

Linking Ecosystem Nitrogen Retention with Soil Microbial Community Structure

Preston Christensen, Bonnie G. Waring, Kenneth Smith

Department of Biology, Utah State University | 5305 Old Main Hill Logan, UT 84322

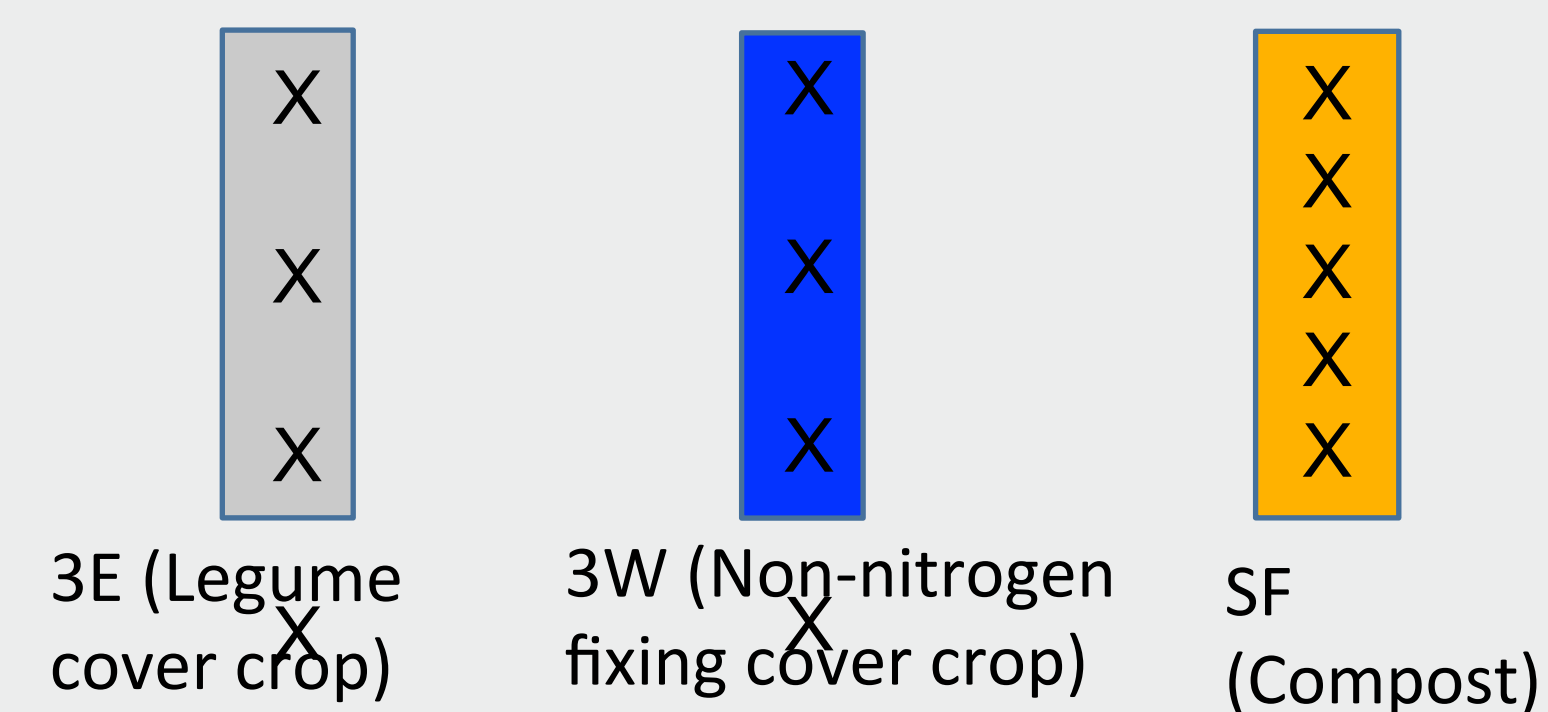


Introduction

- Understanding the mechanisms behind nitrogen loss in soil through leaching of inorganic nitrogen helps us better understand mechanisms for retention.
- Hypothesis:** we should see different levels of soil inorganic nitrogen in various agricultural treatments, due to the effects these treatments have on soil microbial communities.
- Fungi use N less efficiently than bacteria
- Fungal-dominated soils should have more inorganic N than bacterial-dominated soils

Methods

- Five soil samples were taken from three treatment plots for a total of 15 samples.



