A Landowner's Guide to Careful Logging

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1.0 Introduction

Woodlot owners *harvest* trees for many reasons: to generate income; produce lumber or firewood for their own use; create recreational trails for skiing, snowmobiling or hunting; improve wildlife habitat; or just to maintain the health of their forest. Whether any of these reasons apply to you, one thing woodlot owners have in common is a strong desire to do what is right for their land — that's why the Ontario Woodlot Association created ***A Landowner's Guide to Careful Logging***.

Most woodlot owners are not forestry or logging experts, yet they are often involved in harvesting activities. This guide offers a clear, practical overview of careful logging practices, or CLPs, both for the novice and professional logger. However, it is not intended to be a definitive logging manual.

The choice of *silvicultural system* (e.g., harvest and regeneration) depends on characteristics unique to each woodlot. This decision is influenced by factors such as *stand* and site conditions, forest health, management objectives, markets, wood-processing requirements and the size and intensity of a harvesting operation. The breadth and range of these factors means that this CLP guide cannot answer all of your questions and that a number of silvicultural systems (*selection cutting*, *shelterwood cutting* or *clear-cutting*) may be appropriate for logging operations in southern Ontario.

A Landowner's Guide to Careful Logging provides landowners with sound advice as they make decisions to protect the health and integrity of their woodlots, while maximizing financial returns. It also identifies some of the relevant federal and provincial legislation, as well as regulations and municipal bylaws applicable to logging on private land.

Look for these symbols for special alerts, information and tips

How to use this guide

Throughout the guide, there are "Stop Signs" that alert the reader to potential legal requirements, "Caution Signs" that point out important information that should not be overlooked and "Tips" to identify elements that may warrant further consideration.

Italicized words are defined in the **Glossary of Terms**. The appendices provide additional information under the titles of **Legislation and Regulation** (Appendix 1), **Sources of Information and Assistance** (Appendix 2) and **Logging Damage Guidelines** (Appendix 3).

What are careful logging practices?

Careful logging practices (CLPs) include a range of techniques and practices used by landowners and loggers to minimize damage to the forest, soil, wildlife habitat and water. Examples of CLPs include *directional felling* of trees, *erosion* control measures on *skid trails*, tree protection for wildlife and the establishment of *buffers* near water.

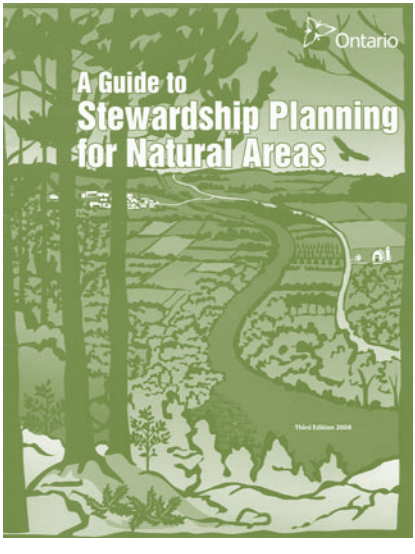
When properly implemented, CLPs benefit the woodlot by:

- protecting and/or maintaining forest health and productivity by reducing site impacts and logging damage to *residual trees* and other vegetation;
- protecting and/or maintaining other forest values and features such as wildlife habitat, *streams*, *woodland pools* and *wetlands*; and
- maintaining the ecological functions of the woodlot.

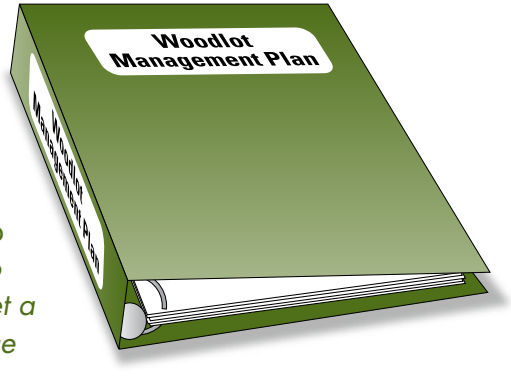
2.0 Planning for Harvest Operations

This section describes two distinct kinds of woodlot planning. A woodlot management plan is a long-term, strategic document, which includes a detailed inventory of the woodlot, the landowner's objectives and a series of activities that will help to achieve these objectives over time. A harvest plan is a one-time, technical document, written to plan a specific operation on the property, and ensures that harvest activities are well-thought-out prior to implementation.

Woodlot management plan



All woodlot owners should create, implement and maintain a woodlot management plan. A properly prepared and implemented plan will help woodlot owners to maximize the ecological and economic benefits obtained from their forest property.



Information on preparing a woodlot management plan can be found in A Guide to Stewardship Planning for Natural Areas. *Refer to Appendix 2 to find out where to get a copy of the guide and for assistance in preparing a plan.*

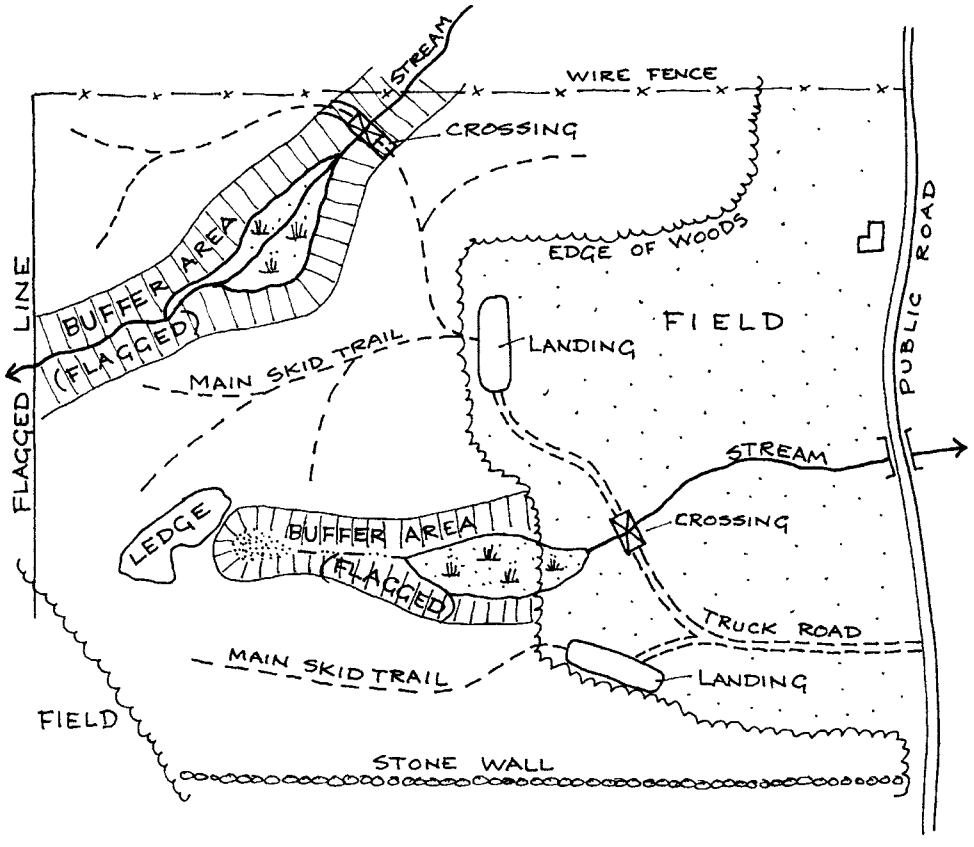
The content of the management plan will vary according to ownership objectives, woodlot characteristics and the financial resources available for the preparation of the plan.

As a minimum, the management plan should contain the following:

- a property and forest stand map;
- a description of the woodlot (including legal description) and its history;
- a statement of the woodlot owner's management objectives;
- information on the type, location and quality of resources in the woodlot (e.g., forest inventory, wildlife habitat, significant features); and
- a schedule of activities that are planned to take place, typically for a five- to ten-year period.

Harvest planning

Harvesting and other forest management operations (e.g., *tree marking* or thinning) that are to be implemented in the woodlot, are outlined in the schedule of activities section of the woodlot management plan. A second document, the harvest plan, provides much greater detail about these operations. A harvest plan should ensure that operations are appropriate for the individual woodlot and are carried out according to the landowner's objectives, relevant legislation, principles of good forestry practices and recommended careful logging practices.



Proper planning for harvesting and the layout of roads, trails and landings will protect woodlot values and improve the financial bottom line of the logging operation.

TIP

Engaging a reputable consultant and/or logger can help ensure that logging operations are conducted in accordance with good forestry practices and that other values in the woodlot are protected and/or maintained.

