

Kearney Foundation Fellowship Final Report Summary

Fellowship Recipient's Name: Megan Abercrombie

Project Title: Ponderosa pine plantations, intensive silvicultural treatments and soil C and N budgets of volcanic soils in Northern California

Mentor Professor's Name: Dr. Will Horwath

Reporting Period: March 26, 2009 - June 6, 2009

Background:

Silviculture is the act of tending a forest stand to enhance the growth of certain desirable species. As with any ecosystem manipulation, soil plays an integral role. Understanding different silviculture practices effects on the soil can provide the forestry industry with more efficient methods of stand manipulation and a better understanding of their environmental impacts.

The U.S. Forest Service established the "Garden of Eden" (GOE) long-term silviculture experimental sites to aid in the study of silviculture practices. The GOE consists of eight different long-term management regimes each made up of a combination of insecticide, herbicide, fertilization, and control treatments. The GOE sites are located in ponderosa pine plantations among different locations in Northern California.

Objectives:

Using the "Garden of Eden" (GOE) silviculture experimental sites, our objective is to quantify the effects of each of the 8 treatments on the total carbon and nitrogen from the surface to a maximum depth of 2 meters. The data created for Feather Falls will later be combined with soil data from other Garden of Eden sites to create a large database and search for possible trends between carbon and nitrogen levels and the GOE treatments. As part of the project, more tests will be performed on the Feather Falls soils and the other GOE sites' soils, which include organic carbon extractions, particle size analysis, and color measurements. The color measures will later be combined with the carbon percentage data to create a predictive model.

Major Challenges

Though simple in design, there were major challenges in preparing and analyzing these soils. The first problem encountered was removing the soil from the Geoprobe tubes. The soil had been collected during a drier time of the year and the soil in the tubes was somewhat crumbly. This became a problem in that accurate bulk

densities are integral to this project, so that the carbon and nitrogen measurements can be extrapolated upwards and used to represent whole areas of soils. During removal from the tubes, some sample lost significant amounts of soil, rendering their bulk densities inaccurate. For this issue, the only solution was to take detailed notes on which samples had usable bulk densities and which ones would be problematic.

Another challenge that arose was in determining how to remove organic matter from the soil, so an accurate carbon measurement could be taken. We considered a chemical solution, but worried that would affect the soil particles' chemistry. It was decided that we would root pick the soils by hand. We imposed a ten-minute limit for root picking to make sure the process would slow the project down too much.

At the final part of the project, a large and reoccurring challenge was dealing with technical difficulties of the Costech elemental combustion machine. If the machine were not working properly, an entire productive day would be lost. It was only through trial and error, that slowly a better understanding of the machine was gained and we were able to run samples with a much higher success rate.

Major Opportunities

This research lead to many opportunities for me. The large scope of the experiment let me use many of the research machines that I had learned about in my classes. I was trained and able to use the laser particle size analyzer on some samples. I also learned how to do organic carbon extractions and use a large-scale centrifuge for the first time.

I was also encourage to attend the seminars put on in the Plant and Environmental Science building, which helped me better understand experimental design and graduate level research. Attending these seminars put my work in the lab into a bigger context and I could better see where my work was going and what the final product may look like.

Summary of Progress:

For the Forest Fall soils, all the processing has been completed from the initial extraction of the samples from the Geoprobe tubes, the root picking, the grinding, the weighing and finally the running of the soils in the Costec elemental combustion analyzer. The carbon and nitrogen data has been collected and entered into excel. The data has not been formally analyzed yet. We have performed laser particle analysis on some of the Feather Falls soils and done organic carbon extractions on them as well. We are now moving onto to soils from new sites and preparing them for Costech elemental combustion analysis just as we did for the Feather Falls data. All this data will eventually be put together in a large database and analyzed for trends.