

# Do forests in Central PA have more available nitrogen on shale than on sandstone?

Jennifer Christhlf, Warren Reed, Lillian Hill, David Eissenstat

## Introduction

As a major component of chlorophyll and amino acids, nitrogen (N) is a vital plant nutrient that is commonly limiting in temperate forests. In soil solution, mineral N nitrogen is found as  $\text{NH}_4$  and  $\text{NO}_3$ , with nitrate being the form readily available to plants. We examined the effect of lithology on N status of forests and forest soils in the Ridge and Valley Province of Central Pennsylvania. We hypothesize that trees growing on sandstone-based soils will have less available N than those growing on shale-based soils.

## Study Sites

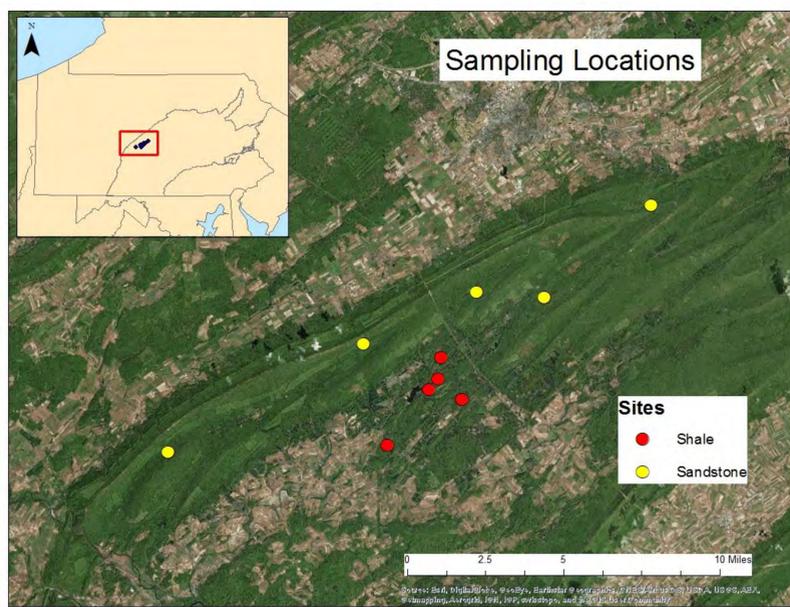


Figure 1. Map of ten sites chosen for study. The Ridge and Valley Province of PA is shown.

## Methods

- Soil  $\text{NO}_3$  and  $\text{NH}_4$ 
  - Sample collection with soil cores to depth of 40cm
  - KCl extraction
  - Microplate reading
- Canopy leaf %N
  - One red maple (*Acer rubrum*) and one red oak (*Quercus rubra*) chosen from each site
  - Collection of canopy leaves by shooting
  - Preparation by drying and grinding
  - CHNS Analyzer for total N
- Analysis - T-test

## Results

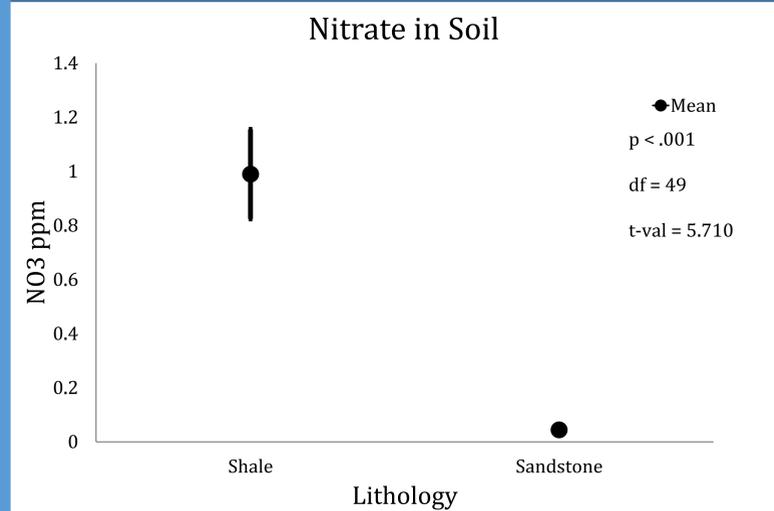


Figure 2. Nitrate concentration in shale-based and sandstone-based soils. The mean of the measurements at all sites with standard error bars was used.

