Volcanic soil C and N budgets under intensive silviculture treatments in Ponderosa Pine Plantations

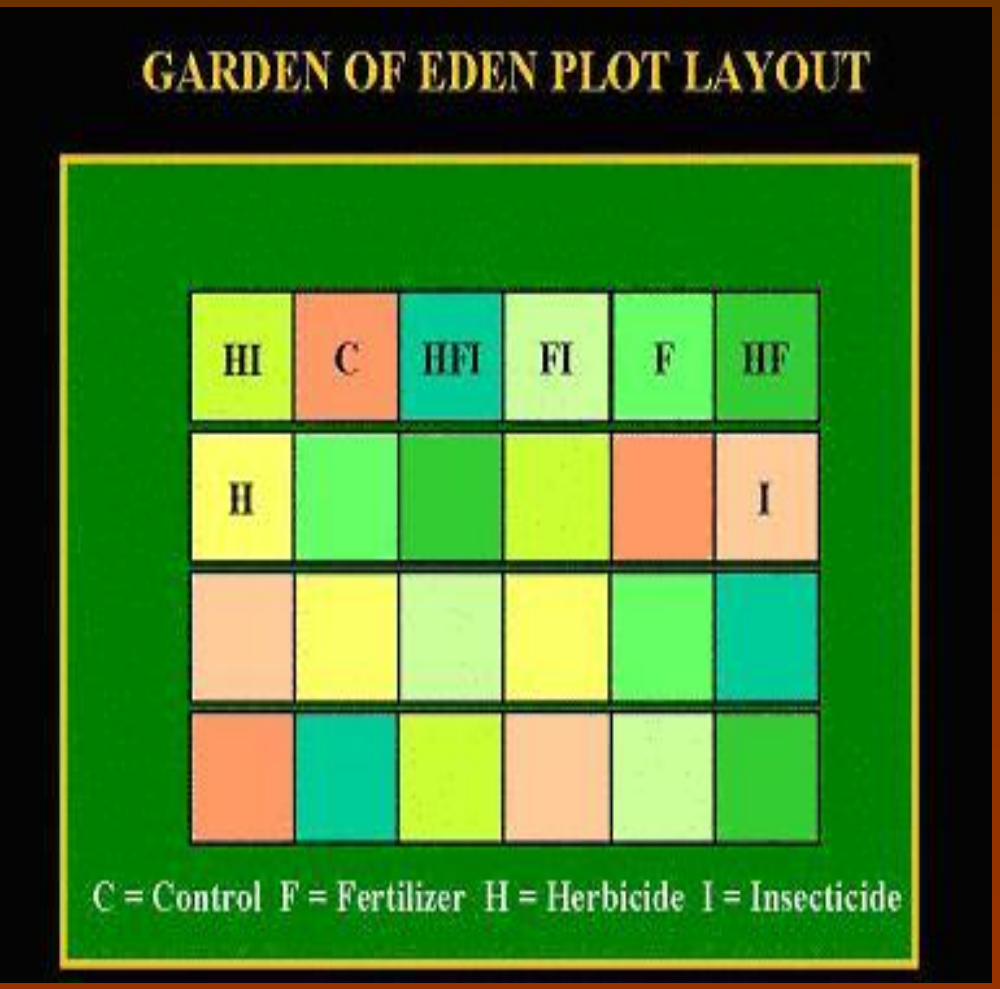
Megan Abercrombie

U.C. Davis

Ponderosa Pine

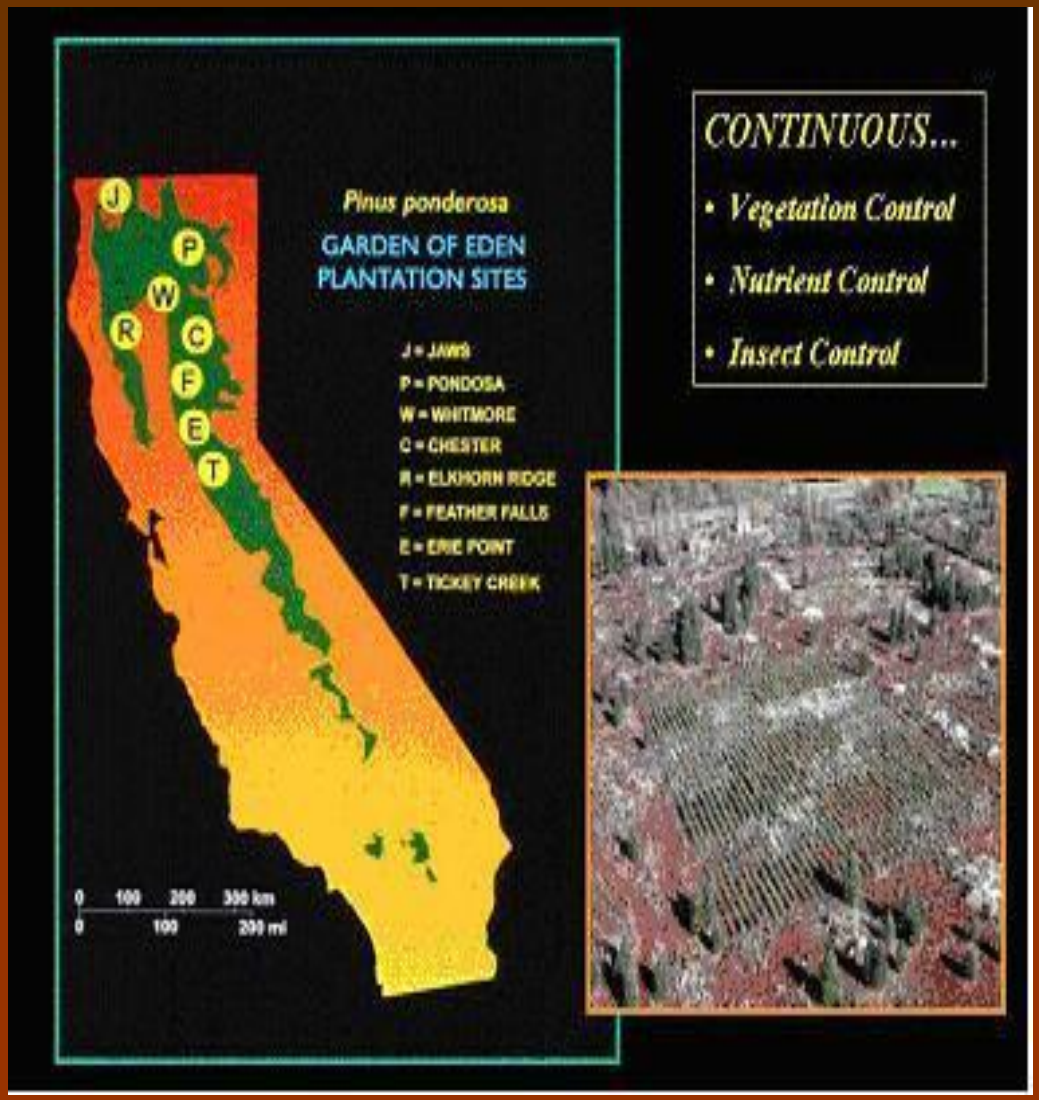
- Most widely planted forest tree in CA
- Common reforestation tree
- Responds quickly to treatments
- Could be used to reduce pressure on natural forest

Garden of Eden Experiment



- Established by the U.S. Forest Service in 1986
- Understand the response of P. Pine to herbicide, fertilizer, and insecticide treatments
- Randomized block experiment

Feather Falls



- Volcanic Soil
- Powelltown Series
- Fine-loamy, parasesquic, mesic Andic Haplohumults
- 105 miles from Davis, CA

We can see the treatment effects above ground, but what's going on beneath the soil?

Objective

- To quantify the effects of the 8 treatments in the GOE on the total soil carbon and nitrogen to a depth of 2 meters

Methods: Site Sampling

- Geoprobe down to 2 meters
- 2 samples taken for each plot in GOE

Methods: Lab Processing

- Soil cores sliced into 10 cm samples
- Oven Dried and Weighed →Bulk Density
- Ball Mill Grinded

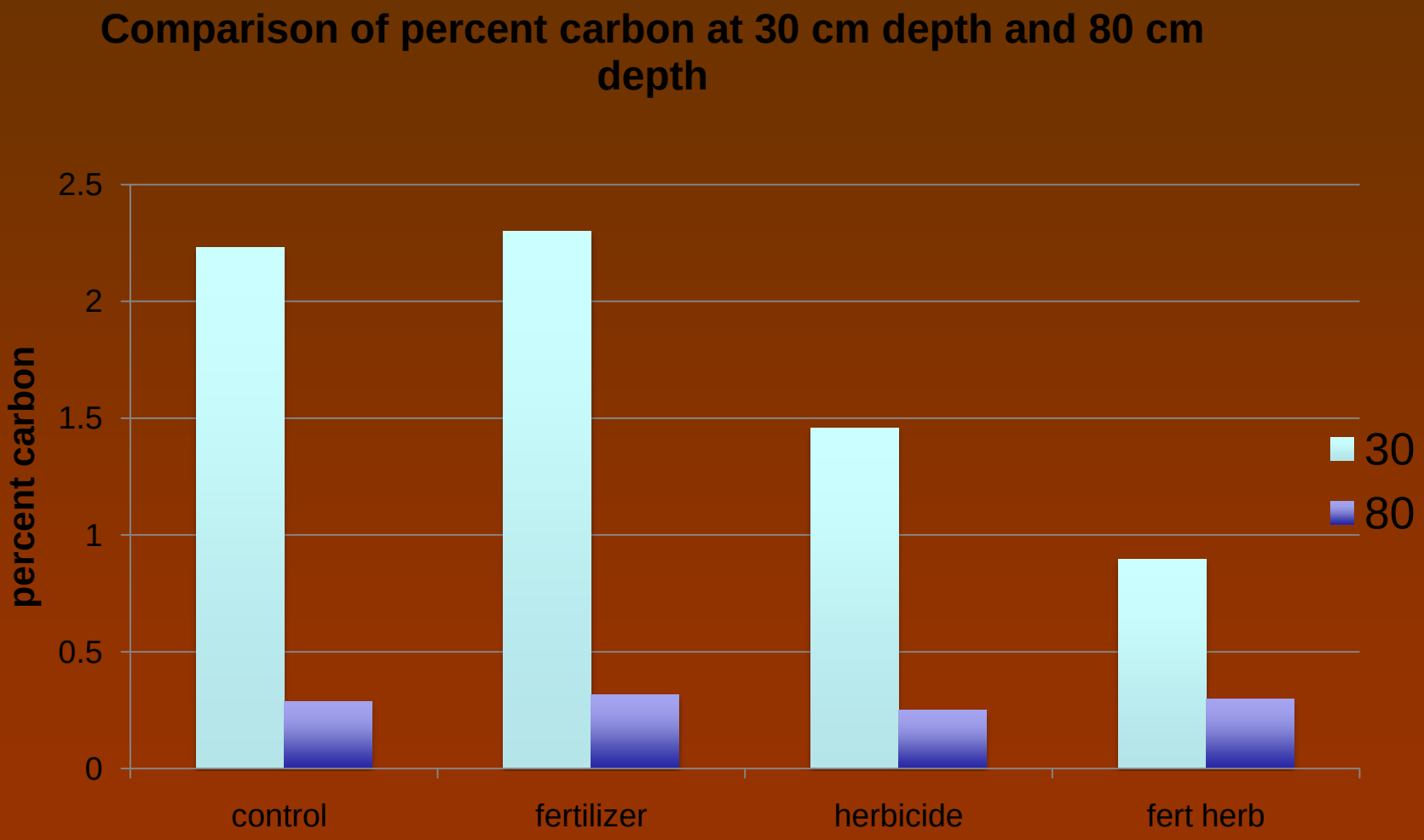
Methods: Microbalance

- Ground soil weighed into Costech aluminum tins.
- Upper depths - 10-20mg
- Lower depths – 20-40mg

Methods: C:N Analysis

- Costech elemental combustion system
- Dry-chemistry
- Converts soil components to gas by instant by flash combustion
- Concentrations measured by gas chromatography

Results: Carbon



Discussion: Carbon

- These preliminary results follow expected trend of fertilizer treatments having more carbon and the herbicide having less carbon.
- At the lower depths, there are not much differences in carbon % between treatments, showing that the GOE treatments may only effect the top depth significantly.

