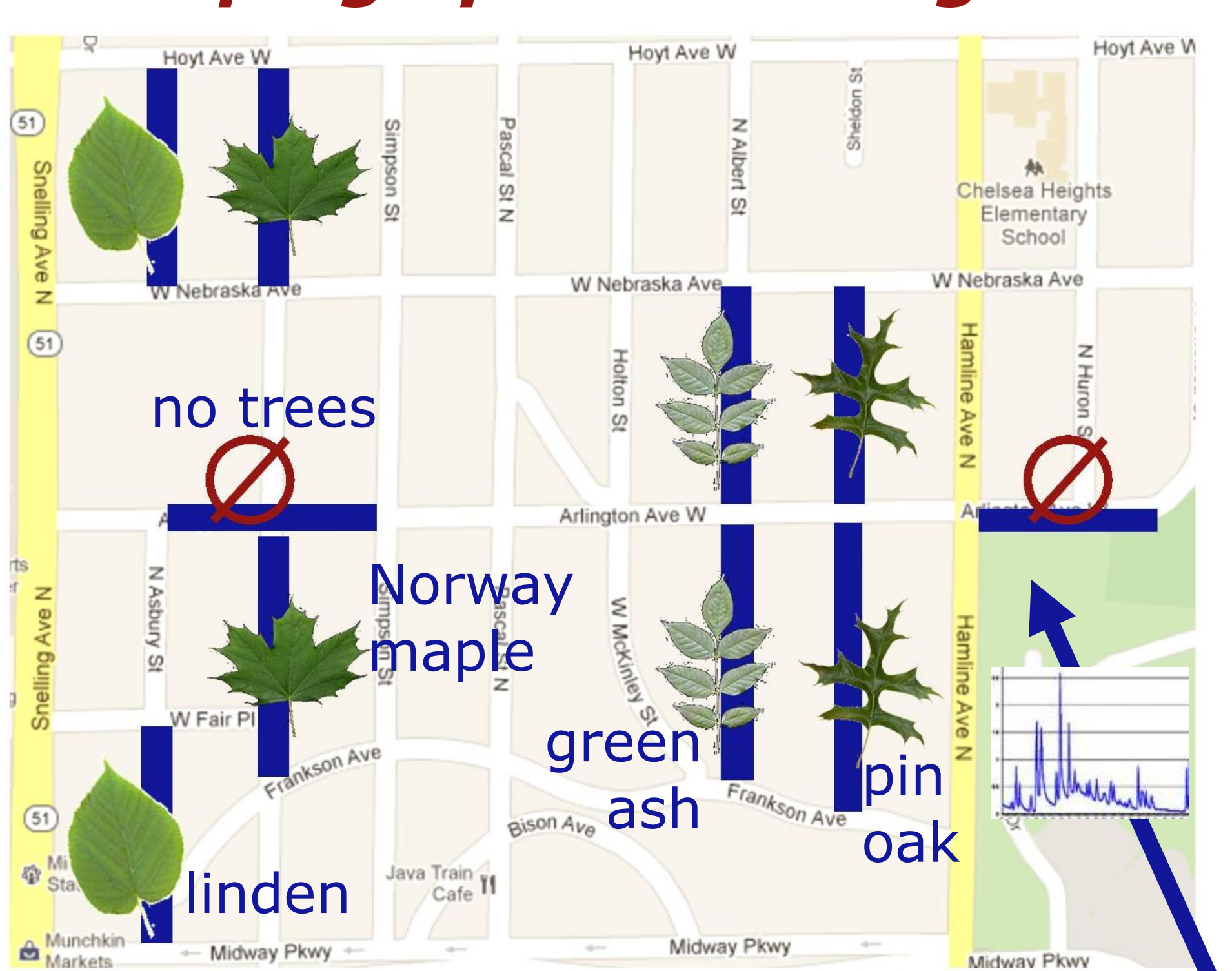


N concentrations are best predicted by soil C:N ratio plus net mineralization rate.



- In Progress & Next Steps:
- Speciation: NH₄⁺, NO₃⁻, SRP, organic N and P
 - Tree litter, root, grass C:N:P
 - Brays-extractable P
 - Net nitrification potential
 - Flow rate calculations and bromide tracer experiment
 - Leaf-drop and snowmelt (weather permitting...)

Street Trees and Stormwater: Sweeping up the street gutters



- Measurements:
- throughfall and precipitation
 - runoff & snowmelt
 - tree phenology
 - litter mass
 - litter size fractionation
 - in-lab litter leaching

This neighborhood drains into a **watershed outlet monitoring station**.

