



## Careful Logging Practices – Part III Physical Site Damage

This is the third and final article in a series looking at the merits of implementing careful logging techniques while carrying out management activities in your woodlot. In this final chapter we will look at physical site damage, and discuss why it needs to be addressed in your logging plan.

Site damage can occur on any logging operation if the proper advance planning and the forest operations conducted in your woodlot are not properly implemented. If the damage is severe, the impact can negatively affect the long-term health of your woodlot. It will lower its overall

productivity and will greatly reduce your ability to manage your woodlot in a sustainable manner from both an environmental and financial perspective.



Figure 1: Rutting damage caused by skidding through a low wet area.

Typically, physical site damage can appear in a number of forms, and this article will focus on the three main types of damage that could occur in smaller woodlot operations.

1. *Rutting and compaction* (deep furrows or trenches) resulting from the use of heavy equipment such as a skidder in moisture-saturated soils;
2. The *erosion of soils* as the result of being exposed to the elements of wind and water; and
3. The *loss of productive forest* (long-term or permanent) through the construction of roads, landings and major skid trails.

### Rutting and Compaction

How does rutting and compaction occur? It occurs when the ground pressure exerted by repeated equipment use gradually breaks down and exceeds the load-bearing capacity of the soils. It is a simple matter of mechanics – the soil structure is not strong enough to hold the weight of the equipment, causing it to break through the surface and forming ruts.

Normally finer-textured soils (loams, silts and clays) are more susceptible to damage than coarser-textured soils (coarse sands and loamy sands). In turn, organic and peat-type soils are inherently more susceptible to rutting damage than mineral soils.

It is important to note that the long-term moisture conditions of the soil (moisture regime) are less a factor in causing rutting than the immediate moisture content of the uppermost layer of the ground. As a rule, the severity of rutting and compaction is normally directly related to the moisture content of the soil at the time of conducting the logging activities. For example, a woodlot is more susceptible to rutting in the early spring just after the frost leaves the ground or during the cool wet conditions that are commonly found in late September or November. Other factors that can influence rutting are the depth and type of litter and organic material covering the forest floor. Generally, the coarser the material and the deeper the litter layer, the higher the load capacity at the site.

Rutting damage can have an accumulated impact on your woodlot. It can result in the severing of the roots of the residual trees and can also lead to an increase in the incidence of stem wounding. This occurs because of poor machine maneuverability and the tendency to frequently establish new trails. As discussed in part one of this series, when major logging damage occurs there is a fifty-fifty chance that the tree affected will die before the next cutting cycle. At the very least, rot and decay will occur, reducing the quality and growth of the affected tree, resulting in lower financial returns.

### **Best Practices**

*Timing and scheduling of operations* – woodlot owners and loggers need to recognize that some sites are more sensitive to compaction and rutting. In these cases, timing is the key element. These sites need to be operated in during the driest times of the year, or during winter when there is adequate frost in the ground.

*Trail layout* - In partial harvest operations, confine skidding to a set network of trails. A recommended standard<sup>1</sup> for the amount of skid trail coverage for a logging operation is as follows – a minimum of 80 percent of the ground area in a selection harvest, and a minimum of 70 percent of the ground area in a shelterwood harvest, is to be free of skid trails.

*Recommended guidelines* – Table #1 provides guidelines developed by the Algonquin Forest Authority and is recommended practice<sup>1</sup> for partial-cut systems in the Great Lakes-St. Lawrence forest region. They have been successfully implemented in numerous harvesting operations carried out in central Ontario.

### **Erosion of Soils**

Surface erosion will occur when your logging operations expose mineral soils to the natural elements of water and wind. It can be caused through road and water crossing construction, skidding activities or from site preparation operations used to ready a site for planting. The likelihood for it to occur and its severity are directly related to three main factors – the steepness of the slope, the length and size of the exposed area and the texture of the soils exposed (e.g. silt soils are more susceptible to erosion).

Soil erosion can result in reducing the productivity of your woodlot through the loss of the nutrient-rich upper layers of the soil. Soils moved off-site can also be detrimental to other values within the woodlot. For example, poor road construction techniques may result in depositing soil particles and nutrients into a nearby stream, adversely impacting its water quality and fish habitat.

### Best Practices

*Mitigation techniques* – the use of water bars on slopes can be an effective way to minimize potential erosion problems. Water bars can be easily constructed to filter runoff and to divert water into vegetated areas at the side of the road or trail. Figure #2 shows how tightly packed stacked bales of straw can be used as a water bar. Other techniques used to minimize erosion include filling the ruts with logging slash or debris and ensuring prompt regeneration (e.g. seeding of grass cover) of exposed slopes.

