

How Carbon Amendments To The Soil Affect Above And Below Ground Processes In Restoration

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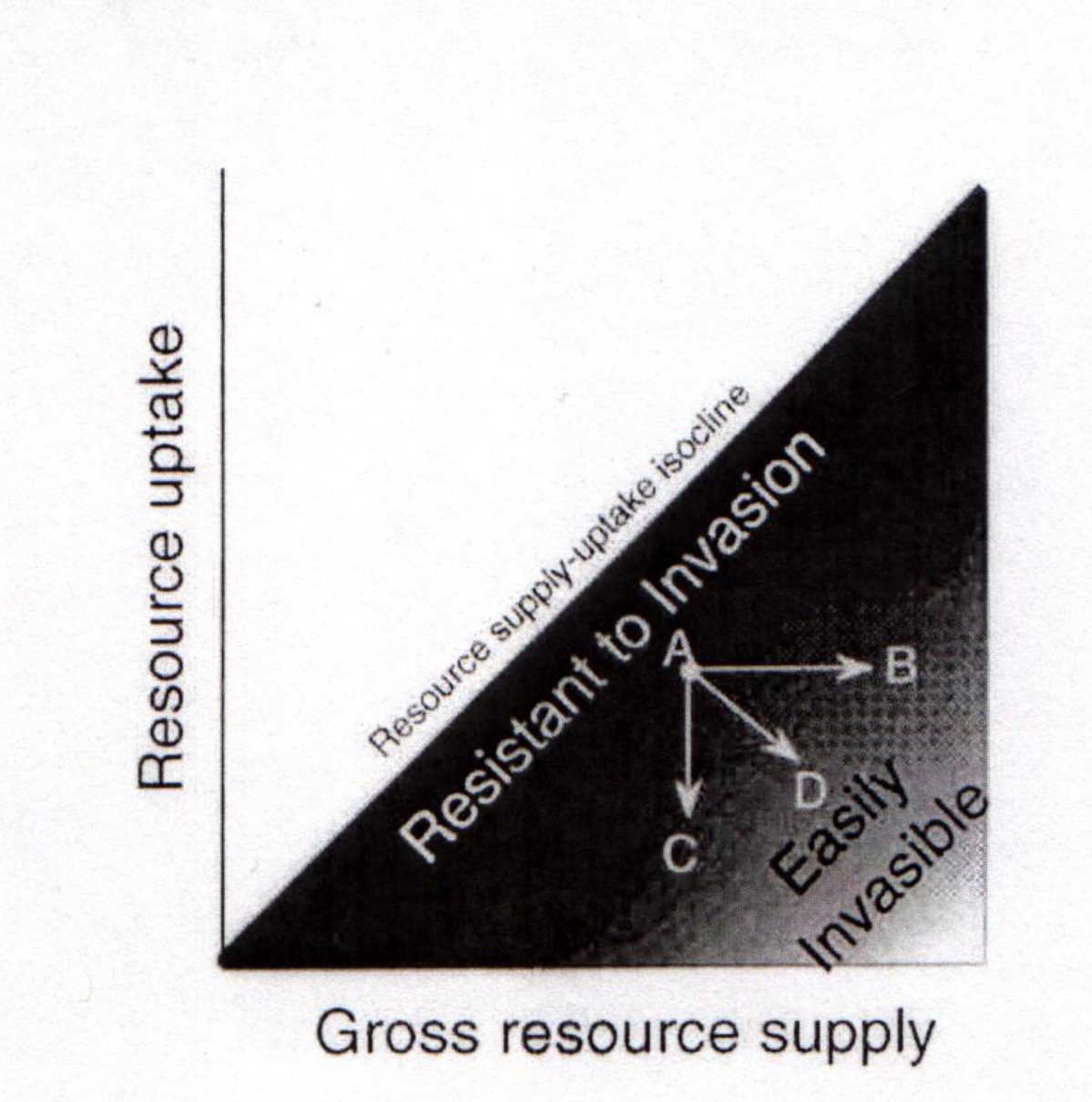
CHICAGO BOTANIC GARDEN

Invasive Species Lead to a Decrease In Biodiversity



Images of non invaded area (left) and invaded area (right).

