Mill-Key-Wey Soil Compaction Check

Nov. 7, 2000

To Traci Sylte:

I mapped LSIs by equipment use limitation from the interpretation section of the Lolo LSI book. I overlaid past harvest units, and selected some of the past regeneration harvest units to check because they had the most extensive equipment use. I selected units with LSIs that are somewhat sensitive to compaction – most rated "moderate." I selected units on Keystone Ridge, midslope units in Pardee, and valley bottom units near Slowey campground.

Map should be attached or can be printed from ArcView project /fsfiles/office/d7/supno/mill_key_wey/Veg_Silv/soil.apr.

My field methodology consisted of observing trees and digging soil pits. Upon entering a stand, I wandered around trying to identify skid roads. Sometimes the skid roads were obvious, sometimes there were faint parallel tracks, and sometimes I wasn't able to discern the skidding pattern. I observed tree heights to see if there was any difference between those growing in relatively untrammeled ground and those growing in the skid roads. I dug soil pits trying to get past the rooting layer down into the subsoil until I could not get past the rocks without major excavation. I noted: 1) how difficult it was to get the shovel into the soil (indicator of bulk density) and 2) whether I could discern the soil clumping into horizontal plates (indicator of compacted layer). I tried to sample at least one pit in the relatively untrammeled areas, at least two pits in the skid roads, and one just outside the stand in unharvested forest.

<u>77001018 #1</u>
This unit was clearcut in 1972 then dozer piled in 1973. Records are not clear, but indications are that the work was completed in October. In this portion of the unit, the dozer piling was not obvious. Apparently it was done with a fairly light hand. Skid roads were light and not very obvious. Tree heights were relatively uniform across the area. I dug one pit in an untrammeled area. It was fairly easy to dig, and I found no evidence of compaction. I dug four pits in areas that I was pretty sure were skid trails. They were just as easy to dig and showed no compaction. I am confident that this area has not suffered enough compaction to affect productivity, even in the skid trails.

<u>77001018 #2</u>
This is another portion of the same unit. In this portion of the unit, the dozer piling was obvious, and there are some obvious skid roads at wide intervals. Tree heights were fairly uniform across the area. I dug three pits in dozer piled areas without clear signs of skid trails. They were difficult to dig because the soil was shallow and rocky. I did not note any platey clumping that would indicate compaction. I dug one pit in an obvious skid trail that had few trees growing on it. It was very difficult to dig and appeared to

have some platey clumping. It was probably compacted. This portion of the unit has had a lot of the organic layer disturbed and displaced through the dozer piling. It does not seem to be affecting the trees relative to the other portion of the unit. The obvious skid trails seem to have some compaction still evident. Except for the few obvious skid trails, tree growth does not indicate any loss of productivity from compaction.

77001049

This unit was clearcut in 1977 and dozer piled in 1978. The records are not clear, but indicate the dozer piling was completed in September. Tree heights were fairly uniform across the stand in general, but there were exceptions. I followed the dozer fireline around part of the unit, and found patches totaling about 30% of its length where the trees were considerably shorter than the adjacent unit. This indicates a loss of productivity either due to topsoil removal or compaction. I walked up and down four skid trails. On two skid trails, the trees were as tall as the surrounding trees. On the other two skid trails, I found patches of smaller trees, indicating some compaction on about 20% of the length of those two trails. Digging soil pits confirmed the story of the trees. Two pits dug in the unaffected skid trails showed no sign of compaction compared to adjacent untrammeled areas. Three pits dug on the fireline and skid trails with smaller trees showed some evidence of platey clumping indicative of compaction.

76901027

This unit was clearcut in 1984 and dozer scarified (not dozer piled) in 1985. Tree heights were variable across the stand because it had been planted more than once. I did not see any indication of trees being shorter on skid trails. I dug one pit in an untrammeled area, and four pits along different skid trails. One of the skid trail pits was harder to dig, indicating an increase in bulk density. I did not observe platy clumping or any evidence that the compaction impacted tree growth.

76901032

This unit was clearcut in 1985 and broadcast burned in 1988. Tree heights were fairly uniform across the stand. Trees along the dozer fireline looked the same as trees inside the unit. I dug two pits in untrammeled ground and three in skid trails. There was no indication of compaction (increased bulk density, platy clumping, or different tree heights).

70102006

This unit was clearcut in 1986 and dozer piled in September of 1986. Tree heights were variable because of natural seeding and multiple plantings over a few years due to damage from big game. I did not detect any difference in tree heights in general between the skid trails and other areas. I dug five soil pits and found no evidence of compaction. The soil is fairly deep and sandy.

70102179

This unit was clearcut in 1986 and dozer piled in 1986. Tree heights were variable because of natural seeding and multiple plantings over a few years due to damage from big game. I found sections of skid trails that had shorter trees, but found that the trees

were from the latest planting in 1991. I could not determine if the previous planting in the skid trails failed specifically due to big game damage. I dug five pits in this unit. The soil has large rock fragments (6 inch plus) at the soil surface, so digging the pits was difficult. I did not detect any increased bulk density or any platy clumping in skid trails, but the rock content made it difficult to detect.

70101159

This unit was clearcut and dozer piled in 1986. Tree heights were variable because of extended regeneration time including two plantings. Soil was fairly deep and sandy. I dug one pit in untrammeled ground and four pits along skid trails. Two of the skid trail pits had an increased bulk density apparently due more to heavy use by cattle than from the skidding, but there was no sign of platy clumping.

Summary

None of the LSIs in the analysis area have high equipment use limitations because of compaction hazard. Several LSIs have moderate equipment use limitations because of soil compaction hazard. These moderate equipment use limitations usually can be overcome by strict timing mitigation where equipment is used on dry or frozen ground.

Season of equipment use and soil moisture appear to have an influence on soil compaction. The worst compaction observed was on the ridgetop locations – associated with higher precipitation and likely more moist soils in September and October when the dozer piling was done on these units.

General observations of these units led me to these conclusions:

- Units harvested over 20 years ago showed more lingering signs of compaction, while units harvested less than 20 years ago showed less.
- Skid trails probably affect about one-quarter of the average unit.
- Where digging was not complicated by rocks, about one-third of the skid trails had a tactile increase in bulk density indicating lingering compaction.
- Skid trails with a tactile increase in bulk density usually had a slightly different understory plant community – an increase in grasses and decrease in forbs – indicating that there was a difference in site quality even when there was no observed difference in tree heights on the skid trails.
- Where the skid trails had a tactile increase in bulk density, about half of the time there was a corresponding decrease in tree height, indicating an observable and quantifiable loss of soil productivity.

Caveats

This is by no means a statistically sound sampling. I just tried to cover a variety of sites where LSIs indicated compaction may be a problem in order to gather observational data on compaction in past harvest units.

The majority of the units sampled were dozer piled. As with most forest management practices, dozer piling has changed considerably over the past 10 to 20 years. Formerly resulting in a clean “potato patch” unit with most of the organic material piled and burned, today’s dozer piled units are “messy” in recognition of the need to keep organic matter of all sizes distributed across the unit for long-term site productivity. Seasonal and moisture restrictions are standard to prevent equipment use when the soil is most prone to compaction. Much of today’s piling is done by excavators to reduce soil disturbance.

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