Landowners should be aware that some forestry consultants work independently, while others are employed by the forest industry. When hiring a forestry consultant, landowners should seek out a member of the Ontario Professional Foresters Association to ensure that professional standards are met.

Before you start harvest planning, you need to evaluate your role in these activities. Landowners possess a wide variety of skills and knowledge and have different interests and expectations of their role in forestry operations.

Landowners who have been trained in forestry or logging may choose to carry out operations on their own. Others may choose to seek out the services of a well-trained and conscientious forest consultant and/or logger to assist them with this process. This decision should be made before you begin harvest planning.

Hiring a consultant

Local forestry consultants can assist landowners in all aspects of woodlot management and planning. Consultants can provide expert advice, independent of the logging contractor. In many instances, forestry consultants will offer a range of services associated with logging, such as timber sales negotiation, timber valuation, operations planning, tree marking, road and trail layout and supervision and/or monitoring of operations. They will also have knowledge of legislation and local forest conservation bylaws that may affect your harvest activities, as well as insight into local markets and familiarity with local loggers.

Professional forestry consultants can help you achieve your forest management goals and ensure that the forestry practices used in your woodlot will enhance its future condition and value. The Ontario Professional Foresters Association (OPFA) is responsible for the regulation of the practice of forestry in Ontario. A list of OPFA members who provide consulting services is available on the OPFA website www.opfa.ca.

In addition, a listing of forestry consultants and loggers is also available at the Ontario Woodlot Association's Forest Services Directory website www.ontariowoodlot.com.

Guidelines for hiring consultants are similar to those applicable to hiring loggers and are outlined in the section below.

Hiring a logger

Many landowners decide to harvest their woodlands on their own. Logging is physically demanding work that can be dangerous. It requires experience and care to ensure safe operations and to avoid damaging the woodlot. Carefully consider all aspects of the harvest operation, including your knowledge and skill level, time and available resources (money and equipment). You should also look at your stand management objectives and the value of your timber when considering whether to log the woodlot yourself, sell standing timber or contract logging services.

A key step in maximizing future financial returns from the woodlot is to minimize the damage to residual trees. When harvesting timber, there is no substitute for a well-trained and conscientious operator.

Remember, when selling timber, you are entering a buyer/seller relationship. The logger is buying raw material and reselling it. Like anyone in business, the logger needs to buy low and sell high to make a profit. Know the value of your timber. If necessary, hire a qualified consultant to provide an independent appraisal. Always obtain more than one bid to ensure that you get a fair price. Also, be sure to consider the following when hiring or contracting for logging services:

CAUTION

If you decide to cut timber yourself, it's important that you understand the potential hazards associated with logging. Be sure to maintain your equipment properly, wear safety gear, carry a first aid kit, and most important of all, conduct work safely. It is strongly recommended that you never work alone. Also, be sure that family members (or others) know where you are working.

TIP

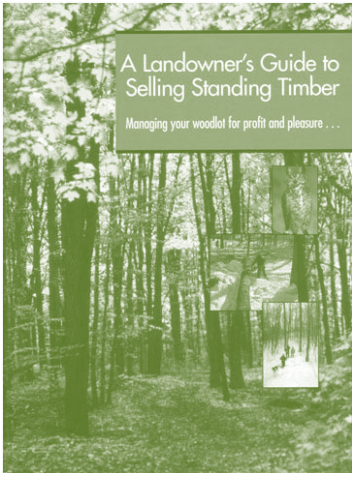
Operator skill and care is one of the most important determinants in the amount and severity of stand and site damage from harvesting.

- The suitability of logging equipment to the woodlot site and stand characteristics.
- The level of on-site supervision during operations.
- The experience of the contractor (i.e., the number of years of experience harvesting in similar forest types).
- Are all forest workers trained and certified under the *Cutter-Skidder Operator Program*?
- Are portions of the operation subcontracted, and if so, are the subcontractors qualified, supervised and insured?

Logging is dangerous, physically demanding work that requires experience and care to ensure safe operations and to avoid damaging the woodlot.

The following guidelines are applicable whether you sell standing timber or contract a logger to harvest your woodlot:

- Ask for and check references. When possible, visit woodlots harvested by the contractor.
- Use a legally binding contract. A contract that contains terms and conditions consistent with the objectives of your management plan will protect both your financial interests and your investment in forest management. See ***A Landowner's Guide to Selling Standing Timber*** or contact the Ontario Woodlot Association for a sample contract.
- Ensure that all forest workers are trained (certified) and that the contractor has sufficient general liability insurance and a valid Workplace Safety Insurance Board (WSIB) *clearance certificate*. Obtain a WSIB clearance certificate for confirmation that the contractor is registered and has met their obligations.
- Insist that safety equipment be worn at all times and that a first aid kit and a *spill kit* are on site.
- Meet with the contractor on site, prior to operations, to discuss the harvest and clarify any misunderstandings or misconceptions.
- Hire a consultant to conduct the timber sale and monitor the logging operation, or monitor the operation yourself on a regular basis.



When selling standing timber, get more than one bid to ensure that you receive a fair price. A Landowner's Guide to Selling Standing Timber *(Ontario Woodlot Association) provides additional tips on selling standing timber, including a sample timber-sale contract.*

Developing a harvest plan

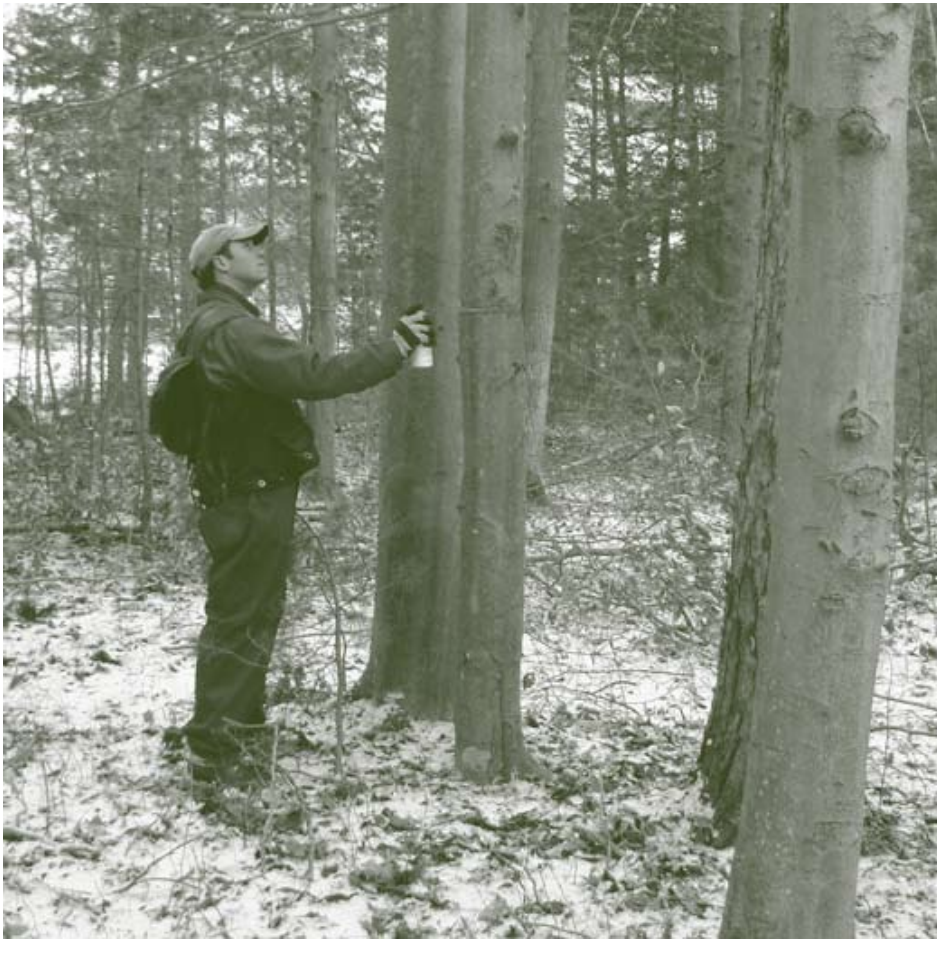
The harvest plan will cover six critical elements, which are described in the following sections:

1) Stand *prescriptions* and tree marking;
2) Boundary marking;
3) Protection measures for sensitive features and sites;
4) Planning access roads;
5) Harvest timing; and
6) Logging equipment.

At the onset of harvest planning, it is critically important to walk the woodlot. This on-the-ground assessment of the woodlot is used to develop all aspects of the harvest plan. It is recommended that this field assessment take place in spring or early winter when visibility in the woodlot is best.

During the reconnaissance, take note of any sensitive features and sites (e.g., stick nests or shallow soils) and physical characteristics that may affect logging operations or other forest management activities (e.g., steep *slopes* or rock outcrops). Mark these sites on a sketch map for use when preparing your harvest plan.