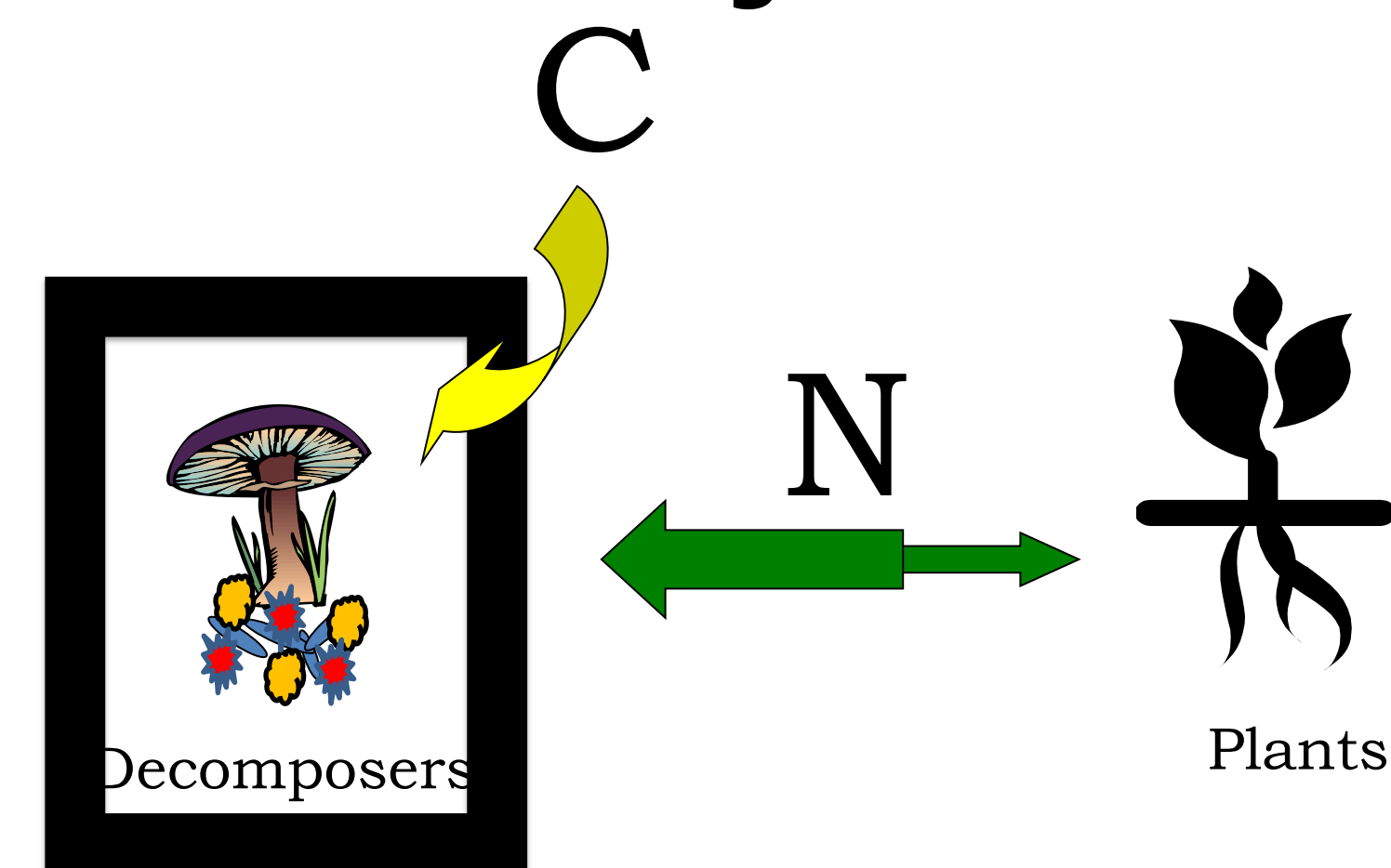
Buckthorn Invaded Areas Have Increased Levels of Soil Nitrogen



Graph of the correlation between resource supply and uptake in relation to invasion. Buckthorn invaded areas have been shown to have elevated levels of available nitrogen in the soil compared to non invaded areas, a condition that favors invasive species.

