SBEADMR SUPPLEMENTAL INFORMATION REPORT ON CUT-TO-LENGTH AND TETHERED LOGGING TECHNOLOGIES

Introduction

The Spruce Beetle Epidemic and Aspen Decline Management Response (SBEADMR) Final Environmental Impact Statement (FEIS) made assumptions for estimating effects analysis based on the most common, conventional types of logging equipment used in the area. Alternative logging equipment does exist and has been demonstrated recently for the forest's specialists. Given this technology, my staff has reviewed the language of the design criteria in the SBEADMR checklist and the FEIS analysis to determine whether or not the language is consistent with use of newer technology. This technology incudes cut-to-length systems which may be used with a tether on steep slopes.

Cut-to-Length System

Cut-to-Length (CTL) harvesters delimb trees directly at the stump, leaving tops and branches in front of the equipment. Trees are then gathered with a forwarder that also travels on the slash mat. The slash serves as a buffer that reduces impacts to soils from the tracked equipment while also allowing nutrients from stems and needles to remain on site.

Tethered Logging

The use of tethered assistance can permit operations and mobility in adverse soil conditions while also improving traction on more gentle grades. Tethered logging utilizes cable winch systems on various mechanical logging equipment (i.e. cut-to-length harvesters, forwarders, feller-bunchers, etc.) to stabilize and assist operations on steep slopes. These steep-slope mechanical harvesting and yarding systems, also referred to as cable-assisted, or winch-assisted operations, allow the equipment to enter previously inoperable steep ground that would normally be considered unsafe by enhancing equipment stability to prevent sliding and overturning.

Tethered systems consist of a cable winch mounted on equipment that is then connected to a fixed object or anchor point, like a tree or stump, or another piece of equipment to help navigate steep ground. This increases access for most ground-based equipment to areas that were previously limited due to steep slope gradient (>40%).

SBEADMR FEIS and Checklist Considerations

Three checklist criteria are being considered:

- **SBEADMR Checklist WQSP-7B (A)** Skid trail locations will be agreed to by the Forest Service in advance of construction; spacing will be approximately 100 feet apart, allowing for topographic variation and skid trail convergence. Space water bars as appropriate on skid trails according to slope and soil type, as indicated in Table A-14.

- **SBEADMR Checklist WFRP-11** Skid trails and landings will be located to minimize impacts to advanced regeneration. Skid trails will be placed at least 100 feet apart, except where they need to tie in together at landings.

- **SBEADMR Checklist WQSP-5B(D)** Avoid ground skidding on sustained slopes steeper than 40 percent and on moderate to severely burned sustained slopes greater than 30 percent. Conduct logging to disperse runoff as practicable.

The next consideration was around the operational constraints and assumptions specified in the FEIS.