Be sure to provide a copy of the harvest plan and sketch map, and discuss these documents with your consultant and/or logging contractor before logging begins.



Tree marking involves the careful selection of trees for harvest. The tree marker must assess each individual tree and give consideration to a number of variables (e.g., regeneration, tree health, site conditions, wildlife habitat, diversity and the overall objectives of forest management) before a final decision is made whether to leave the tree or mark it to be cut.

Lists of qualified tree markers are usually available through resource agencies (see Appendix 2).

1) Stand prescriptions and tree marking

Woodlots managed under selection or shelterwood harvest systems should be marked in accordance to a stand prescription prepared by a member of the Ontario Professional Foresters Association.

The stand prescription is a key document that provides guidance to tree markers about the number of trees to cut or retain (e.g., species or quality) for the future timber crop or for regeneration, as well as information about site protection and wildlife habitat. Tree marking must meet the intent of the stand prescription if management plan objectives are to be realized.

The decisions made during tree marking will directly influence the long-term economic and ecological integrity of your woodlot. Because of this, tree marking should be done by *certified tree markers*.

Contact your local municipality if you are working next to an unopened road allowance.

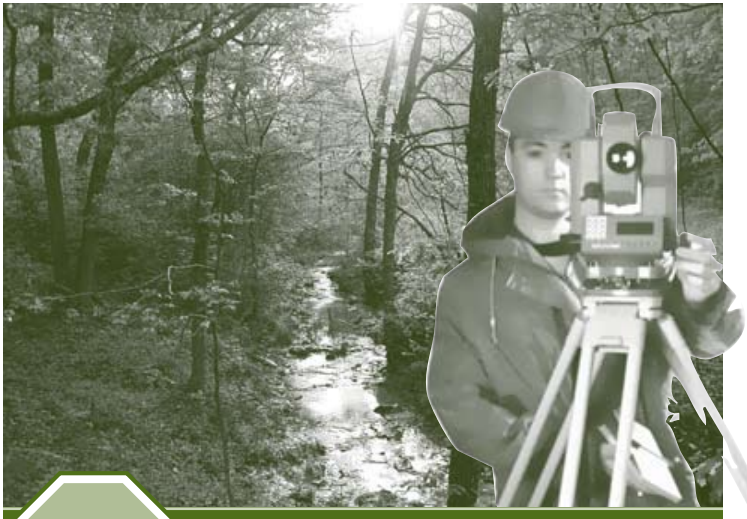
2) Boundary marking

Before starting operations, clearly mark all harvest boundaries with red paint. Place these markings where harvest operations are planned near property lines and to identify internal harvest boundaries — areas of your property not included in the harvest. Use evidence such as survey markers, *blazes* and/or fences to assist with the identification of property boundary lines.

Care should be taken when marking near unopened road allowances to avoid penalties arising from *cut trespasses*.

Natural boundaries, such as water and associated buffers, open fields or changes in forest cover, make excellent natural locations for internal harvest boundaries. Ensure all boundary marks are readily visible from all directions. Well-

marked boundary lines and a good map will help to avoid cut trespasses and/or other property damage.



STOP

The ***Forestry Act*** requires mutual consent of both owners when harvesting boundary trees.

STOP

Only a **licensed Ontario Land Surveyor** can identify a property boundary.

TIP

Inform adjacent property owners of your logging plans and cooperatively locate and mark property lines.

3) Protection measures for sensitive features and sites

The harvest plan should identify, map and provide prescriptions (direction) for stand management. It should also protect sensitive features and sites, such as stick nests and shallow soils in the woodlot. Mark the boundaries of any buffer zones prior to harvesting and ensure that they are visible from all directions. Confirm that all forest workers are aware of the sensitive features and sites in the woodlot and of the management requirements for the protection of these areas. Monitor operations on a regular schedule to ensure that marked features are not damaged.

4) Planning access roads

There are a number of factors to consider when planning forest access. First, consider whether access road construction is absolutely necessary. Instead of constructing a new road, use adjacent fields, existing trails or other forest openings. This will save money and reduce the risk of site damage or disturbance.

When determining the type and length of road to be constructed, consider factors such as the value of timber to be harvested relative to road construction costs, the duration and season of the cut, haul truck and logging equipment requirements, safety, road maintenance costs and any water and wetland crossing requirements. Remember, well-planned road networks can be used for future logging operations and for other activities in the woodlot, such as trail riding and cross-country skiing.

Identify on the sketch map the preliminary locations of any roads, skid trails and *landings* associated with the harvest to assist in operations planning. Be sure to consider the locations of landings, roads and skid trails for future logging or other forest management activities.

For more information on planning and constructing access roads, refer to Section 5.

5) Harvest timing

Choosing the right time of year to harvest can help to minimize stand and site damage. Logging operations can also be timed to promote natural regeneration (by timing cuts with good seed crops or exposing mineral soil) or to enable landowners/contractors to take advantage of good market conditions for certain species or forest products.

Winter cutting can give excellent results. With frozen or snow-covered soil, there are fewer access limitations in wet areas, and *rutting* and soil compaction is minimized. Visibility during operations is also increased by the absence of leaves. This provides for safer operations when felling and *skidding*. However, cutting in winter is not without challenges, such as the potential for increased snow-plowing costs and poor working conditions in deep snow. Carefully weigh these factors when determining the best time to harvest.

Depending on ground and forest conditions, logging should generally be avoided from early spring to late July. This avoids the potential for site damage (due to wet soils) and disruption of breeding activities of birds and other wildlife. The risk of bark damage to residual trees from felling and skidding abrasions is also reduced; tree bark is highly susceptible to wounding during periods when trees are actively growing.

For information on careful logging practices for skidding and harvest operations, refer to Section 7 and Section 8.

CAUTION

Wet, low-forested areas should be harvested when the ground is frozen or during dry periods.

TIP

Equipment choices also affect other operational considerations (such as the width of a road's right-of-way) and construction costs.

6) Logging equipment

It is very important to carefully match your choice of logging equipment with the characteristics of the woodlot and the objectives in your management plan.

Although it is the skill of the operator (and the care that they take) that ultimately determines the condition of the forest after logging, the appropriate equipment should be used for the volume of wood to be harvested. Smaller equipment generally leaves less of a footprint in the woodlot. However, while small equipment may be lighter and more maneuverable, it often requires significantly more trips to remove a given volume of wood than larger equipment does. This repeated travel may result in compacted soils, excessive rutting, *basal scarring* to trees and root damage.

3.0 Stream Crossings

Special care is required when planning, constructing and abandoning stream crossings. This ensures safe operations, controls costs, and protects water quality and the aquatic environment.

Planning stream crossings

When planning stream crossings, try to minimize the number and length of the crossings. This strategy will reduce costs and will minimize the risk for negative environmental impacts on water quality.

Locate potential crossing sites during the field reconnaissance to lay out the road and trail network. Always investigate a number of potential crossing locations to ensure that the best possible site is selected.

When searching out potential crossing sites, look for areas where the stream has a narrow and relatively straight channel, a hard bottom and level or gently sloping banks.

Types of crossings

Stream-crossing structures may be temporary or permanent. Temporary crossings that are used for a limited time reduce the environmental impacts associated with the construction, use and maintenance of a permanent crossing. Permanent crossings are constructed when long-term access is required.

The most common types of crossing structures are *culverts*, bridges and *fords*. The type of structure installed is determined by factors like stream size, *peak water flow*, stream bed material, requirements for fish movement, other aquatic habitat requirements, safety requirements and cost.

Stream crossings must be in compliance with the federal ***Fisheries Act*** and the ***Conservation Authorities Act***. The *Fisheries Act* makes it illegal to harmfully alter, disrupt or destroy fish habitat. Before starting any crossing, contact your local conservation authority (CA) or the Ontario Ministry of Naturl Resources (OMNR) office (if there is no local CA) for advice and permits.

TIP

Talk to a local forestry consultant or CA for assistance in determining the type of crossing or structure that is most appropriate to your circumstances.

Crossing structures

Of all forest management activities, the installation, use and removal of water and wetland crossings have the greatest potential to impact water quality. Specific guidance on locating and constructing water crossings is provided in the sections below.

Rip rap or cobbles are larger stones used to stabilize culverts and prevent water from undercutting the culvert.

Careful logging practices for locating and constructing stream crossings

Regardless of the type of crossing or structure used, adopt the following procedures:

- Locate crossings where the soil is stable and not easily eroded.