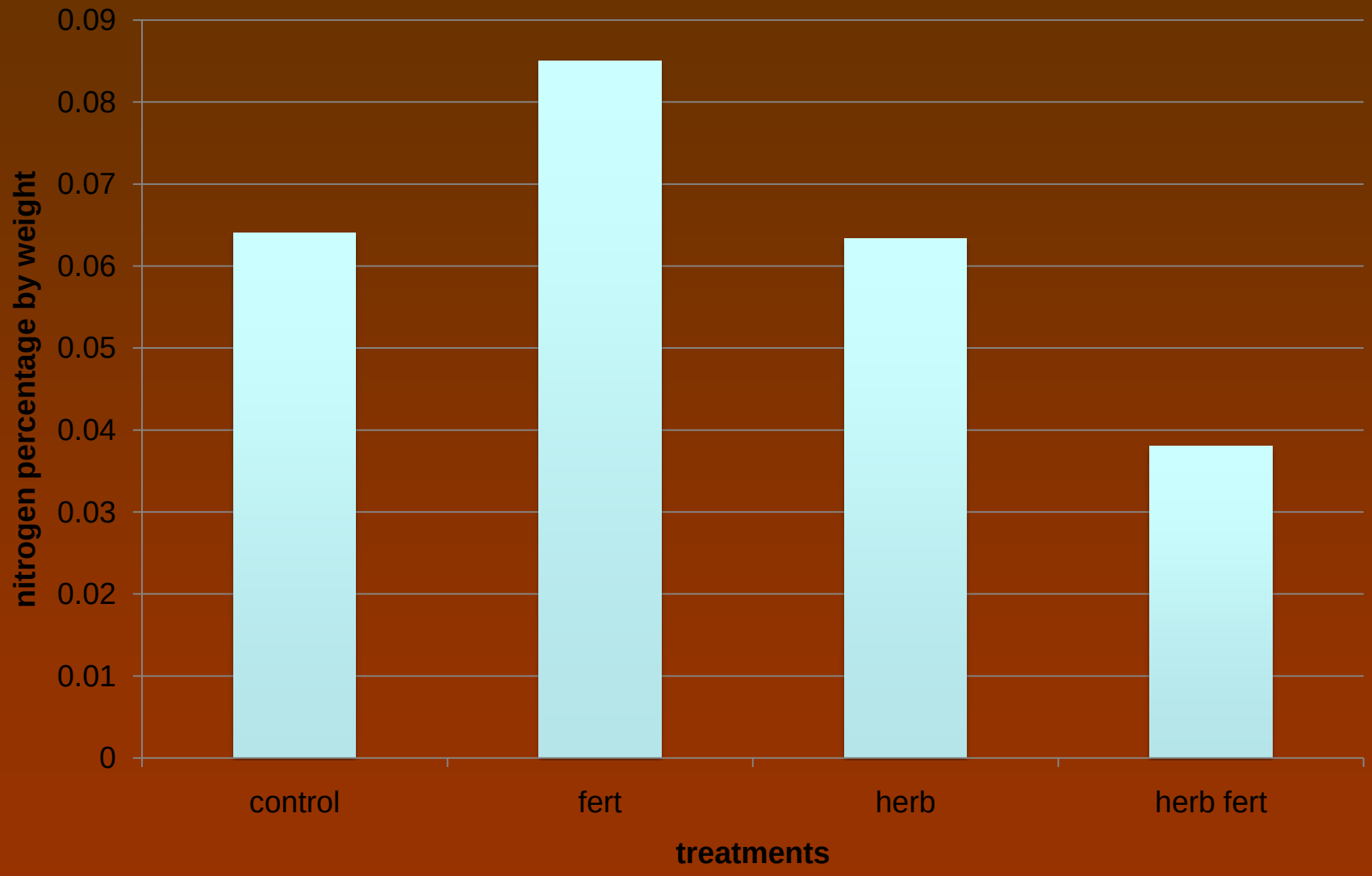
Results

- Using bulk density, carbon data can give us an idea of total carbon in the soil over an area.

Example equation:

1kg/1000g x 58 grams carbon/kg soil (% carbon) x 830 kg/m^3 (bulk density) x .1m (depth) = 4.8 kg/m^2

Results: Nitrogen % at 30 cm depth



Nitrogen at lower depths?

At lower depths, usually past 50 centimeters, nitrogen levels were to low for detection.

Discussion: Nitrogen

- As would be expected, nitrogen percentages are highest in the fertilized soils.
- Control and herbicide soils were about the same level.
- Herbicide and fertilized soils had the lowest average nitrogen percentage, perhaps due to the possible increased success of trees due to the herbicide in those plots.

Conclusions

- Data set too small to create any real conclusions.
- Possible trends from these initial results
  - Higher nitrogen and carbon levels in fertilizer plots
  - Lower nitrogen and carbon level in herbicide and fertilizer plots, perhaps due to increase success of trees in those plots.

Challenges during Research

- Extracting soil from Geoprobe without ruining bulk density measurement
- Creating a root picking technique that would give us soils free from organic matter
- Costech malfunctions

Further Research

- Continue C:N analysis on other GOE sites in C.A. to generate enough data to test for statistically significant trends
- Continue other tests on the GOE sites' soils, which include organic carbon extractions, particle size analysis, and color data collection.
- Use color data and carbon % data to generate predictive model

Thanks Kearney Foundation!!!