- 2M KCl solution was then used to extract inorganic nitrogen (N) from samples.

- Soil moisture content was measured.
- Nitrate and Ammonium concentrations were determined colorimetrically through spectrophotometry.
- DNA was extracted from samples and amplified using PCR
- qPCR was used to determine the abundance of bacteria and fungi in soil.

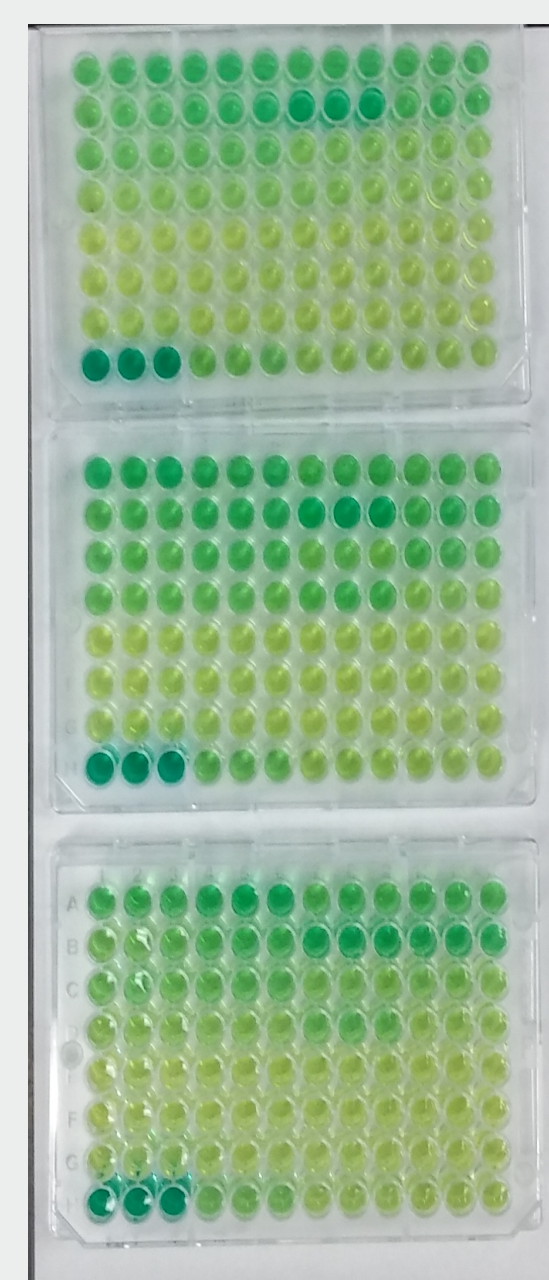


Image 1: Microplates used for ammonium concentration determination.

Results

Figure 1: Mean soil moisture in the three treatments. Bars are ± 1 SE.