- Keep the crossing as short as possible, while ensuring suitable abutment on each stream bank.
- Install the crossing at a right angle to the stream channel.
- Do not obstruct water flow or fish movement during the construction.
- Construct road approaches to crossing structures using fill instead of *grubbing* to minimize the potential for erosion. Ensure that the "no-grub zone" is at least the width of the riparian buffer zone (see Section 4). Keep the approaches straight, level or gently sloping. Reduce erosion or sedimentation by applying crushed rock or gravel to the approach.
- Grade any exposed soil to a stable angle and protect it from erosion by seeding and/or applying mulch.
- Use *water bars,* dips, cross drains or other diversion structures to reduce erosion near the crossing site. (See the sections below for guidelines on installing and removing these structures.)
- Do not operate equipment in the stream during crossing installation or removal.
- Inspect crossings periodically for structural safety. Ensure that fish passage and water flow are not obstructed by blockages.
- Avoid construction work during wet weather or when the soil is saturated.
- Use *rip rap* to stabilize culverts and prevent undercutting and erosion.

Fords are the least expensive type of stream crossing. They should only be used during periods of low water flow and where the stream bed is comprised of stable material (i.e., rock or gravel).

Fords

A ford is the most basic and least expensive type of stream crossing. A ford uses the stream bed as part of the road or access trail.

CLPs for locating and using fords

Adopt the following careful logging practices:

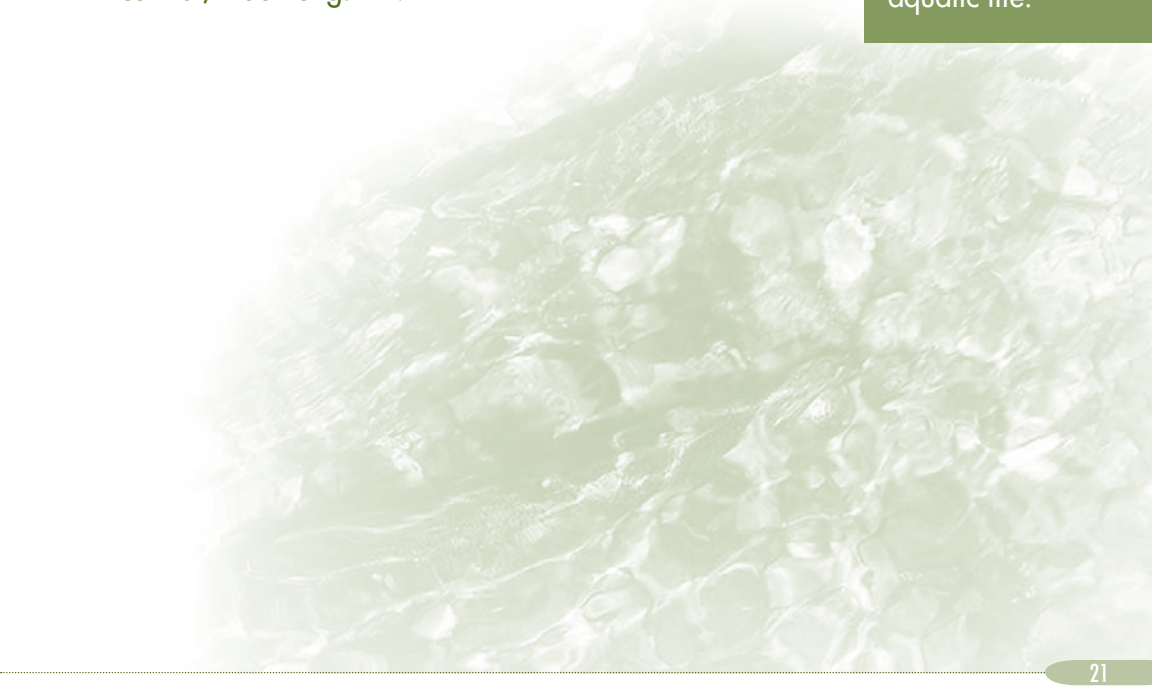
- Locate ford crossings only where stream banks are low and gently sloping and where the stream bed is comprised of stable material (i.e., gravel or rock), with good load-bearing capacity.
- Fish spawning beds often occur at or near good ford crossings sites. Do not ford streams at these locations.

- Where the stream bed is less stable, use rocks, logs or man-made materials (e.g., rubber mats) to support equipment.
- Construct and use fords only during periods of low water flow (i.e., when the water is less than 0.3 m deep).
- Keep equipment (that will use the ford) clean and well maintained.
- Protect approaches to the ford with clean gravel, *brush mats* or other temporary surfacing materials to minimize the amount of mud and debris, which may be dragged into the water by the equipment.
- When abandoning the ford, ensure that all material used to stabilize the stream bed is removed from the water.

Additional information and guidelines for ford crossings are available on the Department of Fisheries and Oceans (DFO) website http://www.dfo-mpo.gc.ca/regions/central/index-eng.htm.

CAUTION

Obtain advice from your local CA before placing any materials in a stream. Make sure that materials are clean, will not erode and are non-toxic to aquatic life.



Bridges

Bridges may be temporary or permanent. The cost of installation and maintenance is directly related to the length of time the structure will be used, the span it crosses and the load it is intended to carry.

Using a bridge is the most effective means to protect water quality. Bridges span the water, reducing the potential for sedimentation during construction, maintenance and abandonment.

CAUTION

All bridge designs (portable and permanent), including abutments, need to be approved by a professional engineer.

Portable bridges are becoming increasingly popular with landowners and loggers as they offer several cost advantages. While initially more expensive than other crossing structures, portable bridges can be reused and are easier to install than traditional structures.

CLPs for installing bridges

The following careful logging practices are recommended for installing bridges:

- Set bridge abutments well back from the edge of the stream.
- Construct the bridge higher than the approaching road or trail to prevent surface runoff from draining onto the crossing structure.
- Use solid decking to prevent debris from falling through the deck into the watercourse.
- Where there is a risk of flooding, anchor temporary bridge structures.

Culverts

Culverts can be installed as either temporary or permanent structures to cross a permanent or *intermittent stream*.

CLPs for installing culverts

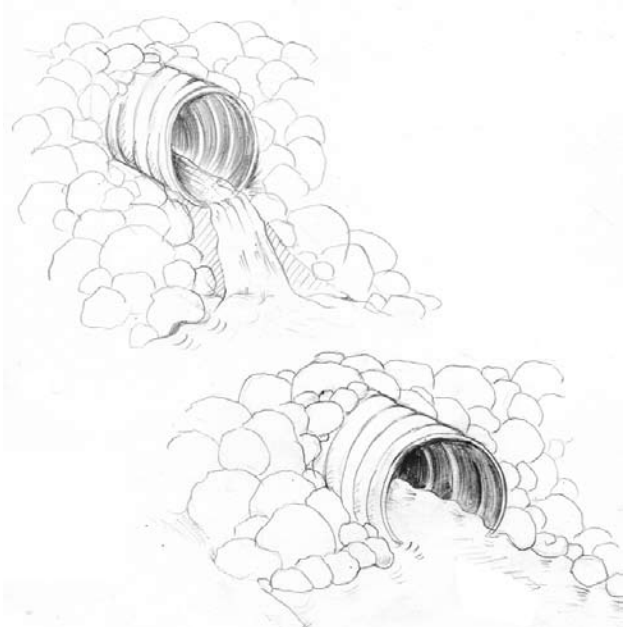
Use the following careful logging practices to protect water quality when installing culverts:

- Size the culvert to handle peak water flow. Seek the advice of a forestry consultant to assist you in determining the appropriate culvert size.
- Install the culvert during a period of low water flow. This will reduce the impact on water quality and the potential for disrupting fish movement during culvert installation.
- Ensure that any fill material used does not extend beyond the end of the culvert.
- Install the culvert on compacted granular material. Ensure that at least ten percent of the pipe diameter of the

The same regulatory requirements that apply to the installation of a water crossing may apply to its removal (including the removal of a temporary crossing).

culvert is below the natural stream bed. This will facilitate the movement of fish through the pipe.

- Use rip rap around the culvert inlet to prevent water from eroding and undercutting the pipe.



Culverts must be set into the stream bed (bottom illustration) to provide fish passage and reduce environmental damage.