- P. 25, “As stated in 36 CFR 219.14(c), lands identified as "tentatively suited" for timber production must be further evaluated to determine which lands are "not appropriate" for timber production to meet the objectives of each alternative analyzed in detail. Pages B-7 to B-10 of the GMUG Forest Plan describe the process used to identify lands not suitable for timber production. Factors used to identify areas not suitable for timber production include low productivity sites, steep slopes (>40%), sites where irreversible damage could occur, and visually sensitive areas. In the GMUG Forest Plan, the Forest evaluated all tentatively suited lands on a site-specific basis using 1:24,000 scale topographic maps together with field verification and on-the-ground knowledge of Ranger District personnel. Tentatively suited lands which pass through this screen are considered "suited" for timber production; however, during treatment reconnaissance and layout, Forest Service personnel can exclude portions of these lands from commercial harvest based upon these factors and other considerations for resource protection.”
- Pp 50-51, “…Mechanical treatment on slopes greater than 40% would be limited to chainsaws. All commercial mechanical treatments and non-commercial mechanical treatments involving large equipment would occur on slopes less than 40%. For slopes greater than 40%, mechanical treatments would be limited to chainsaws.”
- P. 64, “Commercial mechanical treatments and non-commercial mechanical treatments involving large equipment on slopes < 40%...Non-commercial mechanical with chainsaws on slopes < or >40%”
- p. 98, “Because it is a 3rd order survey and given the inherent variability of soils, treatment proposals generally need to be reviewed to confirm slope, depth, drainage, and other soil and site characteristics that may affect a particular use.
- P. 134, WQSP- 5B, “...Avoid ground skidding on sustained slopes steeper than 40%”
- P. 136, “Identify sensitive soil areas, e.g. severe EHR [Erosion Hazard Rating], slopes greater than 40 %, and landslide prone areas, in or near treatment units… Complete detrimental soil disturbance surveys… Limit mechanical equipment use to slopes less than 40 % (WQSP-5B). Properly locate and drain skid trails (WQSP-7B).”
- P. 137, “The effects of mechanical harvest activities on soils are likely to be localized, moderate, and short-term. Forest Service direction is to manage land treatments to limit the sum of severely burned soil and detrimentally compacted, eroded, and displaced soil to no more than 15 percent of the treatment area (USDA Forest Service 2006a). Design features, BMPs, and soil disturbance monitoring will avoid treating areas with sensitive soils (e.g. severe EHR and steep slopes), restrict activity when soil conditions are too wet, limit the aerial extent of skid trails and landings, and decompact and revegetate disturbed areas to minimize areas of detrimentally compacted, eroded or displaced soil.”
- P. 357, “Mechanical treatments usually occur on slopes less than 40 percent, due to equipment limitations.”
- P. 603“[I]t is estimated at least 25% of a treatment area would be excluded due to steep slopes…”

Forest Plan Direction Applicable to Issue

Timber management is constrained by forest plan standards in Management Area 7A to slopes under 40%. FP III-150 to III-154.

FP III-41 to III-42, to facilitate the control of soil erosion with acceptable tolerance:

1. Permit conventional logging equipment on slopes of less than 20% where soil surveys or site-specific soil data are unavailable.
2. Allow conventional logging equipment on slopes up to 40% where soil surveys or site-specific soil data are available to design erosion mitigation needs.
3. Utilize high floatation equipment on slopes up to 60% or cable and aerial systems on any slope.

The 1991 Forest Plan amendment includes a discussion on timber suitability based upon then in-effect 36 CFR 219 regulations. One of these was an assumption based on the underlying FORPLAN economic analysis identified in that Final EIS that assumed either high or low slopes. Low slopes (<40%) were assumed to be "Level 4 identifies where tractor logging can occur (low slopes [less than 40%]) and where other forms of logging are needed". (FP Final EIS, Appendix B, p. B-26)

Information Review

Effects to Soil & Hydrologic Function from Cut-to-Length and Tethered Logging Systems

Soil type and moisture affect the level of ground disturbance. Fine-grained soils are more prone to compaction when wet or lose bearing strength when saturated. Coarse grained soils likely slip and cause displacement due to pulverization under dry conditions. Use of a tether with appropriate tension may decrease the relative disturbance levels for these soil conditions by (1) relying less on soil shear strength for traction, (2) decreasing ground pressure, and (3) increasing the equipment's balance on steep slopes. In general, the weaker the soil conditions, the higher tether tension is required to reduce the level of soil disturbance.

Research suggests that soil disturbance is reduced by tethering because ground pressure is more evenly distributed along the track length of equipment, especially on steeper terrain (Sessions and Leshchinsky 2017). Chase et al. (2019) found that across a wide variety of local site conditions, tethered harvesting operations did not have extensive negative impacts on either soil disturbance or stream-adjacent disturbance. According to Green (2017) and Visser and Stampfer (2015), use of cable assisted equipment results in less soil disturbance due to the decrease in ground pressure and by reducing slippage of the tracks compared to untethered equipment. Furthermore, when a cut-to-length harvester processes trees in-woods, it provides a layer of woody debris that buffers equipment disturbance. As a result, impacts to soil and hydrologic function are reduced.