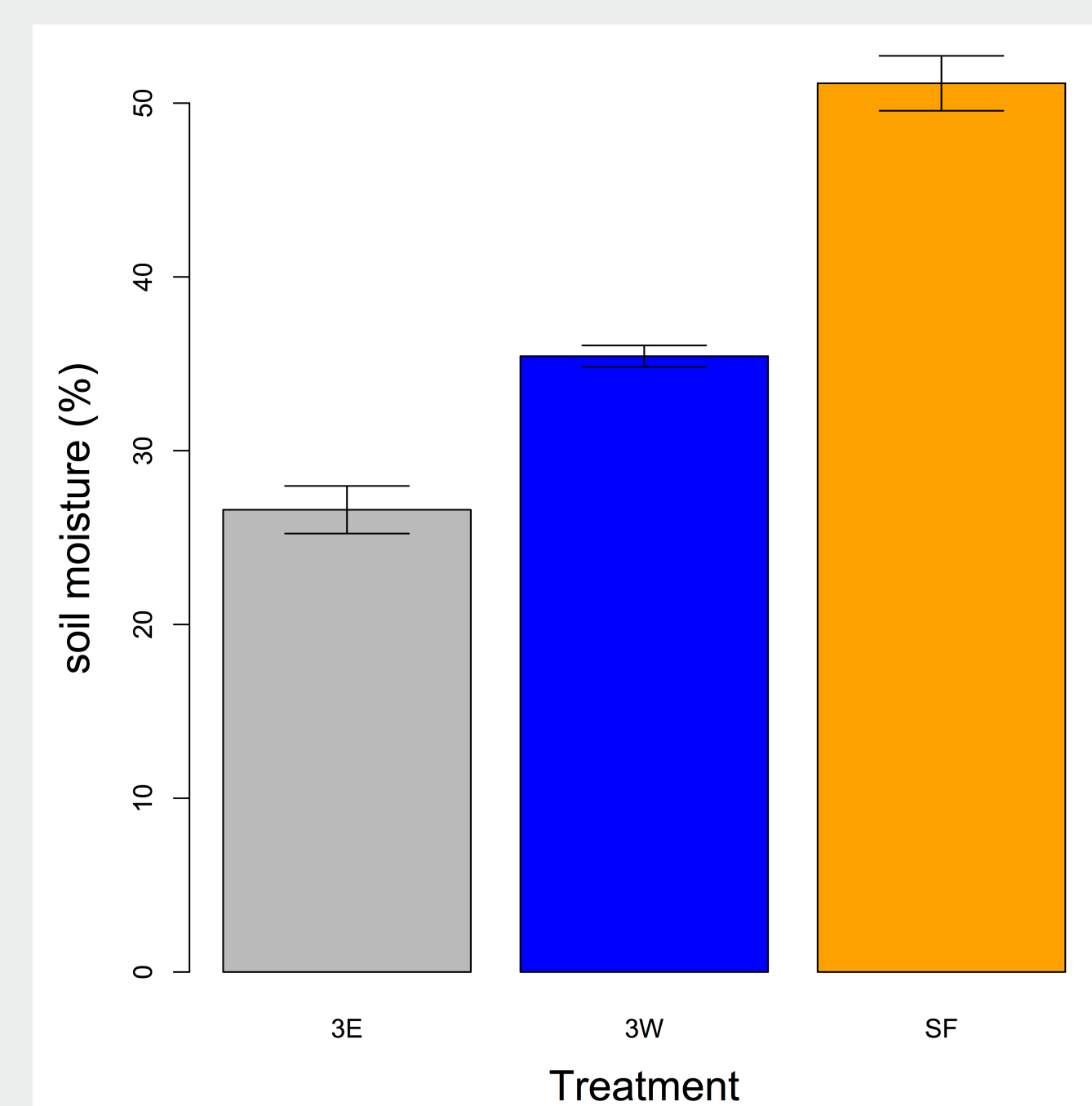


Figure 2: A. Soil nitrate concentrations and B. ammonium concentrations in each treatment.