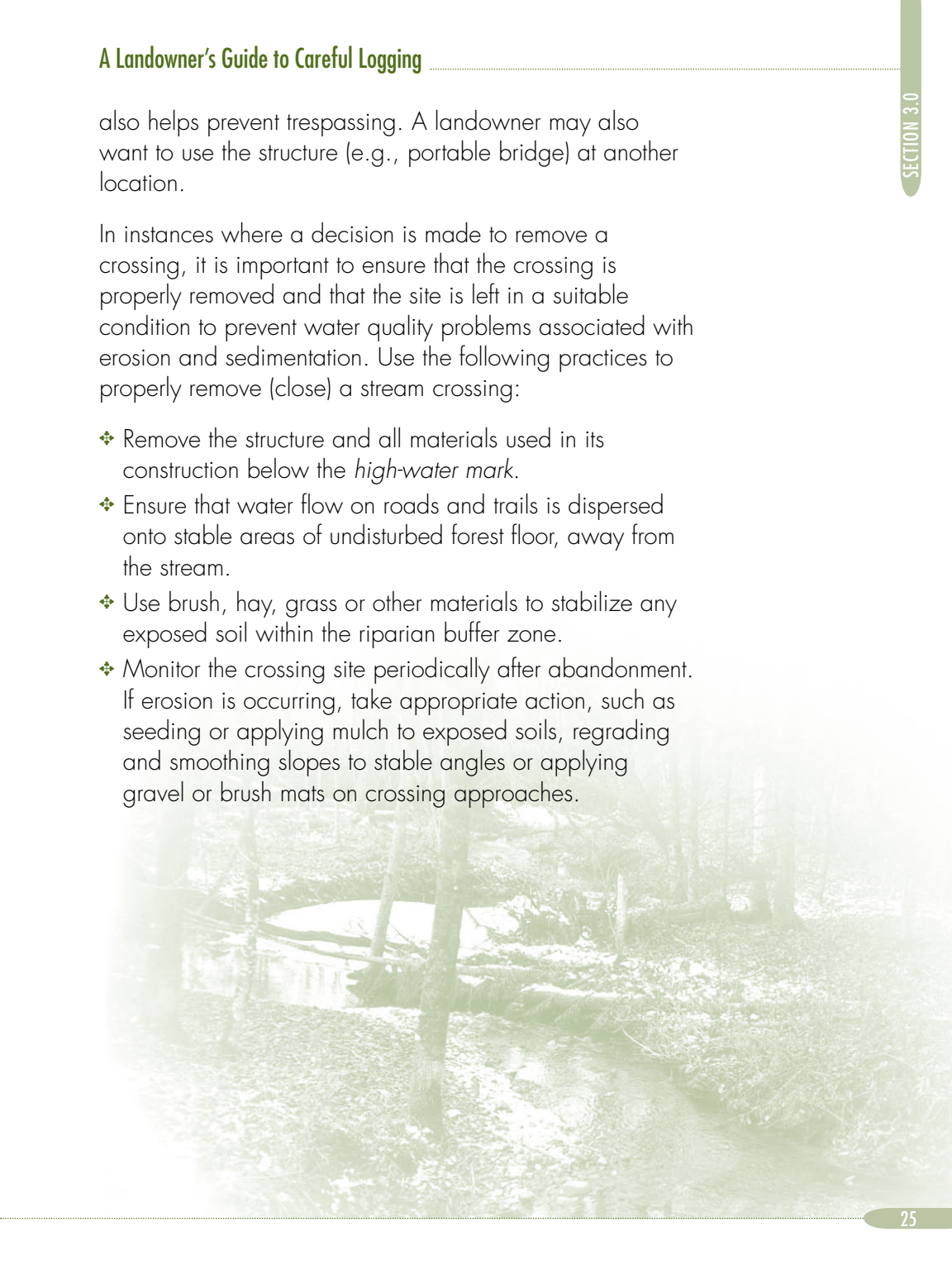
CLPs for abandoning a crossing

Landowners may wish to maintain water crossings permanently to facilitate recreational activities or future forest management operations in the woodlot. In other circumstances, it may be advisable to remove the crossing to prevent possible negative environmental impacts, arising from the degradation of the crossing. Removing a crossing

also helps prevent trespassing. A landowner may also want to use the structure (e.g., portable bridge) at another location.

In instances where a decision is made to remove a crossing, it is important to ensure that the crossing is properly removed and that the site is left in a suitable condition to prevent water quality problems associated with erosion and sedimentation. Use the following practices to properly remove (close) a stream crossing:

- Remove the structure and all materials used in its construction below the *high-water mark*.
- Ensure that water flow on roads and trails is dispersed onto stable areas of undisturbed forest floor, away from the stream.
- Use brush, hay, grass or other materials to stabilize any exposed soil within the riparian buffer zone.
- Monitor the crossing site periodically after abandonment. If erosion is occurring, take appropriate action, such as seeding or applying mulch to exposed soils, regrading and smoothing slopes to stable angles or applying gravel or brush mats on crossing approaches.



4.0 Working Around Water

In this guide, "water" includes lakes, rivers, streams, intermittent streams, open wetlands, woodland pools, seeps and agricultural drains. Special care and attention is required when cutting timber adjacent to water as these areas (known as *riparian areas*), are particularly sensitive to site disturbance. This section of the guide provides CLPs for harvesting near open water and wetlands; Section 8 provides CLPs for harvesting in *treed swamps*.

Harvesting activities in riparian areas can take two approaches: riparian areas may be left and not harvested, or modified cutting may occur. The modified approach establishes buffer zones allowing some trees to be harvested while protecting and enhancing the ecological functions and habitats of riparian areas.

Care should be taken when working in treed swamps (e.g., stands of silver maple, cedar, black ash). Refer to Section 8 for more information.

When working in or around wetlands and water, know which laws (e.g., ***Fisheries Act, Conservation Authorities Act***) apply to your situation. Permits and/or timing restrictions may also apply. Contact your local CA (or OMNR office if there is no local CA) for information and guidance.

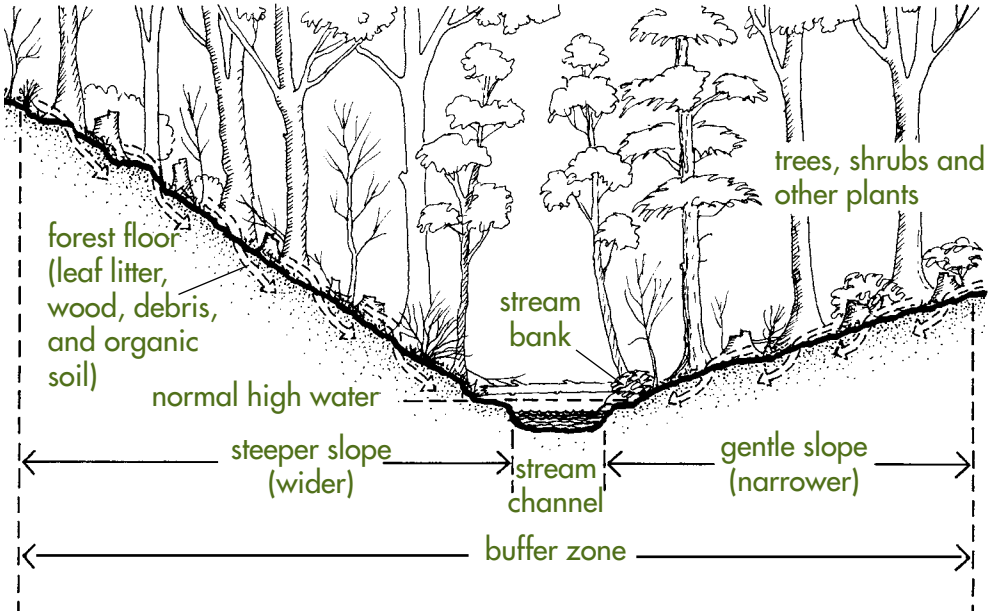
Woodland pools are temporary pools of water that generally appear in the spring (vernal pools) from snowmelt or heavy rains; they sometimes appear in the fall of the year (autumnal pools).

TIP

Seek the advice of a forestry consultant or CA when establishing buffer zones.

Establishing buffer zones

The decision whether to establish a riparian buffer resides with the landowner. This decision should be made after due consideration of existing legislation and recognition of the ecological functions of riparian areas (wildlife habitat, maintenance of water quality and quantity, wildlife travel corridors, etc.). Also, the impacts of the planned harvesting system and physical site conditions (e.g., soil type, slope, type and size of the water body, sensitivity of the fishery, flow characteristics, etc.) should be considered.



Limiting the impact to the bank of the watercourse, forest floor, trees and other vegetation within the buffer area will help maintain the health of the riparian area and the water quality. The width of the buffer area along the watercourse is determined by the slope of the bank (i.e., steeper slopes [left] have a wider buffer area; gentler slopes [right] have a narrower buffer).

It is common practice in forestry to establish a buffer with two distinct zones.

1. Immediately adjacent to the water's edge, a *no-disturbance zone* is maintained where the forest floor and vegetation are left undisturbed.

2. Outside of the no-disturbance zone, a larger buffer area is maintained where cutting is modified and equipment access is limited. (Refer to CLPs for Working around water and open wetlands and Maintaining forest cover in buffers for guidance).

