EVALUATING SOIL COMPACTION ON UNCONTROLLED TRACTOR LOGGED SKID TRAILS BY THE RUBBER BALLOON METHOD OF BULK DENSITY MEASUREMENT

A Report

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Conclusion

Increased use of machinery in the forest has led to increased awareness of the effects machinery can have on the forest environment. Soil compaction is a major problem that must be assessed if future tree growth is to be accurately predicted. Forest growth models and machinery designs need data on the long and short term effects of soil compaction by various machinery so that predictions and improvements can be made. The methods by which this data is collected must be standardized so that easy and accurate interpretation is possible.

This study involved the use of a home built rubber balloon device for determining the in place density of soil. It is used as an alternative to other inexpensive volumetric bulk density measuring methods. This method proved to accurately measure the soil's density when compared to the Coring method; however, only one soil level at a time can be measured, and considerable time and patience are needed when collecting data. In this study only the surface 2-4 inches of mineral soil was sampled; samples at other depths would require even more time and work if accurate data is expected.

The results of using this method to determine the soil's density change on tractor logged skid trails found decreased soil density after logging was present on several skid trails. Proctor analysis was used on the soil type present to try and explain some of the observed soil moisture conditions, and compaction characteristics that may have caused these confusing results. Assuming the moisture density data collected in this compaction study is correct, Proctor curves indicate that the soil was compacted far below optimum moisture content for maximum compaction at a compactive effort below an equivalent 12 blow Proctor test. The only way higher soil density could have been reached would be if the soil moisture or compactive effort increased. For this reason it seems that possibly the inherent nature of the soil present on this logging operation began at a high bulk density and skidding traffic only decreased its density through various combinations of vibration, log gouging and soil churning by tire/track action.

Hopefully the problems encountered here, and the methods explained in this report will aid further investigation in this subject. Studying soil compaction on an actual logging operation is very difficult unless cooperation from each organization involved is possible. Controlled studies may be the only way to obtain reliable data, but should not be expected to represent the actual conditions because more takes place on an actual logging operation that can be simulated on a controlled study. The real discovery made in this study was the importance of pre-design and planning, worker cooperation and communication, and the need for authoritative assistance and advice throughout the course of the study. Without these, as in this study, the study methods will change to accommodate unplanned or unavoidable circumstances and data will be lost because delaying the logging operation is usually impossible. With proper design, cooperation and assistance in the initial stages of the studies design, problems encountered in the field can be avoided.