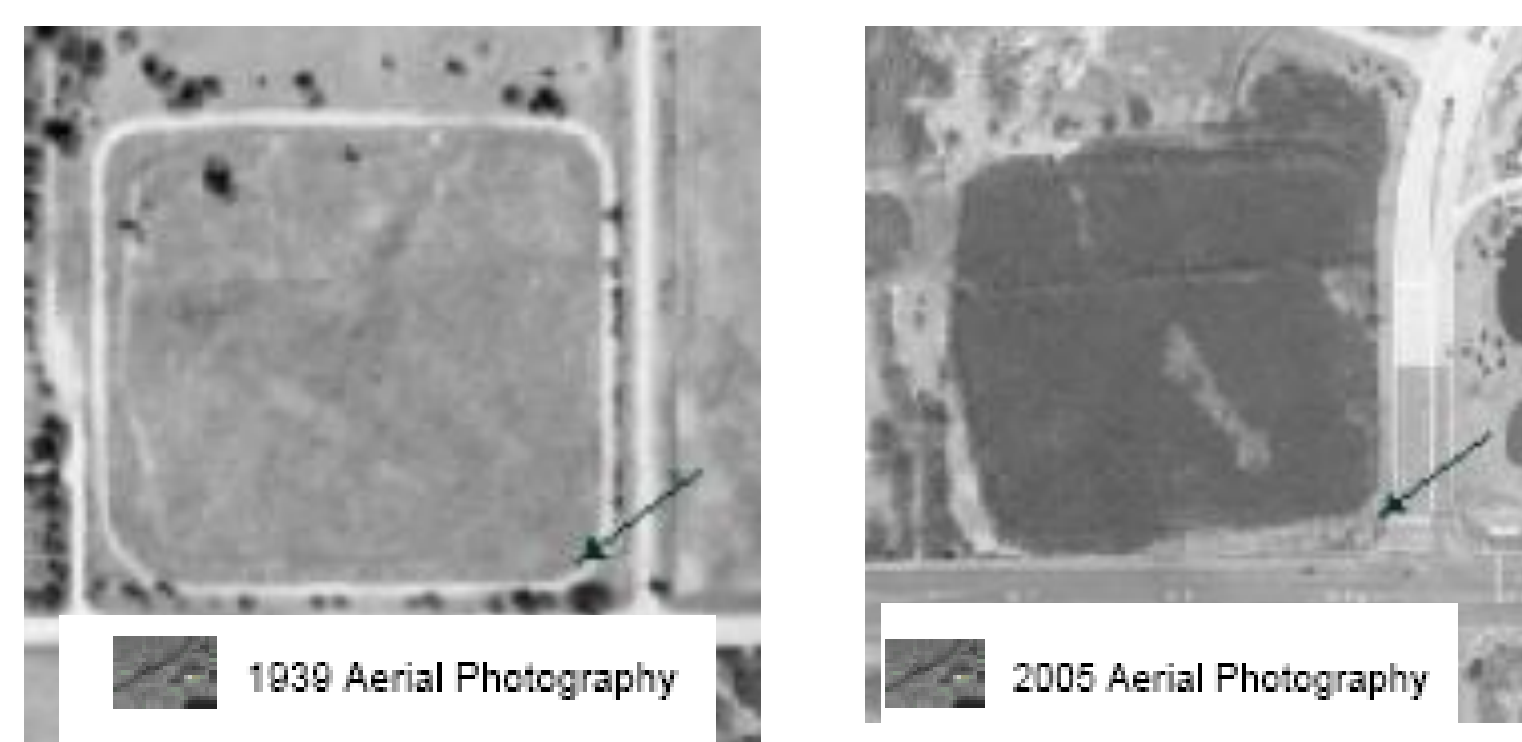
Image from Davis et. al. 2000. *Fluctuating resources In Plant Communities: General Theory of Invasibility. Journal of Ecology.*

Does the Addition of Carbon Decrease the Available Nitrogen In the Soil?