Together, these zones function to reduce the potential for negative environmental impacts on the riparian area, on the water and on watercourses (e.g., lake, stream, open wetland, spring, etc.).

The water flowing from a seep is true groundwater, not surface runoff, and its temperature will generally remain relatively constant year-round. They are typically found along lower slopes and are very susceptible to soil compaction and rutting from logging equipment or ATVs.

CLPs for establishing buffer zones around water and open wetlands

Adopting the following CLPs will assist in protecting water quality and riparian and aquatic habitats.

- For lakes, rivers and streams, adopt the buffer zone guidelines presented in Table 1. Within the buffer, immediately adjacent to the water's edge, maintain a minimum 3-m no-disturbance zone. In the remainder of the buffer, modify harvest operations by limiting equipment access and maintaining a minimum *canopy closure*. Buffer zones should be measured from the high-water mark.

Table 1: Recommended Buffer Zone Widths Based on Slope (degrees) for Watercourses

Slope (degrees)	Buffer Zone Width (metres)
0-8.5	30 m
8.6-16.7	50 m
16.8-24.2	70 m
>24.2	90 m

- For open wetlands (i.e., bogs, fens and marshes), woodland pools, agricultural drains and intermittent streams, adopt a 15-m buffer zone. The width of the buffer should be measured from the high-water mark. Within the buffer, immediately adjacent to the feature's edge, maintain a minimum 3-m no-disturbance zone. In the remainder of the buffer, modify harvest operations by limiting equipment access and by maintaining a minimum canopy closure.

- To protect seeps, adopt a minimum 3-m no-disturbance zone of undisturbed vegetation adjacent to the feature.

Streams have defined channels and banks and may flow year-round (perennial) or only during part of the year (intermittent).

CLPs for working around water and open wetlands

Timber harvesting can occur in riparian buffer zones with little negative environmental impact, provided that some basic guidelines are adhered to and that operations are conducted with care.

Use the following CLPs to protect water and soil quality when logging in a riparian area:

- Log only during periods when soils are dry or frozen to avoid rutting and erosion.
- Limit machine travel in the buffer to minimize soil disturbance and erosion. When feasible, use cables and a winch to extract timber.

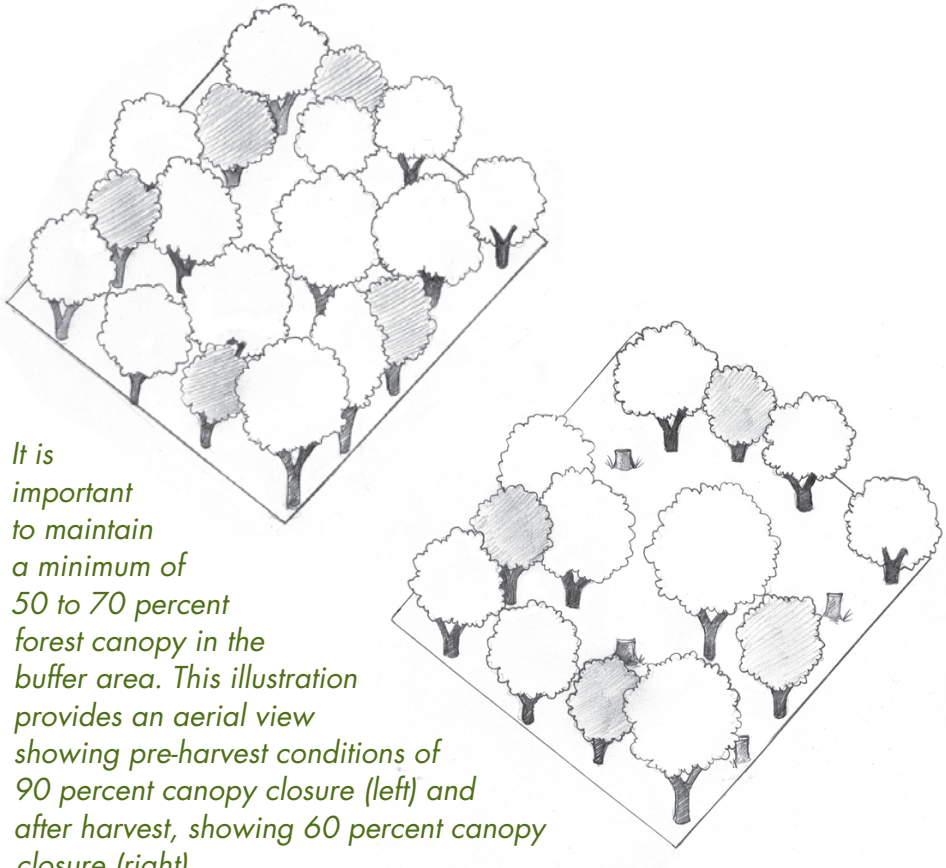
- When cutting, keep felled trees and *slash* out of the water. Avoid damaging the shoreline or exposing soils, which may erode into the water.
- Avoid locating roads and landings in the buffer zone (except to access a water crossing).
- Do not allow ditches or other water diversion structures to drain directly into the wetland or watercourse. Divert runoff onto undisturbed areas of the forest floor.
- Properly close all roads and trails leading into the buffer zone (see Section 7).
- Do not fuel, service or wash equipment near water.

Maintaining forest cover in buffers

It is important to maintain adequate tree cover within the buffer zone. Cutting too many trees can lead to dramatic changes in the composition and structure of the forest. This may adversely affect the quality and quantity of water entering the riparian area, resulting in sediment entering the aquatic feature and altering the hydrologic function of the riparian area.

Trees also deposit leaves, twigs and other organic material and debris into the water, providing habitat, cover and food for aquatic life. Reductions in the amount of these materials reaching the water can alter food supplies and habitats for fish and other aquatic life.

Depending on the silvicultural prescription, it is recommended that a minimum of 50 to 70 percent canopy closure (trees greater than ten m in height) be maintained within the modified area of the buffer zone.



It is important to maintain a minimum of 50 to 70 percent forest canopy in the buffer area. This illustration provides an aerial view showing pre-harvest conditions of 90 percent canopy closure (left) and after harvest, showing 60 percent canopy closure (right).

CLPs for wetland crossings

Cross wetlands only when absolutely necessary and only after assessing the feasibility of all other options.

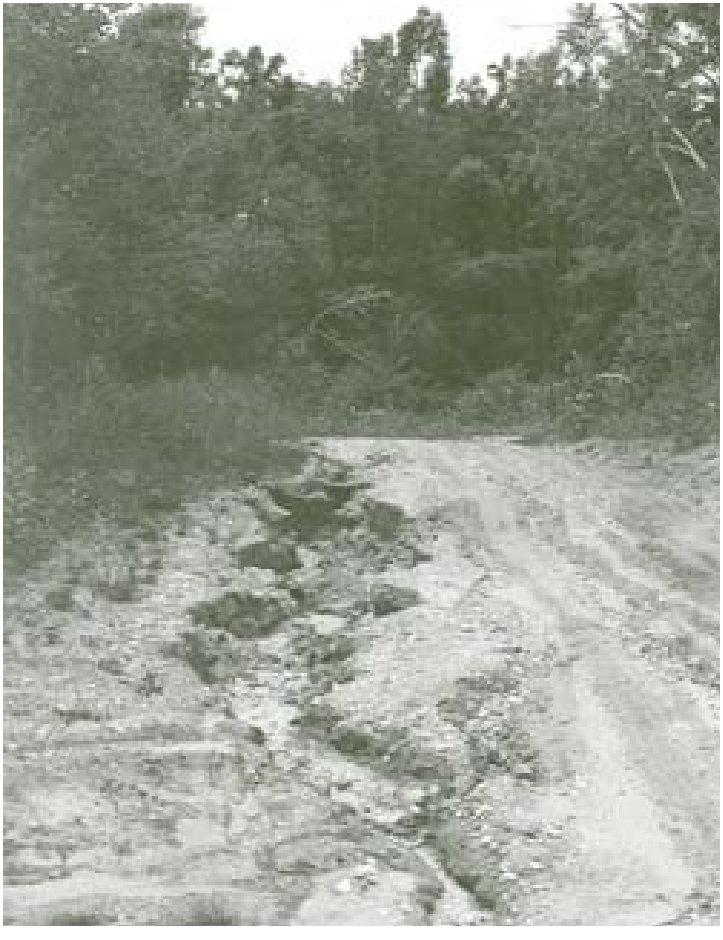
Where crossings are necessary, exercise good judgment and care when locating and constructing crossings. Use the following careful logging practices to plan and construct wetland crossings:

- Schedule harvest operations to cross wetlands when the ground is frozen.
- The crossing installation should not restrict surface or subsurface water movement in the wetland.
- Use water-diversion structures to divert water off trails and roads, so they do not drain directly into the wetland.
- Monitor the crossing site periodically after abandonment. If erosion is occurring, take appropriate action.

