Introduction

Forest regeneration methods are often correlated to soil strength within a plantation forest [R.F. Powers et al. 2005]. Depending on the method undertaken, distinctions can be made in order to determine the comparative productivity and sustainability of the soil. In an attempt to further investigate the differences in soil characteristics among various mixed conifer plantations of the Sierra Nevada mountain range, measurements of soil compaction and soil moisture were taken. These particular measurements were chosen for this study because of their direct relationship with soil strength. Through the use of heavy equipment, wet soils are often susceptible to a greater level of compaction, while the dry Mediterranean climate of Sierra Nevada forests account for further limitations in soil strength due to the lack of moisture. As a result, the variability of soil moisture is absolutely crucial to the outcome of this study, in addition to providing a basic knowledge of dry forest terrain. Observations reveal a positive correlation between the maturity of the plantations measured, and the frequency of wildfire loss, and thus the additional possibility of the soil productivity being compromised [York et al. 2009]. This is accompanied by the fact that the exceptionally high density of plantations, due to their homogeneity, are at a much greater risk of such losses. With the data collected from these measurements, we hope to determine whether or not the soil strength within these plantations suggest that the utilization of bio-mass thinning would significantly reduce the risk of wildfires, while at the same time sparing the soil of the substantial nutrient depletion associated with the use of heavy equipment, in the long run.

Methods

- This study was conducted at the Blodgett Forest Research Station in the central Sierra Nevada, during the early to midsummer months of 2011.
- The climate at Blodgett is montane Mediterranean, with most precipitation occurring in the winter months; half as snow and half as rain.
- Seven compartments were measured, while the number of plots completed within each compartment ranged from four to seventeen.
- Plantations used for the study were between 15 and 25 years old.
- Tree species present among these mixed conifer plantations include white fir (Abies concolor), Douglas fir (Pseudotsuga menziesii var. menziesii), sugar pine (Pinus lambertiana), ponderosa pine (Pinus ponderosa), incense cedar (Calocedrus decurrens), and giant sequoia (Sequoiadendron giganteum).
- Soil moisture was obtained at each plot point (eight points in total) through the use of a soil moisture censor probe.
- A recording cone penetrometer was used in order to determine the level of compaction within each soil measurement. Parameters on the device were set to a depth of 500 mm, while soil resistance was measured in kPa/mm, at 20 mm increments.

Results

Taking soil compaction measurements with the cone penetrometer, through the best of times and the worst of times.

Soil moisture was taken with a soil moisture censor probe directly following the penetrometer readings.

Upon locating the plot center of each compartment, a grid (pictured above) was measured around it. Each of the eight points were measured at a distance of 9.144 m from one another, with a total of three penetrometer readings per point.

Conclusion

- The chosen compartments illustrate a satisfactory gradient for soil strength conditions, which will be beneficial to this study.
- There was a high variability of soil moisture between compartments, however it did not have a large influence on the variability of soil strength between compartments.
- Additionally, a high variability of soil compaction between compartments was detected, with few significant differences between pairs of compartments.
- There was a weak correlation between soil moisture and the most recently significant precipitation, which would suggest that soil moisture was minimally affected by these particular weather conditions.
- Compartment 250 is the only compartment which stands out as being notably different than the others. There appears to be greater soil strength within this compartment, even after accounting for lower levels of soil moisture. This may be attributed to the fact that it was the last compartment measured.
- Measuring soil strength during the early summer within these compartments appears to be favorable, although some compartments should be re-measured in late summer to assess the interaction of summer drought with soil strength measurements.
- As a result of this study, a considerable amount of data may be attributed to the long-term monitoring of soil productivity within these plantations.

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