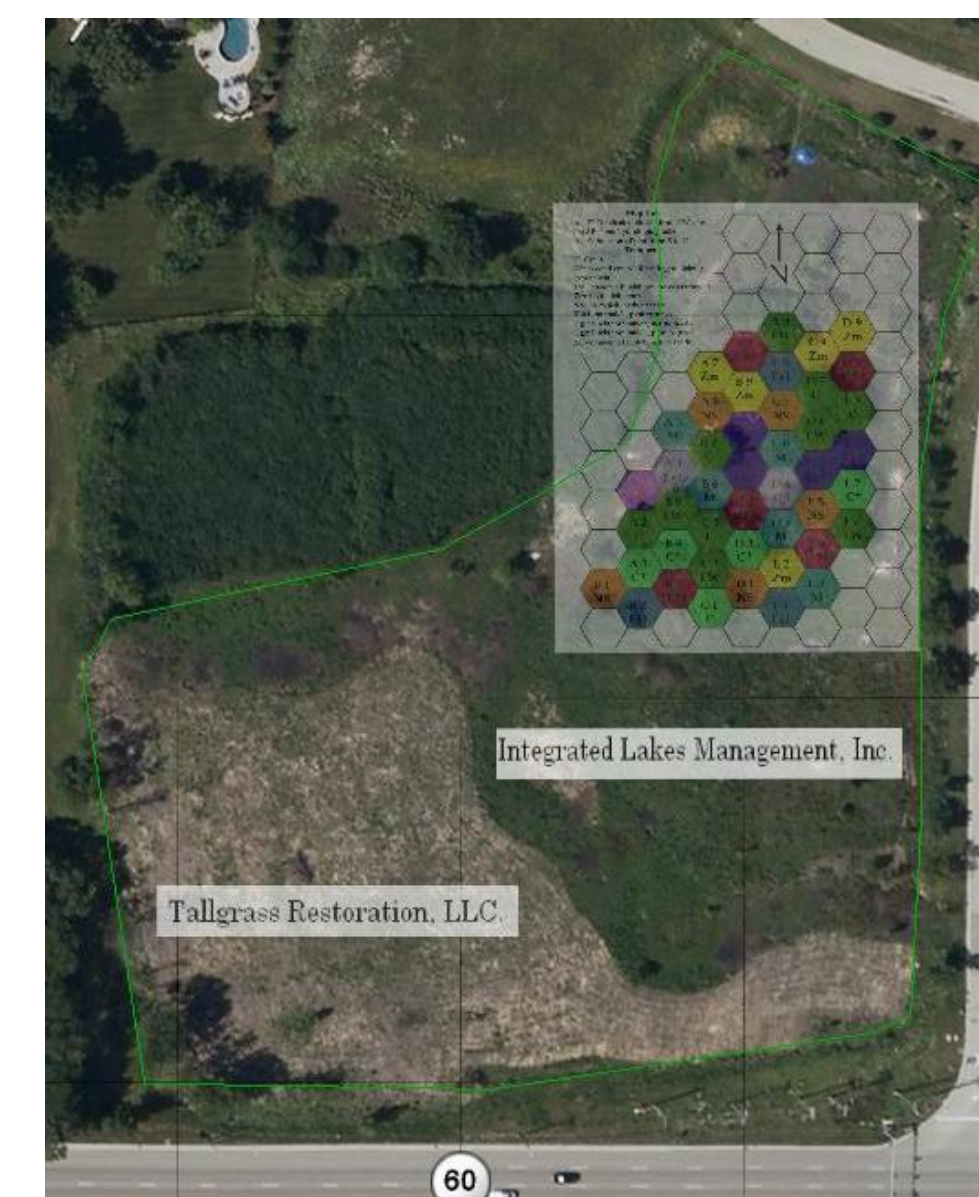
Schematic of experimental hypothesis. Previous research has shown that the addition of carbon to the soil results in a decrease in available nitrogen. The hypothesis behind this is that the addition of carbon prompts the microbial population to immobilize available nitrogen in the soil, though this hypothesis has not previously been tested.

Study Site



The field site for this project is located in Mettawa, IL. The site was once a pasture for horse grazing and was abandoned sometime in the 1980s. The images to the left are aerial views of the site while it was a horse pasture (1939) and after it was abandoned and invaded with buckthorn (2005).

Field Treatments



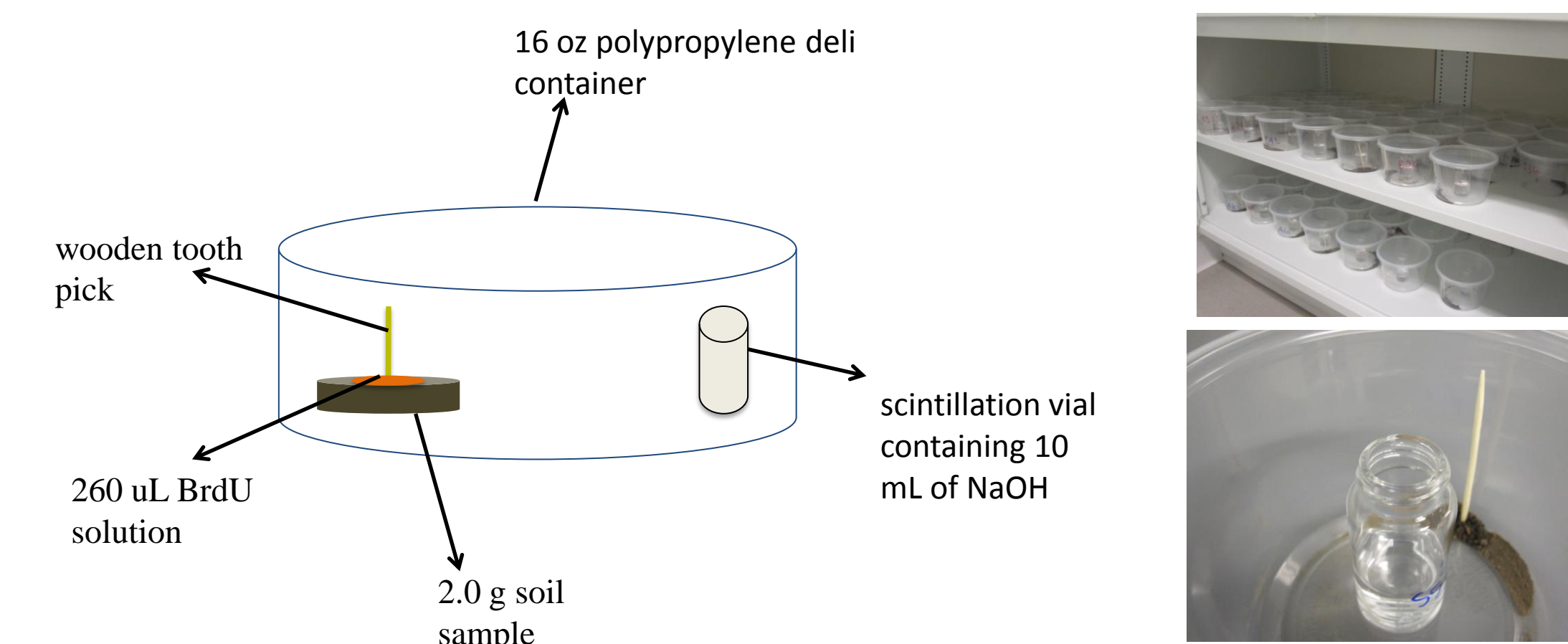
•No Treatment: buckthorn was left standing and untreated as a control.