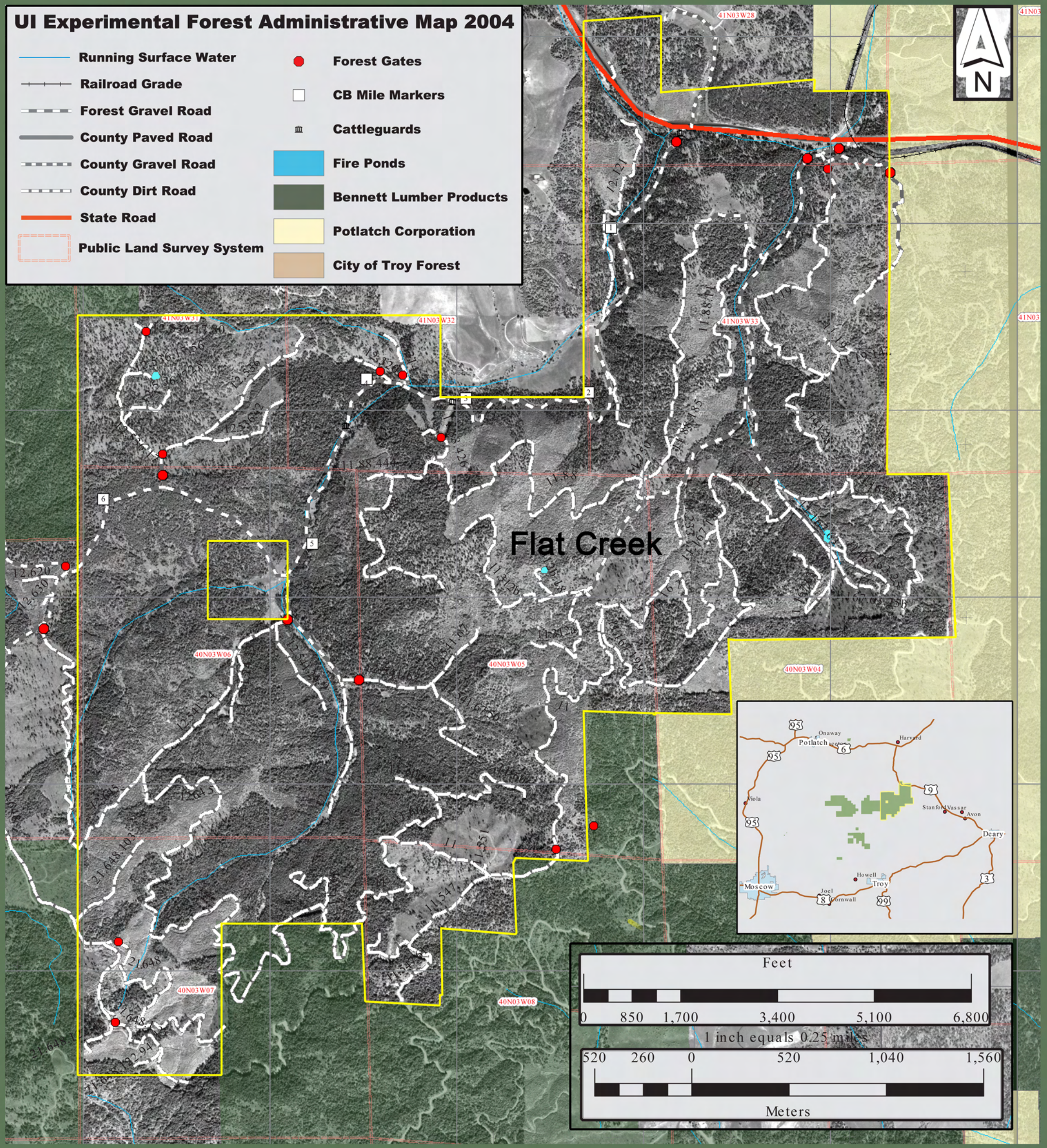
Study Site

The Site

This soil compaction study took place on the Flat Creek Unit of the University of Idaho Experimental Forest. The legal location of the stand that was logged in this unit is, NE 1/4, S ½, of section 32, T 41N, R 3W, Boise Meridian. The habitat type is Pseudotsuga menziesii – Calamagrostis rubescens changing to Abies grandis- Pachistima on the lower slope (Daubenmire 1968). The harvesting prescription for the cutting unit where this study took place was a medium intensity Shelterwood cut favoring the Ponderosa pine (Pinus ponderosa Laws) seed source. Skidding was accomplished with a Caterpillar 518 wheel skidder and a John Deere 550 crawler tractor (Table 2).

Skid trails used by these machines were flagged prior to timber falling. The WT and LT trail systems (fig. 2) were cleared of brush by one pass with the 550 crawler. The WT trails were on a Southwestern aspect and the average trail slope was 24%. The LT trails were on a Northeastern aspect and the average trail slope was 10%.

The OT and ET trails had the trees on the edge of each flagged trail felled into the skid trails with out any clearing of brush in the proposed skid trail by the crawler tractor. These two trails……..


UI Experimental Forest Administrative Map 2004
Running Surface Water
Railroad Grade
Forest Gravel Road
County Paved Road
County Gravel Road
County Dirt Road
State Road
Public Land Survey System
Forest Gates
CB Mile Markers
Cattleguards
Fire Ponds
Bennett Lumber Products
Potlatch Corporation
City of Troy Forest
N
41N03W28
41N03W31
41N03W32
41N03W33
40N03W06
40N03W05
40N03W04
40N03W07
40N03W08
Flat Creek
Onaway
Potlatch
Harvard
Viola
Stanford
Vassar
Avon
Deary
Howell
Troy
Moscow
Joel
Cornwall
Feet
0 850 1,700 3,400 5,100 6,800
1 inch equals 0.25 miles
520 260 0 520 1,040 1,560
Meters

Flat Creek

Location of Complete Research:

Author & Title: Bloch, Vaiden E.
Evaluating Soil Compaction on Uncontrolled Tractor Logged Skid Trails

University of Idaho Library:

Call Number- Not found in the Library's data base.

College of Natural Resources:

Department- Forest Products

Other Sources: