Sunny Oaks Soil Presentation Transcript

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Hello, my name is Danding Gan I am the Forest Hydrologist for Wayne National Forest. Today I will be talking about my analysis for impacts to soils on the Sunny Oaks Project.

Start with, we'll talk about the laws and regulations that govern soil analysis. Some have already been spoken about earlier. We will focus on the ones that are central to the soils resources. That's these two. The Bankhead Jones farm tenant act of 1937 directs development of the land conservation program to control soil erosion, mitigate floods, and conserve surface and subsurface moisture, among other things. The forest service manual chapter 2550 provides policy guidance on maintaining or restoring soil quality on National Forest system land. Some of the issues identified from scoping the project relates to the concern that large-scale removal of tree cover, can potentially cause excessive erosion and/or slips and landslides to happen on steeper terrain. Especially erosion prone soils can see increased risk following the implementation of these proposed harvests. Some of the other factors we need to look at also include compaction, rutting, and displacement of topsoil can result from the use of heavy machinery while implementing the harvest.

To look at these concerns, we will be looking at different parameters. First we will look at is erosion. What is erosion? How does it occur? Erosion is when soil is mobilized and suspended through water or wind. It can be accelerated when you remove vegetational groundcover. It can happen anywhere, where we have human activities that remove ground cover vegetation. Such as on roads, trails, fire lines, landings, farms and on timber harvests.

This picture shows you what erosion can end up looking like when there is no ground cover.. The other parameters include rutting, displacement and compaction. A rutis when there a depression or groove worn into the road by wheels. Displacement is when you have the topsoil being removed by machinery and is mixed in with the subsoil. Compaction is when you compress the soil particles into a smaller volume and it reduces the size of the pore space available for air and water to travel in between the soil particles. These three things happen when you have heavy machinery traveling repeatedly over the same area. Especially on skid roads, skid trails and on log landings.

To the left you see a picture of a rut. Ruts are also usually where there is a lot of displacement when topsoil has been removed and mixed in with the soil underneath it. On the right, is an example of a platey structure which is a type of soil compaction. When soil is compacted it

ends up developing into plates like that often. And prevents roots from breaking through them, prevents water and air to travel and move between them easily. Especially when it's really bad.

The other thing we will look at is the likelihood of slips and landslides. What are slips or landslides? It's when an entire mass of soil or rock slides downslope under the force of gravity. It's more susceptible to happen in places that are excessively steep. Also, where the depth of the soil is above a restrictive layer. When you have a restrictive layer that is defined by rock or clayey soil which prevents water from infiltrating through it. And so when you have somewhere where the depth of that restrictive layer is very shallow and the infiltration through the soil is quickly it can provide like a lubricant and cause the soil above that restrictive layer to slide.

This picture gives you an idea what a slip or landslide would look like.

Some of the spatial and temporal– extent we will be looking at, is approximately hundred feet from the edge of our proposed harvest activities. Now they impact the soil a generallywhat we call “point impacted”, it happens directly underneath where everything happens. It doesn't generally travel very far. The hundred feet spatial extent is specifically to address soil erosion which can travel on sloped surfaces. But if there are vegetative areas within and directly adjacent to the proposed harvests, it generally helps prevent that erosion from traveling further than a hundred feet .

As for the temporal extents, we’ll be using 20 years. That's the long-term extent. Short-term, groundcover in this area of the country generally reestablishes itself within the year. Other impacts such as compaction, rutting and displacement can take upwards of 20 years to recover. If they are properly rehabilitated and revegetated, they can recover as soon as within a year or two.

Impacts that last beyond 20 years though are what we call a detrimental disturbance. This is the type of disturbance that can generally be found on old road beds and really heavily trafficked skid roads. We have best management practices and protocols in place to try to prevent this kind of disturbance occurring anywhere else besides roads and skid roads.

Taking a look at some of the methodology and assumptions for this analysis, to look at erosion, rutting, displacement and compaction, we will be looking at soil survey mapping data. This data was compiled by NRCS when they went through and did comprehensive soil surveys across the entire country. We will be specifically looking at erosion hazard rating and the rutting hazard ratings.We will go into a little more detail, here in a little bit on what all this means.

Wang and colleagues in 2003 did a study and found out when it comes to soil compaction, soil moisture is the most significant variable. The more moisture there is when your harvesting, it's more likely to compact. That excessive compaction can definitely reduce tree growth, but usually, when soils are dry and compaction is not as bad, it doesn't have too much effect on the growth of hardwood trees which is what this project is trying to promote.

For slips and landslides, we will be looking again at soil survey mapping data, specifically on the layers that provide information on how deep it is to a restrictive layer, the hydrologic soil group, and also the slope gradient.

A little bit about the current conditions. In terms of erosion, erosion hazard ratings are mixed throughout the proposed action area. The majority of proposed action is located on soils that are rated for severe or very severe. There's also a substantial minority located on moderate or slight erosion hazard ratings. As for rutting, displacement and compaction, the majority of proposed actions are located on soils rated severe for rutting. So there is a high susceptibility for rutting and compaction in this area. In terms of slips and landslides, throughout the entire project area, the shallowest depths to a restrictive layer is 69 feet. This is pretty substantial. And the majority of them are located on soils where depth to the restricted layer is between 69-100 feet. But at the same time, it's also on soils that have slow infiltration rates. Which means, for the most part, the slips and landslides are really not very likely to occur except where the land is already very steep to begin with.

The following maps, will kind of show you where and how the ratings are located. If you look on the left, there is a map of erosion hazard ratings, the black areas are where proposed action and proposed harvests are located. As you can see, the majority are located on soils rated for severe erosion hazards. Then there's some rated on very severe, but there is a good amount with moderate hazard ratings where these are located too. To the right, you can see the map of where the rutting hazards are located. Again, the majority are located where soil rutting hazard is very high.

The erosion hazard rating actually indicates the likelihood of soil loss after disturbance activities, you know it could expose anywhere from 50 to 75 percent of the soil surface, you knowfrom logging, grazing, mining, any other kind of disturbance really. The soil rutting hazard indicates the likelihood of the surface ruts to form through operation of forest harvesting equipment.

Soil displacement and compaction can also occur simultaneously with rutting. These ratings are based on the depth to the water table, or the amount of rock fragment there on or below the surface of the slope and other parameters.

The next two maps should be looked at at the same time together. On the left we have the depth to soil restrictive layer. So a restrictive layer is defined as a nearly continuous layer that consists of one or more physical, chemical, or thermal properties that impede the movement of water and air through the soil: bedrock, cemented layers, really dense layers or frozen layers are what would be defined as restrictive layers. As you can see there, even at the most shallow , it's 69 feet or more before it reaches a layer such as that. To the right, a hydrologic soil group map estimates like runoff potential. It kind of talks of, it indicates the rate of water infiltration when the soils are exposed. So, when they are very wet, it’s like when Group A has a high infiltration rate. Low runoff potential, which means, when it's raining or wet, most of that water is absorbed into the soil instead of running off. As you get progressively lower into Group B, Group C and Group D, infiltration rates becomes less and less which means a higher likelihood for runoff.

And there is a large portion of our soils actually has low infiltration rate and a lot are in group D or group C. That means most of the water actually runs off and doesn't infiltrate into the soil. What this means, in terms of a landslide or a slip point of view, is that if that water isn't traveling down into the soil to that restrictive layer and building up and causing the soil to loosen, it's not as high of a risk of causing a landslide to happen. As it rains and or storms.

We have a combination of deep soils and low infiltration rates, meaning majority of the water comes off the land when it rains and storms. It's not overall, generally speaking, as prone to slips and landslides.

For this project, we did some monitoring before it started. We also did some DMP monitoring, not for this project, but for other prescribed burns we've donein the past. The best management practices monitoring we did on prescribed burns indicatesthese burns have very low risk of causing erosion here on the Wayne National Forest.

As for other impacts, we have the forest service disturbance monitoring protocol that we implement to try to find out what our current conditions is on the soils here on the Sunny Oaks Project. And we also will be doing some post-treatment monitoring after it's done to gauge and help us determine what kind of impacts will result from our management activities? This protocol, what it does is classifies soil disturbance in four categories. From no disturbance, which is Class zero, to very heavy disturbance, which as Class three. The protocol provides a statistically valid rapid assessment of soil conditions and based on visual indicators that describe the conditions of soil and how they can affect the sustainability of the site as well as productivity and other functions.

Our pretreatment data, what we had before we had done anything, we used to still look at current conditions. It indicates only 2% of our samples collected have some very very minor disturbance from past activities…back in the day. None are detrimental. If you remember earlier, detrimental disturbances are those that would not recover within a 20 year timeframe.

This is a chart based on information collected so far. Showing 98% of the sites from the sample collected showed no disturbance in the soil or basically it means the surface from the past have already recovered and there aren't really any physical disturbances currently and where there was, it was a minor disturbance, they were class I, just 2%.

For the analysis, of the erosion, rutting displacement and compaction chances, the standard timber harvest best management practices are designed specifically to address these issues. So we will be ensuring proper implementation of these best management practices and as well focusing attention towards trying to prevent damage from happening. Or Forest Plan guidance also limits operations to when conditions are dry, so when it's not raining. It also tries to minimize the number of skid trails we use while optimizing the number of passes on these trails. This concentrates the impacts to those locations and not spread out across the entire unit. There are options that we can use such as logging flash, using logging flash as mapping to reduce the compaction and rutting for where it's applicable or needed.

And obviously locations of greatest concern are where the ratings are severe or very severe for erosion hazard rating and where rutting hazards are rated for severe. For slips and landslides, the best management practice is to just stay out of those areas that are slip prone. Our forest plan guidance limits our skid trails for maximum sustained slope of 35%. In those areas, we wouldn't have our equipment traveling into and destabilizing those soils. And obviously the steeper areas of those of the greatest concern. For this project, for the proposed action about 645 acres, or roughly 24% of the entire total proposed action, are located on slopes over 35%. And with Alternative 2 it is about the same even though the acres are small, but there also less acres proposed for harvests in Alternative 2, so…. Both of these are about 24% of the land located on slopes over 35%, which means that we would limit our equipment from going into those areas.

For cumulative effects, we look at future foreseeable activities within that 100 foot area outside of the proposed action. We already know that roads, trails and other infrastructure can extend the distance traveled by eroded soil and that past timber harvest on both on public and private land would also do the same, but a lot of those are existing conditions. And for cumulative effects we are looking at our proposed action, but in the foreseeable future, and foreseeable future actions are the one we know of right now is the Buckeye express pipeline. That adds approximately about 35 acres within this analysis area for both alternatives for cumulative effects. Of those 35 acres, about six acres are located on slopes over 35% where we can have a higher likelihood of slipping or landslide.

That is the end of my analysis. Thank you.