5.0 Access Roads

The factors that determine the type and number of roads required for harvesting operations include: topography, stand conditions, use of adjacent land, silvicultural system and the type of logging equipment to be used.

Poorly planned and built forest access roads can create the most lasting disturbance effect, associated with logging, in the woodlot.



Improper construction practices can result in erosion problems, environmental degradation and higher road maintenance costs.

Types of access roads

Access roads may be temporary or permanent. Temporary roads are least expensive to build. Permanent roads are built to a higher standard for year-round use and are much more expensive to construct and maintain.

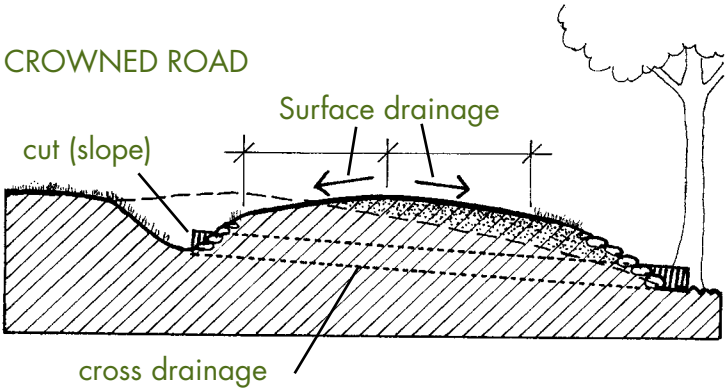
Woodlot owners and loggers can save money and reduce the potential for negative environmental impacts by using old access roads and trails in the woodlot. Walk these roads and trails to determine: 1) if their layout can meet current needs; and 2) if their locations comply with today's more rigid environmental requirements with respect to crossing wetlands and other sensitive areas. Also, as a cost savings and environmental protection measure, consider using agricultural fields adjacent to the woodlot as substitutes for roads, trails and landings.

If new roads must be built, save money and protect the environment by building the shortest road possible, with the fewest number of water crossings. However, recognize that longer skidding distances increase the potential for stand and site damage during operations. This can also increase the cost of logging, and reduce revenues for the landowner.

Be sure to budget adequate funds for road construction and maintenance. Roads that are well- built and maintained will reduce logging costs by:

- allowing trucks to haul heavier loads for longer periods of time (i.e., all seasons);
- allowing trucks to safely travel faster, reducing haul times and increasing efficiencies; and
- reducing road and vehicle maintenance costs associated with travel wear.

CROWNED ROAD



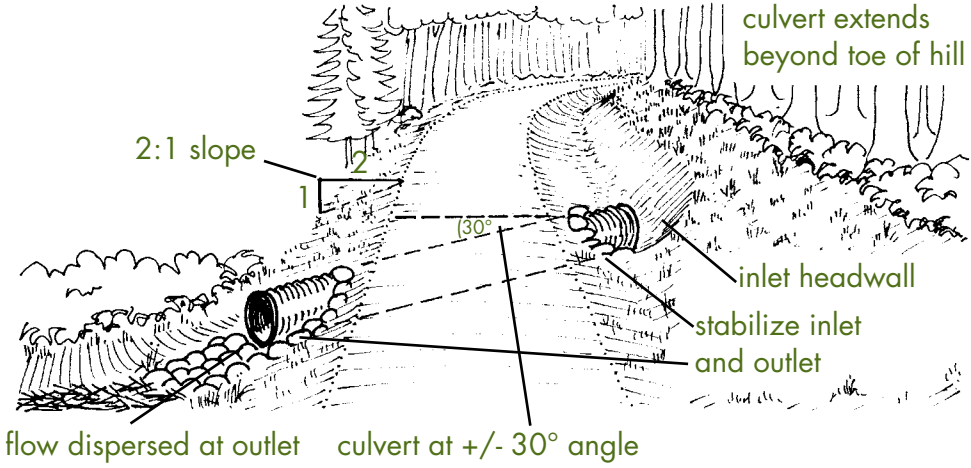
Shaping the road (crown) will help move water off the road surface. This will keep the surface dry and structurally sound, prolonging periods of use and the service life of the road.

CLPs for access road construction

Walk the proposed road and trail network with your consultant and logging contractor before construction starts. During this field assessment, do the following:

- Take note of any old roads, trails or natural openings that could be incorporated into the road network or used as landings.
- Keep in mind the logging equipment and trucking requirements of the operation.
- Locate and mark control points, such as landings, steep slopes or rock outcrops.
- Try to locate roads on well-drained soils and gentle slopes.
- Ensure that road and trail locations avoid unstable slopes/soils and areas where grades are in excess of ten percent.

- Ensure that all potential water or wetland crossing locations meet environmental protection criteria. (See Section 3 and Section 4 for guidance.)
- Identify all construction or erosion control requirements (i.e., the need for *cut and fill* or *drainage structures*).



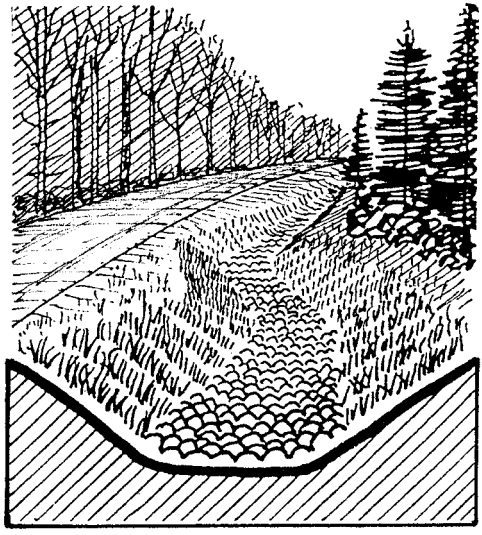
Cross-drainage culverts are used to move water from a ditch on one side of the road to a ditch on the other side. Ensure the culvert is sized to handle peak flows and is properly sloped. Other guidelines for proper culvert installation procedures and requirements are provided in the illustration.

Consider the following careful logging practices when planning and building forest access roads:

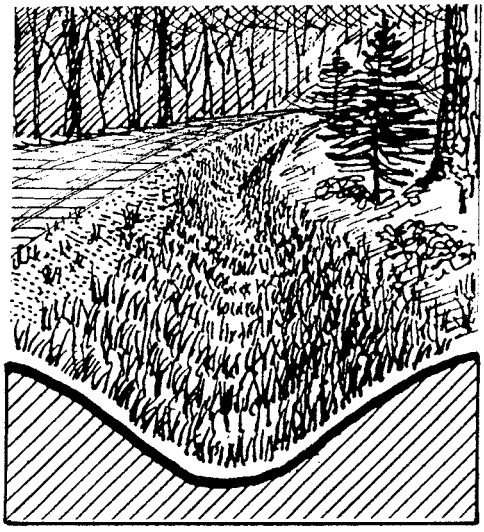
- Permanent roads should be planned and constructed far in advance of being used. As a general rule, roads should be built, then allowed to season for a winter and spring prior to use.
- Locate temporary winter roads in lowland areas and avoid hills.

- Locate temporary summer roads on sites with high load-bearing capacity (i.e., on coarse textured soils).
- Construct roads with a slight slope (one to two percent). Where grades are steeper, use diversions to move water off the road surface.
- Shape the road with a *crown*, an *inslope* or an *outslope* to drain water off the road.
- Construct the road and ditches in one operation.
- Keep excavated material out of ditches and ensure that it will not erode into watercourses. Use temporary sediment barriers as required to minimize erosion.
- Stabilize permanent road surfaces with gravel, crushed stone or other material to help shed water and increase the road's load-bearing capacity.
- Compact and shape fill to reduce erosion, minimize settling and increase load-bearing capacity.
- *Corduroy* soft areas on temporary roads with a brush mat or unmerchantable wood to prevent rutting, ponding and erosion.
- Keep road widths to a minimum.
- When crossing agricultural fields, beware of field tile. When necessary, cross fields parallel to the direction of the tile. Also, following the edge of the field will avoid most of the drainage tiles.

