Rutting Evaluation

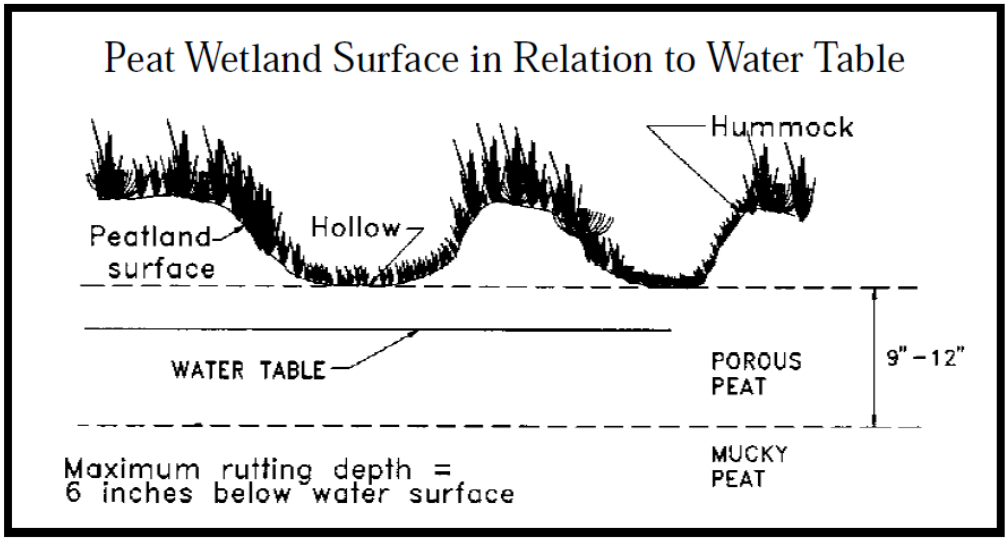
Rutting definition and metrics

Rutting definitions are usually general, referring more to impacts on soil processes rather than defined physical characteristics. We define rutting in the guidebook glossary as:

> *"The creation of depressions made by the tires of such vehicles as skidders, bulldozers, log trucks and pickup trucks. Mixing or smearing of soil often occurs on the sidewalls of ruts, which restricts infiltration of precipitation and disrupts lateral flow of water. Rutting occurs when the soil strength is not sufficient to support the applied loads from vehicle traffic."*

Most of our rutting guidelines do not quantify characteristics of rutting, instead providing qualitative descriptors such as minimize or avoid repeated and excessive rutting. However, there is a guideline for wetlands that recommends ceasing operations if rutting exceeds 6 inches in depth and a contiguous length of 300 feet or more than half of the wetland width. The following is provided as explanation:

Figure ROAD-17



The water table (solid line) is near the bottom of the hollows (upper dotted line). Operations should stop when ruts reach 6 inches below the water table or 6 inches below the bottom of the hollows, whichever is lower. Peat is usually still porous 9 inches below the hollows, and ruts will heal in 2 to 3 years. Deep ruts (more than 12 inches below the hollows) will bring up well-decomposed, mucky peat and may take more than 20 years to heal.

Many other guidelines (or BMP's) also use qualitative descriptors of rutting, but some States, the US Forest Service, and many of the Canadian provinces quantify characteristics of rutting. The metrics identify depth and length criteria for a severe rut that is sometimes coupled with a total allowable amount per unit area (Table 1). The metrics are usually presented as the maximum allowable amount on harvest units. Note that many of the area extent amounts in Table 1 are for total allowable soil disturbance including displacement, compaction, and rutting.

Table 1. Example rutting metrics from the United States and Canada

Entity	Rut depth (inches)	Rut length (feet)	Area extent
Wisconsin	6	NA	Minimize
Michigan • RMZ's • Skid trails	 6 12	 25 50	Minimize
British Columbia[1]	6	6.5	5% area, includes all soil disturbance types
Alberta[1] • Organic soil • Mineral soil	 8 4	 13 13	2% area, includes all soil disturbance types
Saskatchewan[1] • RMZ • General area	 5 6	 16 32	<1% of area
Quebec[1]	8	13	<20% of skid trails (assume 33% trails)
Ontario[2]	12	13	<10% of area
Forest Service[3] • Pacific NW • Southeast • Northeast	 6 6 12 18 12 18	 NA 50 10 Any length 10 Any length	15% of harvest area, includes all soil disturbance types
Forest Service handbook (severe)	4	6	<1% of area

[1] – from Van Rees, 2002
[2] – from Duckert et al. 2009.
[3] – from Cline et al. 2006

The rutting metric used by the DNR was largely developed by Mike Phillips based on an extensive review of metrics (including some of those listed above) used by other entities, local experience and knowledge of productivity and hydrologic impacts, and input from collaborators (DNR and UMN Forestry) and field personnel. The 6 inch depth and 300 foot length criteria is based on research conducted by Sandy Verry in wetlands (USFS Hydrologist, retired). Use of the 6 inch depth for uplands was likely chosen for simplicity even though the physical properties

of upland and wetland soil types are very different. It may be appropriate to define different depths for severe rutting in upland and wetland harvest areas if the committee recommends adopting the metric. Justification for the specific limits related to rut extent in the metric is not clear, but they are likely based on assumptions of rut width and its relation to total area impacted. If a metric is adopted, there will be a need for monitoring and research to evaluate and revise any proposed limits on depth and extent that are included.