<b>Table #1 - Site Impact Guidelines</b>			
<b>Side Trail Category</b>	<b>Maximum Distance of Compaction Per Skid Trail</b>	<b>Maximum Distance of Compaction Per Landing</b>	<b>Operation Status</b>
<b>Minor</b> – 15 cm or less compaction	Can be maintained over the length of the trail	Can be maintained over the entire system of main skid trails.	None
<b>Moderate</b> – 16 cm to 30 cm of compaction	Can be maintained over the length of the trail	Can be maintained over the entire system of main skid trails.	None
<b>Major</b> – 31 cm to 60 cm of compaction	120 m	480 m	If the maximum distance is greater than 120 m, cease operations on an individual trail. This may include up to 30 m of extreme compaction for an individual trail.  If maximum distance is greater than 480 m, cease operations on the landing. This may include up to 120 m of extreme compaction for a landing.
<b>Extreme</b> – compaction greater than 61 cm	30 m	120 m	If maximum distance is greater than 30 m, cease operations on an individual trail.  If maximum distance is greater than 120 m, cease operations on the landing.
<sup>1</sup> Source: A Silvicultural Guide for the Tolerant Hardwood Forest in Ontario (1998), Ontario Ministry of Natural Resources			

Maintain adequate buffer areas adjacent to riparian areas. On longer, steeper slopes extend the width of the buffer area to the top of the slope. If operations are to occur inside these areas, implement appropriate measures to ensure rutting, compaction and erosion do not occur in these sensitive areas.

*Timing of operations* – on high-risk sites you may want to consider the use of winter operations. This will minimize ground disturbance (mineral soil exposure) and will also limit the impact of rutting and compaction on the site. Select the type and size of equipment to be used in the operation carefully. In some situations, using horse logging or a smaller skidder may be more appropriate for the site.

*Planning* – slopes exceeding 10 percent are very sensitive to erosion, and it is important to carefully select the location of your skid trails. On steeper slopes, repeated use of the same skid trail should be avoided, and timber should be removed from these steeper slopes by using extra-long cables. When safe operating conditions exist, skid trails and equipment should operate parallel to the contours.

## **Loss of Productive Forest**

The construction of roads, landings and skid trails is a normal part of carrying out a harvesting operation. However, keep in mind with every foot of road or landing constructed you lose a portion of the productive capacity of your woodlot.

Careful planning and implementation are required to minimize the area affected by these activities. Through advance planning, financial savings can be realized over the short term (i.e. fewer roads mean lower construction costs) and long term (i.e. minimizing the loss of productive forest will maximize future woodlot productivity). A good rule of thumb that is currently being used by the forest industry in south central Ontario has no more than two to three percent of the total forested area being lost due to road and landing construction. In smaller and more accessible woodlots, the loss should be considerably less.

## **Best Practices**

*Advance planning* – maximize the use of existing roads, trails and landings from previous harvesting operations. If you are planning new roads – think long term. The road you build today will still be there in 50 years. If new construction is required, invest some time walking your woodlot to ensure you have selected the best location. Schedule construction for the driest time of the season, keep the width of the road right-of-way to a minimum and ensure drainage is maintained through the proper placement of culverts and ditches.

Where possible, build landings in non-productive areas (barren rock) or outside of the woodlot (e.g. adjacent open fields). Maximize landing space by piling roadside wood as high as safety permits. Consideration should be given to regenerating landings that will not be used in future operations.

## **A Final Word**

Whether it is bark abrasion resulting from poor felling and skidding techniques, or rutting as a result of spring harvesting operations, logging damage is preventable. A well-planned logging operation will help mitigate these potential problems. Consult with your logging contractor and take the time to prepare a logging plan before you start logging in your woodlot. This will help protect your investment and ensure your logging operations will leave a smaller footprint in your woodlot.

## **Recommended Reading**

For a more comprehensive look at the adverse effects and a discussion on best management practices to minimize physical site damage in your woodlot, you may want to read *Forest Management Guidelines for the Protection of the Physical Environment* (Publication ISBN 0-7778-6183-6). Included in this publication are a series of technical fact sheets covering compaction and rutting, erosion, nutrient loss, loss of productive land and hydrological impacts. A copy of this guide is available from the Ministry of Natural Resources Information Centre by calling 1-800-667-1940. The cost of the guide is \$15.00 (plus shipping and taxes).

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