Review of Issues

Trail spacing for untethered conventional ground-based operations on the GMUG is currently limited to ~100 feet (Checklist item WQSB-7B Design Feature A). Tethered equipment on steep slopes has a restricted reach of 50 to 60 feet. To make tethered logging feasible, a reduction in trail spacing is needed.

National Forest specific monitoring, though limited, has been ongoing for several years (Brame and Jimenez 2019; Rone 2017 & 2018) and has shown that soil disturbance from tethered logging operations fall within acceptable parameters that meet forest and regional standards and guidelines. Specifically,

when tethered CTL harvester/forwarder systems are used, the slash mat is the main feature protecting soils.

The SBEADMR FEIS discusses limitations on commercial treatments whereas noncommercial treatments may occur on steeper slopes where equipment limitations apply. More modern technologies, specifically CTL harvester/forwarder systems, remove some of the equipment limitations and resource impact concerns. Many of the steep slopes considered for treatment fall within areas such as ski resorts where the primary purpose would not be commercial sales.

The spacing criteria for skid trails is related to minimizing soil disturbance as well as protecting advanced regeneration (and thus Canada lynx habitat). As CTL systems travel over a slash mat rather than bare soil, they generally cause lower levels of soil disturbance than conventional logging equipment, even with a narrower trail spacing. Since trees are processed at the stump, stand damage is also reduced and the need for large landing sites and associated pile burning is minimized. This benefits soils and promotes regeneration since areas that would otherwise be impacted by pile burning instead retain productive soils. It is also possible that slash mats provide protection to existing advanced regeneration, though the efficacy of this protection likely depends on the amount of slash retained.

While steep slope areas may become more operational under CTL and tethered logging systems, other project constraints would still apply such as the treatment caps established for lynx, slash depth or limit on the amount of soil disturbance within a treatment area.

Finding

I find that that tethered cut-to-length harvester/forwarder systems may result in fewer resource impacts compared to conventional ground-based skidding and the creation of skid trails. The use of this equipment is consistent with Forest Plan Standards and the analysis of impacts in the SBEADMR EIS given the location of some of the steeper slopes where this equipment is likely to be used.

Per AMG discussion, I recommend that tethered cut-to-length harvester/forwarder systems be approved for use in SBEADMR on a “pilot project” basis. Initial project use of this equipment on slopes over 40% within SBEADMR PTAs will be subject to pre- and post-implementation monitoring which will inform future adaptations of the SBEADMR checklist. Further use of this technology in SBEADMR projects will be subject to success of the pilot project, as measured by the ability to meet project objectives while minimizing soil disturbance (erosion, displacement, and compaction).

I recommend the following changes (in red) to criteria WQSB-7B (A) and WFRP-11

> (WQSB-7B(A)) Skid trail locations will be agreed to by the Forest Service in advance of construction; spacing will be approximately 100 feet apart, allowing for topographic variation and skid trail convergence. If cut-to-length logging equipment that travels over a slash mat rather than bare soil is used, 50-60 foot spacing of trails is acceptable. Space water bars as appropriate on skid trails according to slope and soil type, as indicated in Table A-14.
>
> (WFRP-11) Skid trails and landings will be located to minimize impacts to advanced regeneration. Skid trails will be placed at least 100 feet apart, except where they need to tie in together at landings. If cut-to-length logging equipment that travels over a slash mat rather than bare soil is used, 50-60 foot spacing of trails is acceptable.

I recommend the following clarification (in red) to criteria WQSP-5B(D) which aligns with Forest Plan standards:

> Avoid ground skidding on sustained slopes steeper than 40 percent and on moderate to severely burned sustained slopes greater than 30 percent. Use of cut-to-length harvester/forwarder systems that travel on a slash mat, rather than bare soil, is acceptable on slopes up to 60%. Conduct logging to disperse runoff as practicable.

ANTHONY EDWARDS

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Date

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