•No Mulch: buckthorn was cut and treated with herbicide and a native seed mix was applied.

•Buckthorn Mulch: buckthorn was cut and treated with herbicide. Mulched buckthorn was added to the soil and a native seed mix was applied.

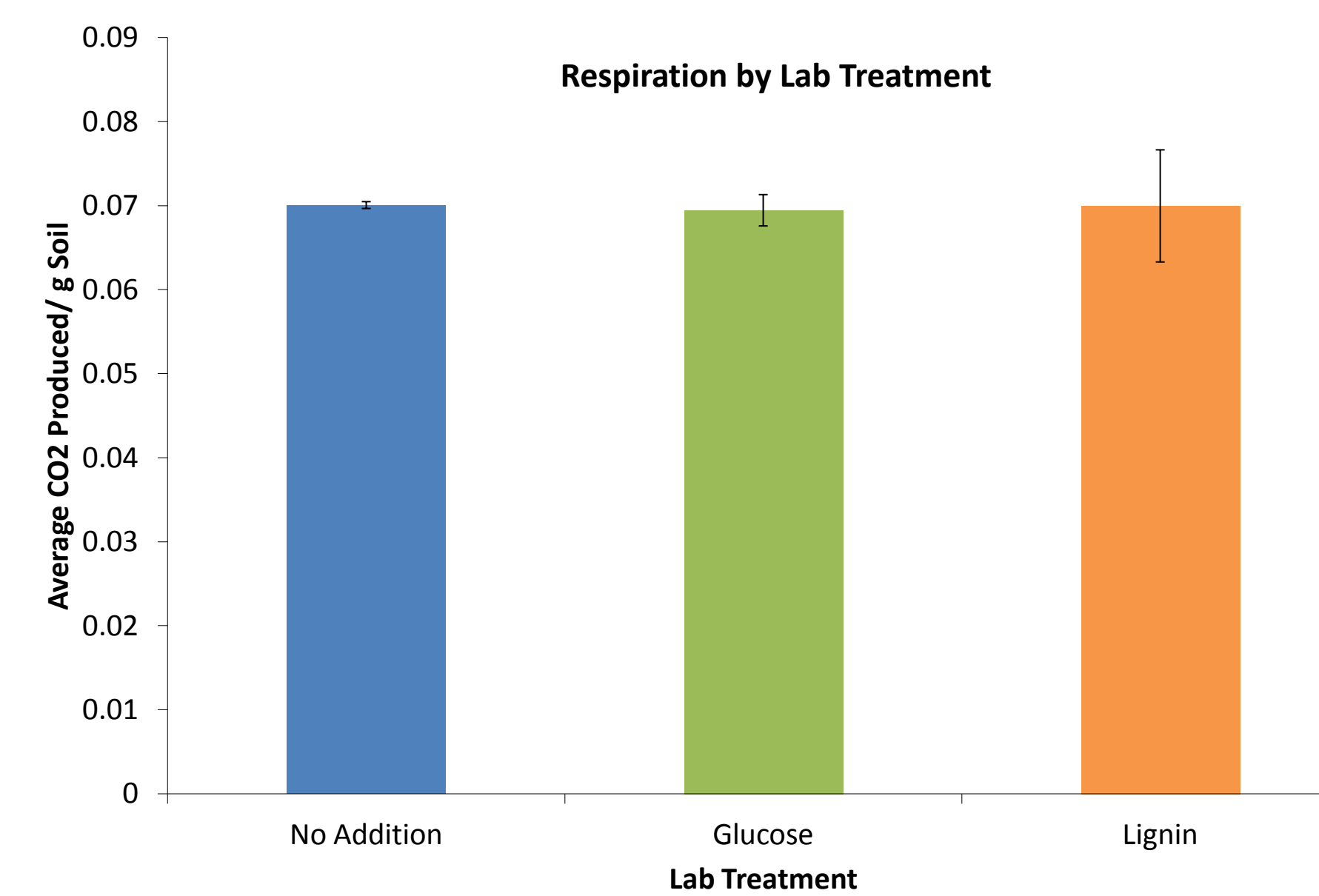
•Standard Mulch: buckthorn was cut and treated with herbicide. Commercially available (standard) mulch was added to the soil and a native seed mix was applied.

