



# THE EFFECTS OF PRESCRIBED BURNING ON SOIL INFILTRATION RATES AND OTHER SELECT SOIL PHYSICAL AND CHEMICAL PROPERTIES IN EAST TEXAS



Cassady Pennington, Dr. Kenneth Farrish, Dr. Brian Oswald

Division Environmental Science    Arthur Temple College of Forestry and Agriculture    Stephen F. Austin State University

## ABSTRACT

The study focuses on whether or not prescribed burning affects the soil physical properties, especially water infiltration. Soil infiltration rates will be measured pre-burn (before the fire), post-burn (one month after the fire), and at green-up (three months after the fire). Soil samples will also be collected to determine the effects of prescribed burning on soil pH, bulk density, particle density, pore space, soil strength, O-horizon weight and depth (organic matter), water stable aggregates, and soil fertility. This project is ongoing and in the early stages of sampling and data collection. The research is being conducted on several types of burn regimes. The National Forests and Grasslands of Texas (NFGT) of the United States Forest Service burn regimes, which occur every two to three years predominantly during the dormant season, The Nature Conservancy's (TNC) Roy E. Larsen Sandylands Sanctuary, burn both during the dormant and growing season, and Winston 8 Land and Cattle Ltd. Tree Farm, often burned biannually, are all being studied. Samples are being taken in the Deep East Texas Piney Woods on the Angelina, Sabine, Davy Crockett, and Sam Houston National Forests; along with The Nature Conservancy's Roy E. Larsen Sandylands Sanctuary, and the Winston 8 Land and Cattle Ltd. Tree Farm. These areas were chosen to showcase a diversity of burn regimes within the same ecological region of Texas with the same vegetation types and a variety of soil types. The study is aimed at developing an understanding of any correlation between the soil physical and chemical properties among the soil types and the ecological region and the affects prescribed burning has on them.

## GOALS AND OBJECTIVES

The overall goal is to determine if prescribed burning impacts soil infiltration rates and soil physical and chemical properties of forest soils in deep East Texas.

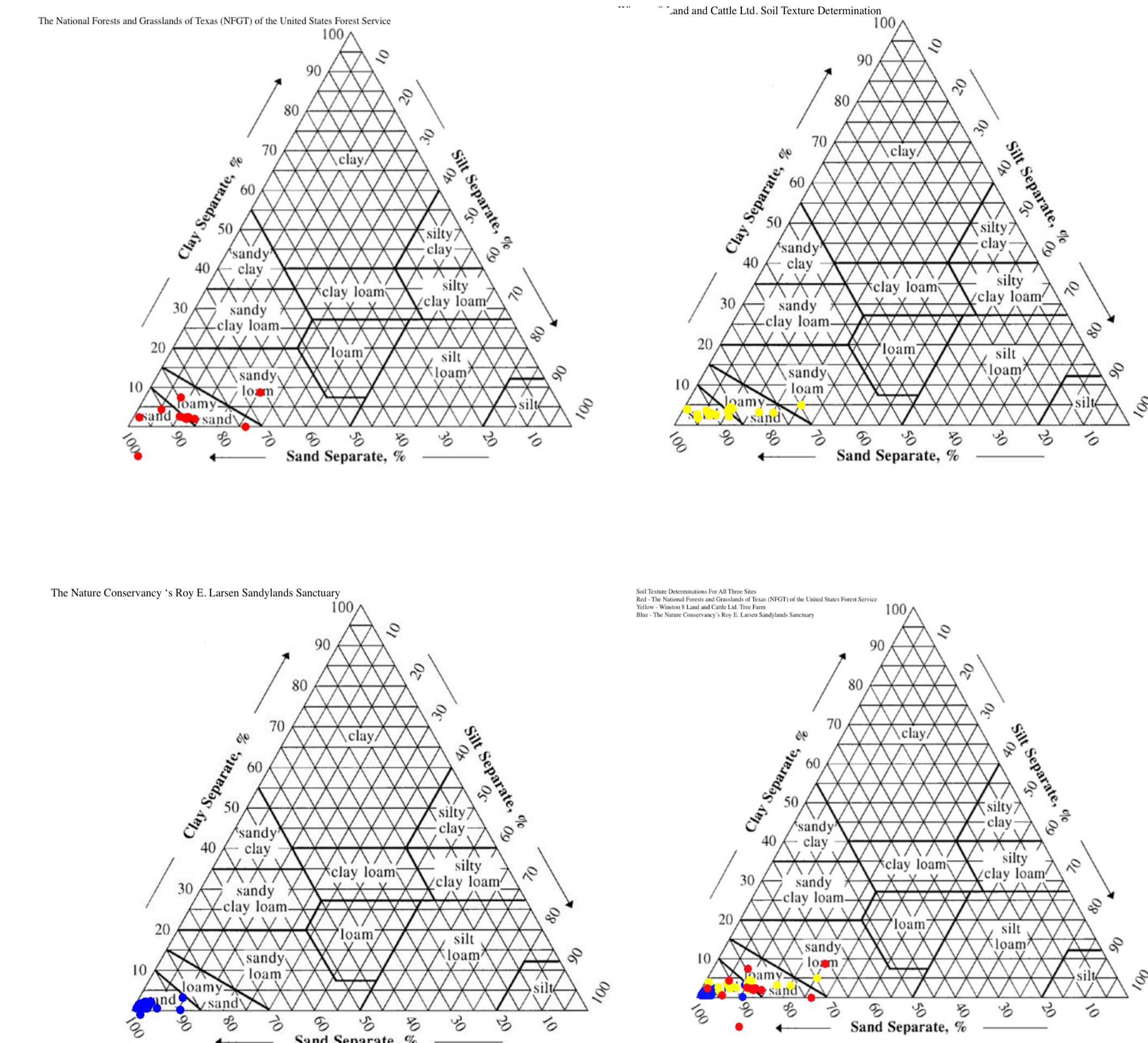
Objectives:

- Test the effects of soil infiltration rates as influenced by prescribed fire in Deep East Texas.
- Evaluate the effects of various soil physical properties influenced by prescribed fire in Deep East Texas.

## SITE DESCRIPTIONS

All of the sites were chosen based on availability and the likelihood of them being burned. NFGT and TNC plots were previously established. The Winston 8 plots were not pre-existing and therefore were randomly selected within the projected burn area in a planted Longleaf Pine area.

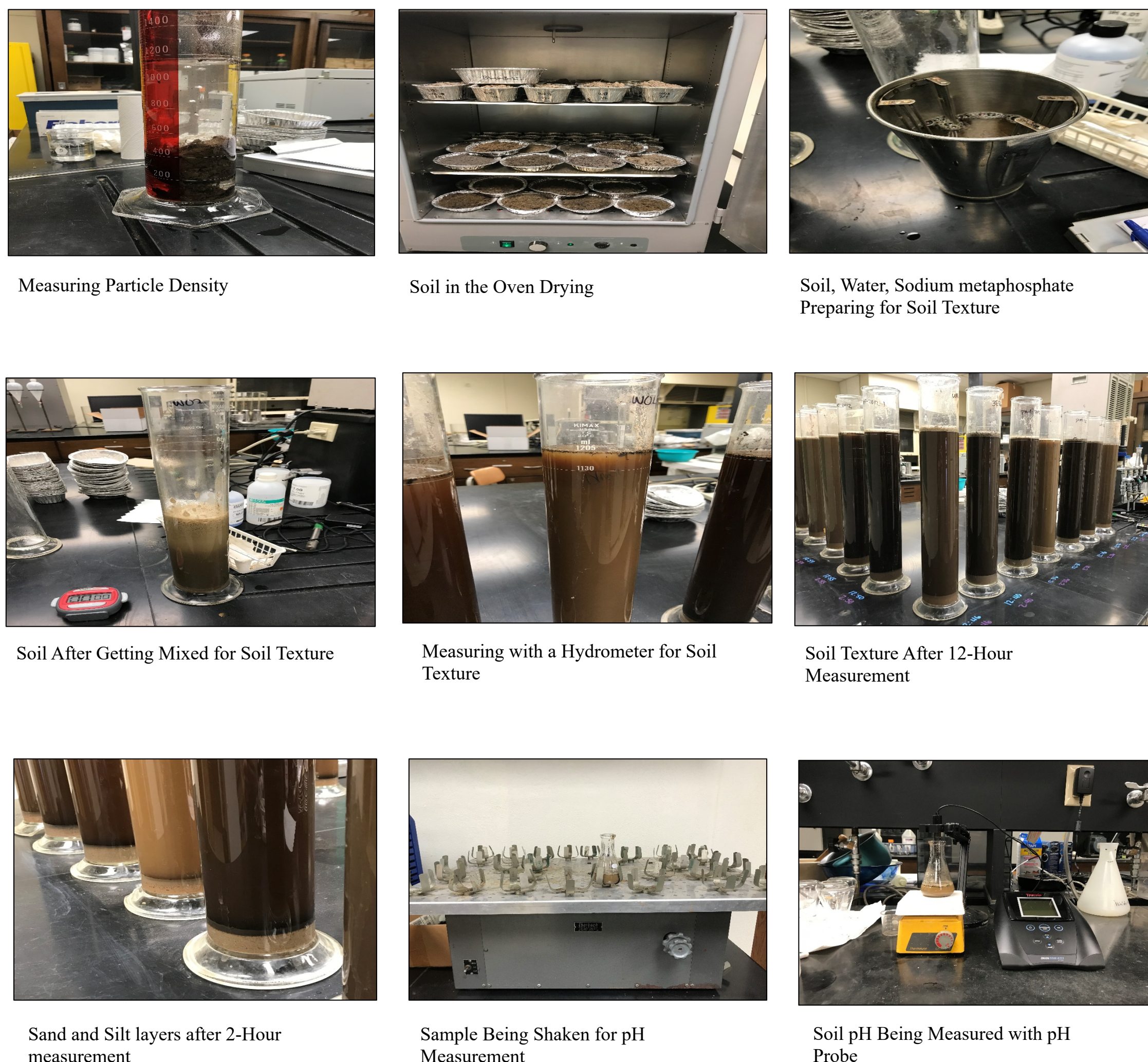
## SOIL TEXTURE DETERMINATIONS



## FIELD SAMPLING PICTURES



## LAB SAMPLING PICTURES



## FIELD SAMPLING METHODS

**GPS COORDINATES:** GPS coordinates will be taken at the site of sampling within the established plot. Another waypoint will be taken at the second sample. The GPS to be used is a Garmin Montana 680.

**RANDOM DIRECTION AND DISTANCE:** A random number generator will be used to determine the direction and the distance from plot center and then again for the secondary plot.

**SOIL SERIES CONFIRMATION:** The Web Soil App (UC Davis and Natural Resources Conservation Service), will be used to determine the soil type at each plot. A soil auger will be used to go to a maximum depth of 1.5 meters to confirm the soil type.

**SOIL BULK DENSITY:** The Excavation Method will be used in the field. A small hole will be dug to the depth not exceeding 15cm, all the soil will be collected from the hole. The hole will then be lined with cling wrap plastic, a known quantity of water will then be poured into the hole filling it to the top.

**MINERAL SOIL SAMPLES:** Two bags of mineral soil samples will be collected from each plot, not to exceed 15cm in depth. One bag will be sent off to an external lab to determine soil fertility. The other bag will be used in determining the wet pH of the soil, the soil texture, and percentage of water stable aggregates.

**O-HORIZON DEPTH AND WEIGHT:** A 22cm X 22cm square will be utilized to collect of the organic.

**SOIL STRENGTH:** A cone penetrometer of 19.05 mm (¾ inch) will be used to determine the soil strength in PSI up to a depth of 127 mm (5 inches).