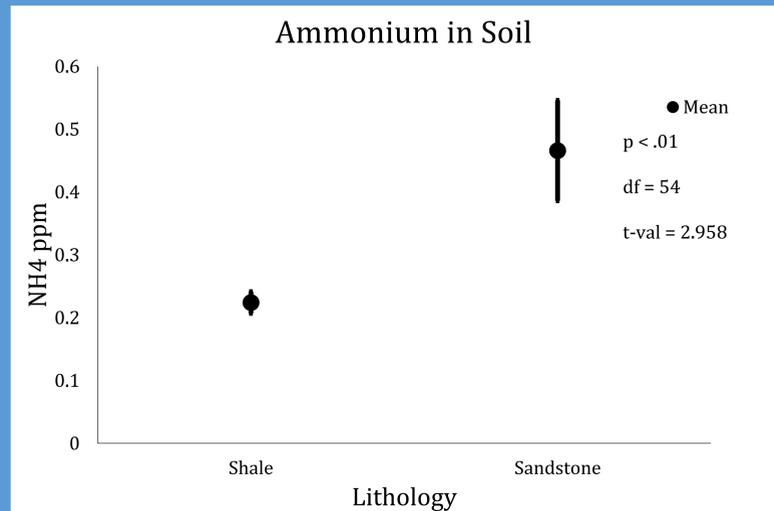


Figure 3. Ammonium concentration in shale-based and sandstone-based soils. The mean of the measurements at all sites with standard error bars was used.

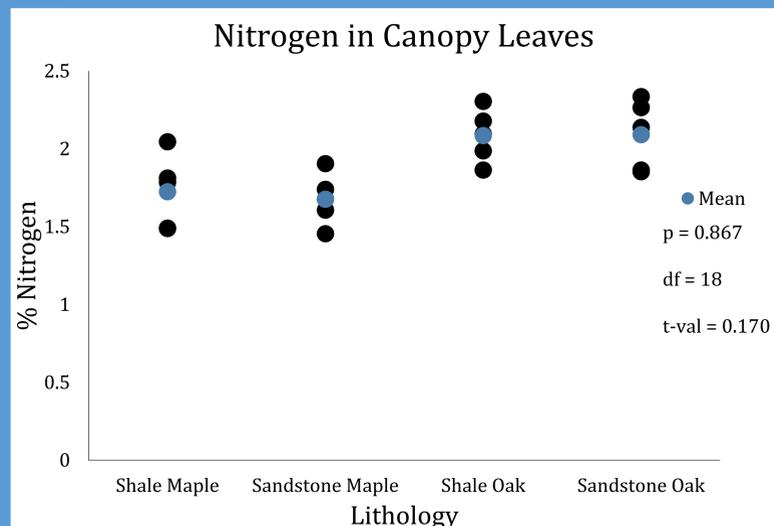


Figure 4. Percent of nitrogen in canopy trees growing in shale-based and sandstone-based soils. The species used are red maple (*Acer rubrum*) and red oak (*Quercus rubra*).

## Conclusions

- There is a significant difference in  $\text{NO}_3$  between shale and sandstone soils, with more nitrate found in shale.
- There is a significant difference in  $\text{NH}_4$  between shale and sandstone soils, with more ammonium found in sandstone.
- There is no significant difference in %N in leaves between trees growing on shale or sandstone soils.
- There is more available nitrogen in shale-derived soils than in sandstone-derived soils.
- Shale and sandstone-based soils seem to have similar impacts on tree nitrogen uptake.



Upper Left: Shale Site  
Lower Left Sandstone Site  
Right: Canopy Leaf Collection

## Acknowledgements

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