Using CO₂ Respiration As A Measure of Microbial Activity

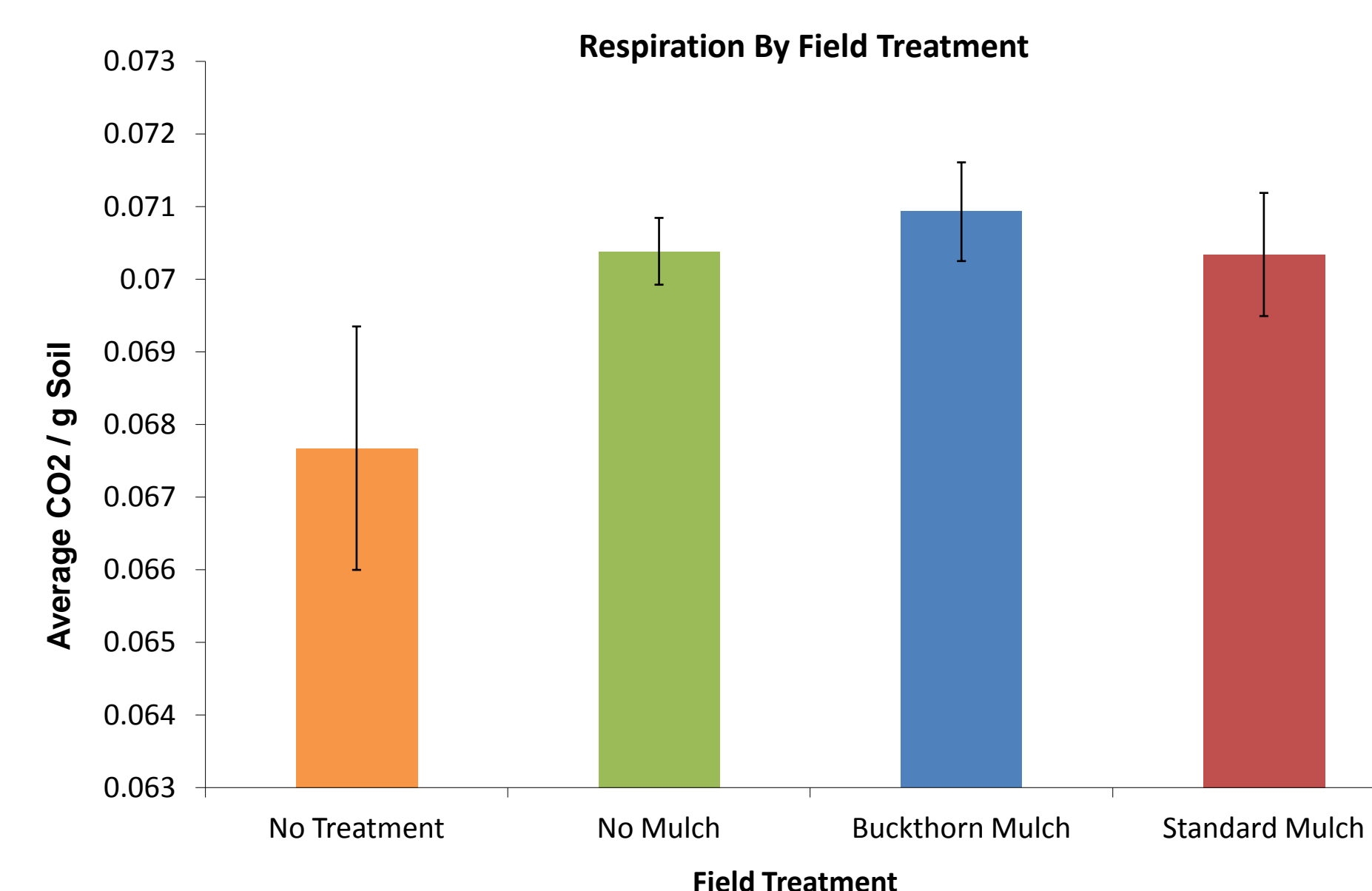


The figure and images to the left show the experimental setup where either glucose, lignin, or no carbon (control) was added to soil collected from the field plots to test for microbial response.