**SOIL INFILTRATION:** A double-ring cylindrical infiltrometer will be used and measurements will occur until a steady rate is reached in the inner ring.

## LAB SAMPLING METHODS

**SOIL TEXTURE:** 100 grams of dry soil is put into a milkshake blender cup with 100 mL of Sodium Metaphosphate and filled halfway with water and mixed for 10 minutes. The sample is then poured into a cylinder and a hydrometer is placed into the mixture and water is added. Measurements will be taken at the 40-second and 2-hour time frame; another measurement will be taken after 12 hours to determine the % Sand, Silt, and Clay.

**PARTICLE DENSITY:** Water displacement of the soil bulk density sample will be taken by filling a graduated cylinder with 1000mL of water and dry soil added. The dry weight is divided by the volumetric difference.

**SOIL PH:** 20g of soil will be measured out and put into an Erlenmeyer Flask and 40mL of deionized water will be added. The flask will be put on a shaker for 15 minutes and measured using a calibrated pH probe

**WATER STABLE AGGREGATES:** The percentage of water stable aggregates will be determined using 200g of mineral soil. The wet soil will be put though a nest of sieves. The sieve sizes will be as follows; 5 mm, 2 mm, 1 mm, 0.5 mm, and 0.25 mm. Aggregates on each sieve will be weighed wet and then placed in an oven at 105 degrees Celsius until a constant weight is reached. Percentages of water stable aggregates on each sieve will then be calculated.

**SOIL BULK DENSITY:** Soil will be weighed wet and then after reaching a constant dry weight at a temperature of 105 degrees Celsius.

**WATER CONTENT OF SOIL:** The water content will be measured from the soil bulk density sample in MWC and VMC.

**WATER CONTENT OF ORGANIC MATTER:** The organic matter will be measured wet and then dried at 60 degrees Celsius for at least 48 hours or until the weight remains constant.

**SOIL FERTILITY:** A separate bag of soil mineral sample will be sent to an external lab to measure the total organic carbon content, total Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, and Sulfur.