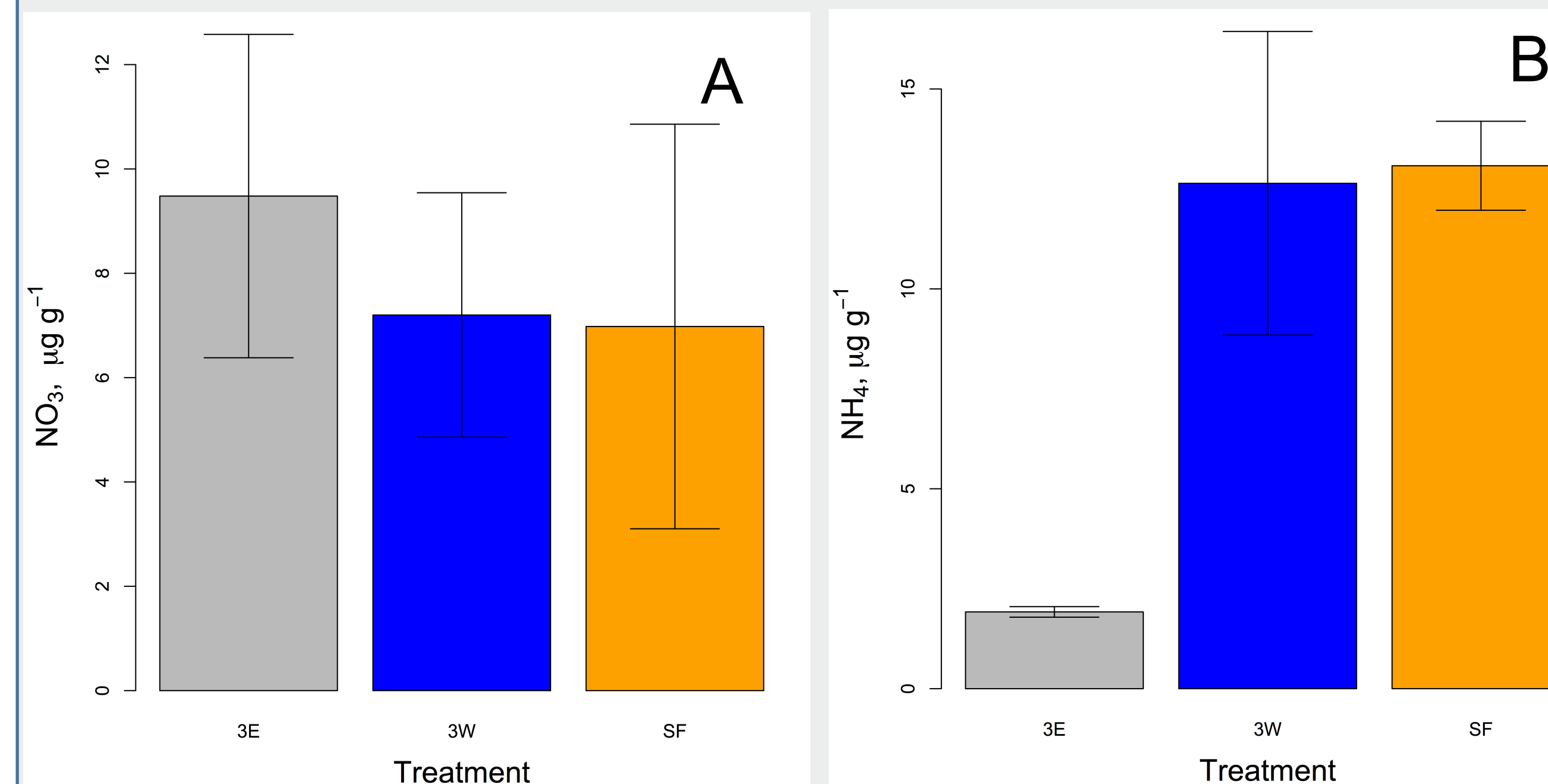
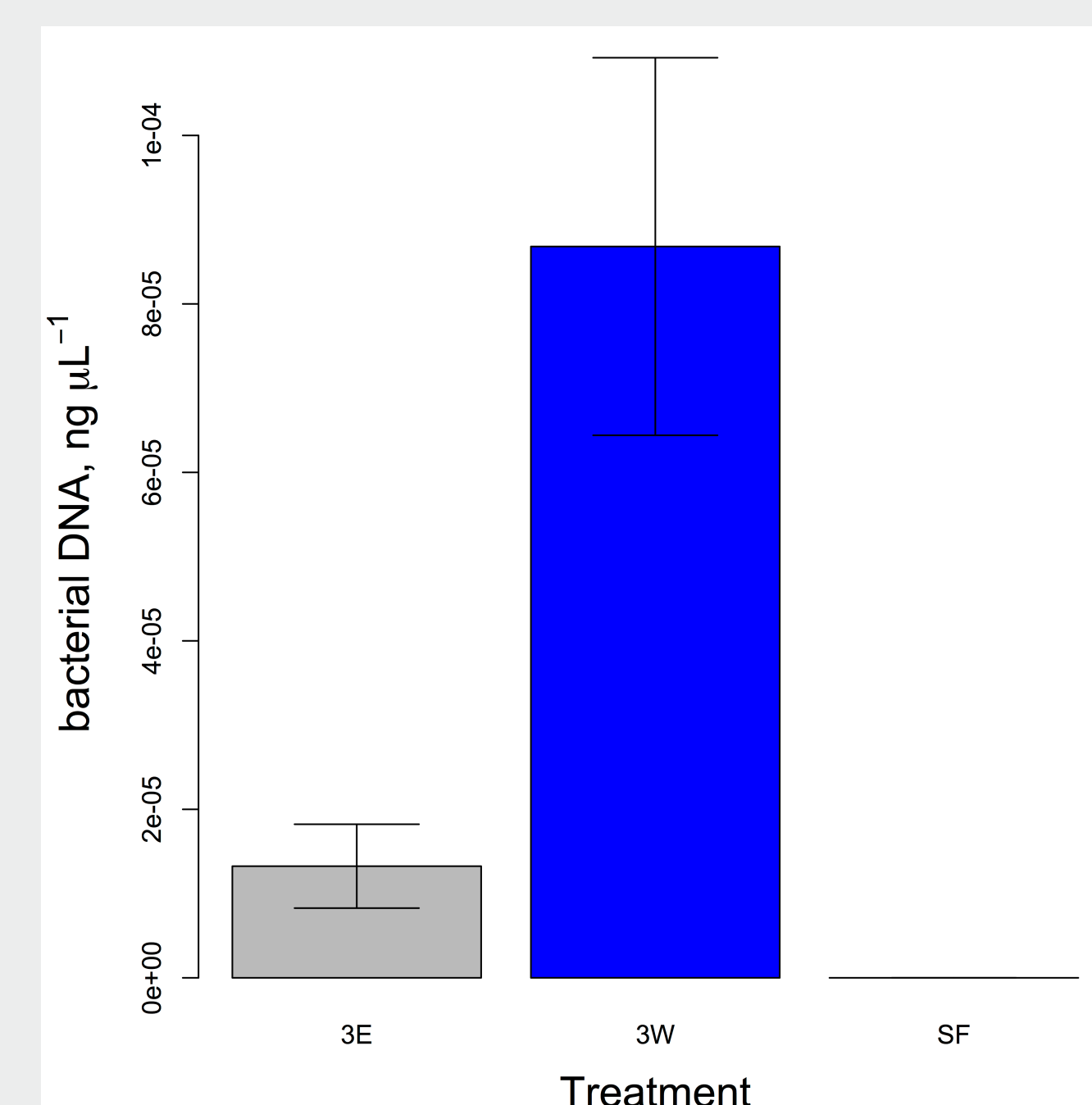


Figure 3: Quantity of bacterial DNA in each treatment. The SF samples had no bacterial DNA.



Discussion

- The levels of inorganic nitrogen varied widely across the three treatment plots.
- Bacterial concentrations in SF were too low to perform PCR. This is most likely due to the high soil moisture which deprived bacteria of oxygen.
- Fungal microbes were not present at high enough levels for DNA amplification across all treatment plots.

Future Research

- The same experimental design will be conducted on samples taken in the summer months. This will allow us to see a more robust fungal community and represent a Bacteria: Fungal ratio.
- In future sampling, we can also quantify organic soil nitrogen pools
- We will use 15N tracers to quantify gross fluxes of nitrogen among organic and inorganic pools

Acknowledgements

- Bonnie G. Waring, Assistant Professor, Dept. of Biology, Utah State University.
- Post-doc researcher Kenneth Smith.
- Greenville Experimental Farm