Does The Addition of Carbon in Either The Field Or Lab Treatment Influence Respiration?

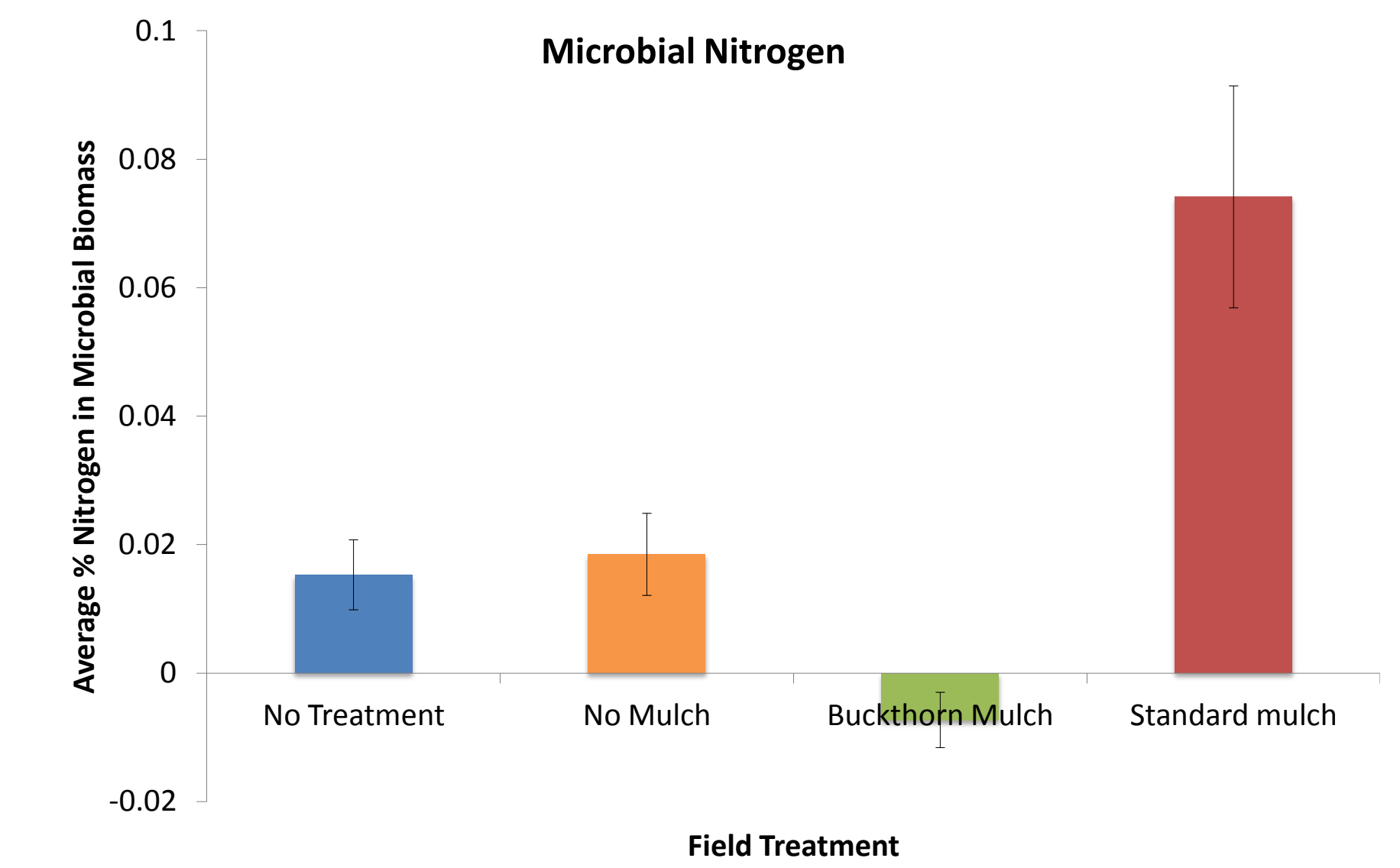


There is no significant difference in respiration between carbon addition in the lab