Monitoring data for rutting

During the Site-level Committee scoping evaluation, one of the main reasons cited for examining creation of a rutting metric was that a partial metric was already being used by contractors during monitoring, and there was a desire to determine if this was appropriate. Given this, I have included information on the protocols developed by DNR for rutting assessment, and have also provided a summary of rutting data from monitoring reports to provide context for occurrence and severity.

Protocols: Contractors measure the area of ruts greater than 6 inches in depth for specific features within the harvest unit (e.g., crossings, road and trail segments, landings, etc.) and also provide an estimate for the general harvest area. Ruts less than 6 inches in depth are not recorded. For each feature, the area of ruts is divided by the total feature area (e.g., total crossing area) to estimate the percent of rutting associated with that specific feature. These percents are then grouped into the following ranges for reporting: none, <2%, 2<5%, 5<10%, 10<25%, >25%. Contractors also determine if rutting bisected a wetland or had a contiguous length greater than 300 feet.

Results: The amount (area) of rutting that occurs at a given harvest site is difficult to determine with existing protocols, but data has consistently shown that about half of the harvest sites have rutting present, and that rutting is most commonly found at crossings and non open water wetlands. If a metric was created or adopted, these would be good areas to focus on. In the 2009 monitoring assessment, approximately 30% of all crossings had some rutting (most on non open-water wetlands), and 7.5% had potential for severe hydrological impacts (rutting >300 feet or bisected wetland). In general, the severity of rutting when it was present increased relative to previous assessments (>40% of rutted areas had severe rutting), but more data is needed to determine if a trend of increasing severity is occurring.

Scraping/matting to improve regeneration in wetlands

The following discussion is designed to assess if it is appropriate to recommend greater disturbance (scraping/matting of moss layer) in non open water wetland crossings to promote regeneration. I have limited my assessment specifically to peatlands as the scoping comments focused on scraping or matting of moss to enhance regeneration, and the two studies cited in support of the suggestion were both conducted in black spruce peatlands in the boreal zone.

There have been a large number of studies that have assessed the suitability of various seedbed substrates for regenerating softwood species in peatlands (primarily Picea spp.). Groot and Adams (1994) (cited in scoping comments) found that germination of black spruce from direct seed was greatest on poorly decomposed Sphagnum peat because of its high water holding capacity, which they noted was abundant on peatland skid trails. Other studies have identified other forms of Sphagnum (living (moss), dead, disturbed, undisturbed) as most ideal for black spruce germination, so it is unclear exactly what substrate is best (Lavoie et al. 2005). Regardless, it is generally recognized that Sphagnum is a poor substrate for growth because nutrient availability is low (Groot and Adams 1994; Lavoie et al. 2005), leading to lower growth rates of seedlings relative to other substrates such as Feather moss (Lavoie et al. 2006).

If matting or scraping of the moss layer is needed for seed germination of certain tree species in peatlands (or any other ecosystem), including a recommendation to address this need is probably outside the scope of the site-level guidelines. The decision to conduct site preparation activities is a silvicultural one, and the Council has historically avoided making silviculture recommendations within the guidelines. Foresters and managers are capable of determining when these practices (or others such as scarification) may be appropriate for regeneration of target species, and a uniform recommendation may hinder their ability to implement site-specific prescriptions. For example, a uniform recommendation to increase surface disturbance in crossings could be detrimental to regeneration by vegetative propagation (e.g., suckering, stump sprouts) because root wounding would likely increase. If a recommendation was made to increase scraping or matting of the soil surface in crossings for regeneration, it should be specific to peatland sites where germination from seed was the planned method of regeneration.

A related scoping comment suggested that we include pictures within the guidebook that differentiate between rutting and other types of soil disturbance (compressing or matting of moss layer, scarification). Since “pictures are worth a thousand words”, including some could be useful for users of the guidelines to differentiate between soil disturbance types and clarify what constitutes a rut. Pictures could be relatively easily incorporated into the field guide if warranted.

Existing regulations and certification standards

The Wetland Conservation Act requires limiting impacts to the hydrological and biological characteristics of wetlands to order to qualify for the silvicultural exemption (General section of guidebook, pg. 22). Identification of some upper threshold in a metric that would be applicable to wetland crossings may conflict with the legislation because it would implicitly identify acceptable levels which would not minimize impacts.

The certification organizations FSC and SFI have different standards for protection, monitoring and assessment of impacts related to rutting, but neither is very specific in their

recommendations and guidance. However, both certification standards contain some language related to quantification of impacts or acceptable practices (in bold).

FSC

Indicator 6.5.a The forest owner or manager has written guidelines outlining conformance with the Indicators of this Criterion. **Guidance: the guidelines should be measurable where appropriate.**

Indicator 6.5.c Management activities including site preparation, harvest prescriptions, techniques, timing, and equipment are selected and used to protect soil and water resources and to avoid erosion, landslides, and significant soil disturbance. Actions addressed include:

- disturbance of topsoil is limited to the minimum necessary to achieve successful regeneration of species native to the site.
- Rutting and compaction is minimized.

Indicator 8.2.d.1 Monitoring is conducted to ensure that site specific plans and operations are properly implemented, **environmental impacts of site disturbing operations are minimized**, and that harvest prescriptions and guidelines are effective.

SFI

Performance Measure 2.3. *Program Participants* shall implement forest management practices to protect and maintain forest and soil *productivity*.

Indicators related to rutting:
2. Process to identify soils vulnerable to compaction, and use of appropriate methods to avoid excessive soil disturbance.
4. Post-harvest conditions conducive to maintaining site *productivity* (e.g. limited rutting, retained down woody debris, *minimized skid trails*).
6. **Criteria that address harvesting and site preparation to protect soil *productivity***.

Literature

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