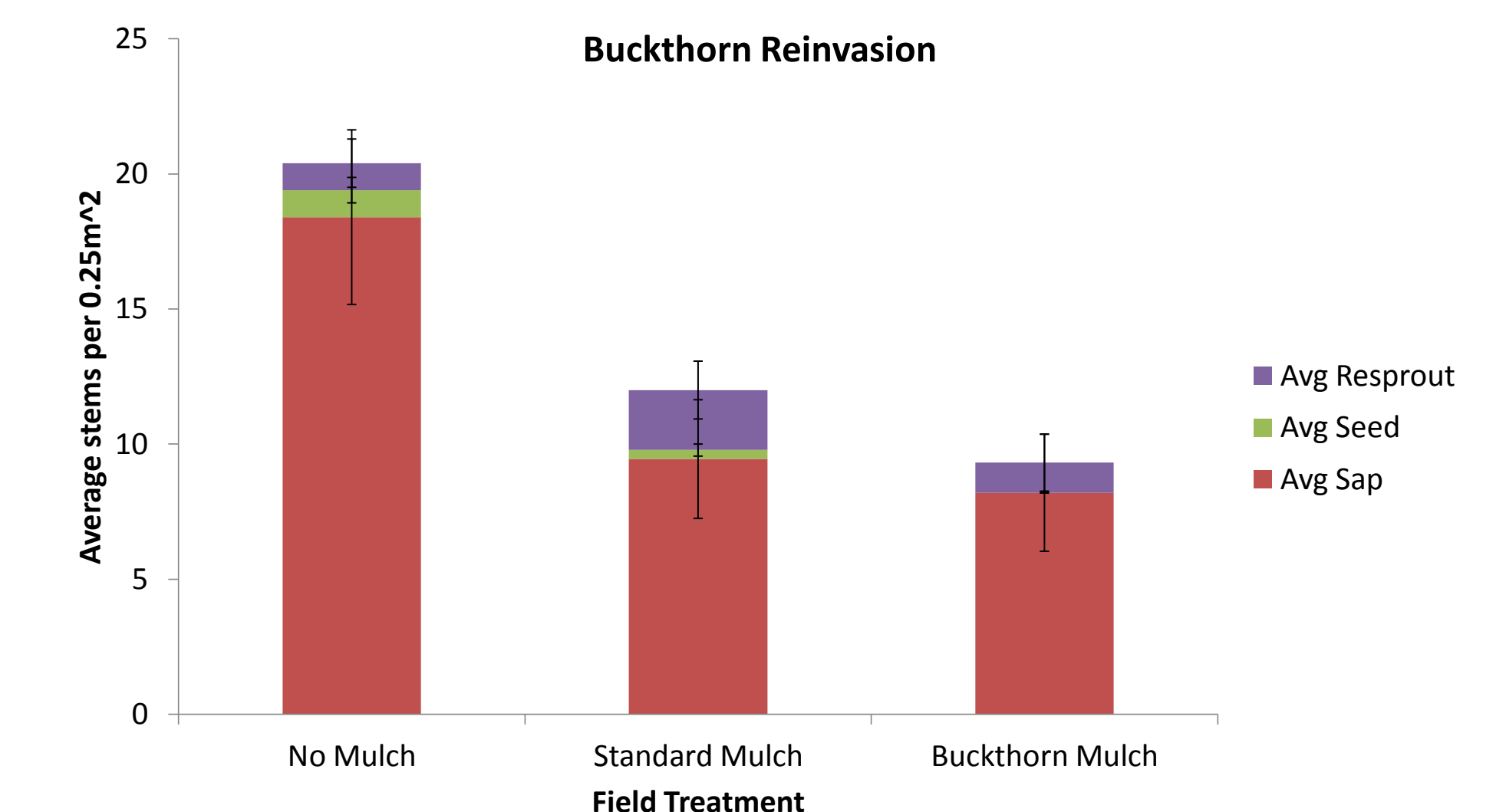
Although the "No Treatment" condition looks to be lower than the rest, there is no significant difference in respiration between carbon addition in the field

Does The Addition Of Carbon Increase Microbial Biomass?



The two images to the right are of the Elemental Analyzer and fumigation apparatus used in this experiment.

Do The Field Treatments Have an Effect on Reinvasion?



Conclusion/ Future Directions

The addition of either glucose or lignin did not result in an increase in microbial activity measured by CO₂ respiration. Nor was there is difference in respiration across field treatments.

The addition of mulch to the soil as a means for restoration resulted in a decrease in total stems, saplings, and seedlings compared to no mulch treatments, but not in resprouts.

Future studies would include performing the the CO₂ respiration experiment in the field to see if similar results are obtained. In addition, the specific composition of the microbial community could be studied to see which microbes are present in the soil. Finally, the difference in respiration among different microbial community assemblages could be measured to see if a particular group responds to carbon amendments.

Acknowledgements

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