Corduroy trail



Grass and stone stabilized ditch

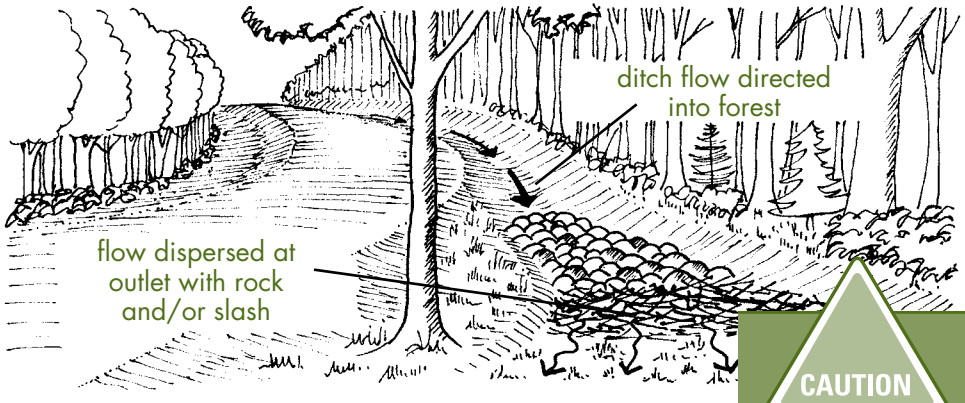


U-shaped, grass stabilized ditch

Ditches carry runoff from the road surface and uphill areas. Ditches that are U-shaped (right) or flat bottomed (left) are preferred over steeper V-shaped ditches because they are more stable and promote slower water flow. It is important to keep ditches clear of debris to protect the road from flooding and erosion.

Water diversions and drainage structures

Water diversions (water bars, *broad-based dips*, *berms*, ditches and cross-drain culverts) are used to divert water away from the road surface and to control water flow along the surface of a road. Install sufficient water diversions to move water off the road. This will protect the road surface and structure. Construct the diversions so that they divert water to undisturbed areas of the forest floor, rather than directly into water or wetlands. Monitor the diversions periodically to remove blockages and ensure that they are functioning properly.



Never allow ditches (or other water diversions) to drain directly into water. Ensure that the diverted water flows onto a filter area of undisturbed forest floor, well away from the riparian area or watercourse requiring protection.

There are a number of erosion control methods that can be adopted to control erosion and sedimentation during harvest operations. Illustrations and guidelines for various water diversion structures and erosion control techniques are presented in this Section and in Section 7.

CAUTION

Ensure that all water diversions and water crossings are constructed to a standard compatible with planned logging equipment and loads.

Sedimentation controls

When constructing water crossings or diversions, it is important to minimize the risk of sediment getting into water or filter areas. Techniques and guidelines for sedimentation control are illustrated in the photographs below.

Silt fences can be used to minimize sedimentation during crossings or construction of water diversions. Ensure that the fencing material is secured to stakes and that fencing fabric is buried to a depth of at least ten cm on the upslope of the fenceline.

Hay bales can be used as a temporary sediment barrier to prevent newly exposed soil from entering water or buffer areas. The photo above shows a barrier made of straw bales and a silt fence.

CLPs for road maintenance

Proper maintenance will protect your road and water quality. Use the following CLPs to maintain road surfaces and to extend the service life of your road:

- Avoid using roads during periods of prolonged rain or thawing.
- Regularly inspect and clear blocked ditches and drainage structures. Replace damaged or failing culverts.
- Grade roads to maintain their surface shape. Try not to mound surface material along the road's edge because this will cause ponding and/or channel water onto the road surface.
- Clear vegetation along a road's right-of-way for safety and to ensure proper drying of the right-of-way.

It is important to monitor water crossings to prevent possible negative environmental impacts, arising from the degradation of the crossing.

CLPs for road closures and retirements

Landowners may wish to maintain roads permanently to facilitate recreational activities or future forest management operations in the woodlot. Alternatively, landowners may elect to close or retire roads in the woodlot to prevent negative environmental impacts, such as erosion and sedimentation. This will also help to reduce trespassing and costs associated with road maintenance.

Abandoned and closed roads can contribute significantly to erosion and to sedimentation problems when they are not retired correctly. Most erosion problems occur within two years of the road closure, prior to the road naturally revegetating.

Implementing proper road abandonment procedures will help protect the road surface and drainage structures for future use.

Adopt the following careful logging practices when abandoning or retiring access roads:

- Remove all temporary drainage and stream crossings.
- Ensure that crossing materials are not left in the stream and that the stream banks are stable.
- Shape road surfaces as necessary to maintain surface drainage.
- Construct water bars or other water diversions where surface runoff or cross drainage may cause erosion or sedimentation.
- Ensure that permanent drainage structures are functional and free of debris. Monitor these periodically.
- If necessary, construct berms or other barriers to restrict road traffic in the woodlot. Any berms or barriers constructed for this purpose should be built in a manner that does not pose a safety hazard.
- Stabilize and seed areas where the soil is exposed.

For long-term access a bridge is the most effective means to protect water quality. Bridges span the water, reducing the potential for sedimentation during construction, maintenance and abandonment.

Landings are the hub of a logging operation. Good planning and proper construction of the landing can improve logging productivity.

6.0 Log Landings

Log landings are cleared areas where wood is piled, sorted or stored before being loaded onto trucks.

Special care must be taken when planning, constructing and using landings to ensure safe operations and to minimize disturbance to the residual stand and the environment. If landings are not located properly or are poorly constructed, large areas of soil may be exposed or disturbed, leading to erosion and sedimentation problems.

Hazardous materials, such as fuel and lubricants, are often stored at landings. Routine machine maintenance and equipment repairs also take place at these sites. Care must be taken to ensure accidental spills do not occur.

Proper planning will ensure that the size and location of the landing is compatible with the harvesting system (e.g., harvest hauling and loading equipment) and environmental requirements in the woodlot (e.g., landings should not be located near water).

Upon completion of operations, landings should be decommissioned. These sites can be reforested or seeded to reduce erosion. They can also be left as an open area for wildlife or future logging operations.

To help reduce the loss of productive land and wildlife habitat, try to minimize the size and number of landings. The number and spacing of landings is mainly a function of local site conditions, access roads and logging/hauling equipment requirements.

Depending on operational requirements, it may be feasible to pile wood on the road right-of-way, rather than to construct a new landing. If new landings are required,

Check with your local municipality or neighbour for permission to use open lands, such as fields and road allowances, for landings.

consider locating them in adjacent agricultural fields or in natural woodlot openings. Whenever possible, use landings from past harvesting operations.

Identify landing locations before road construction or harvesting begins. Investigate a number of potential locations to ensure the best possible site(s) for the operation is selected.

CLPs for constructing and using landings

The following careful logging practices should be considered when constructing and using landings:

- Landings should be located by the logger and reviewed and approved by the landowner before operations begin.
- Landing locations should be clearly marked prior to operations.
- Construct landings well away from water, buffer areas and other sensitive sites. Select locations with firm, well-drained soils. If required, use temporary water barriers (e.g., hay bales) to limit erosion when constructing or using the landing.
- Lay out skid trails and roads so that water cannot flow into or out of the landing. Use water bars, berms or other structures to prevent water from entering or exiting the landing. (Refer to Section 5 and Section 7 for information on water diversions).
- Minimize soil disturbance when constructing landings. Simply clearing vegetation, rather than bulldozing down to mineral soil, will aid in the rehabilitation of the site after operations.
- Maintain the landing surface to keep water from ponding or channeling.

- After significant rainfall, allow the landing to dry before using it.
- Minimize the amount of wood waste at the landing and leave as much woody material as possible at the felling site.
- Keep a spill kit on site to soak up any lubricant spills or leaks. (See Section 8).
- Keep the landing clean and clear of garbage and debris.

CLPs for landing abandonment

Adopt the following careful logging practices to stabilize the landing after operations:

- Stabilize the site and prevent erosion by allowing the landing to regenerate naturally or by applying seed, mulch or other materials.
- Plant grasses or shrubs to revegetate the landing, with a view to future use, or to provide wildlife food and cover. It may be necessary to prepare the landing site for planting to ensure an adequate seed bed.
- Monitor the landing site periodically for erosion problems and maintain as necessary.
- Landings in agricultural fields should be cleared of all logging debris (e.g., blading off or using debris as firewood) at the end of harvest operations.

Landings that are seeded and maintained as open areas can be reused with minimal cost and effort. Seeded landings also provide browse and cover for wildlife.

7.0 Skid Trails

Skid trails are used to move cut timber from the stump to the landing. Repeated trips are often made on the same skid trail; loggers must use care and skill to avoid rutting, erosion and damage to residual trees in the woodlot.

Many of the planning principles and operational practices for forest access are applicable to planning and using skid trails.

CLPs for planning and locating skid trails

Planning skid trails is an important task and requires an understanding of the silvicultural objectives associated with the harvest. It is also important to have an understanding of the limitations and capabilities of the harvest equipment and to be familiar with the terrain and soil conditions of the woodlot.

When planning skid trails, keep in mind that the amount of logging damage is directly proportional to the number of trails. A skilled logger can minimize the number of trails and significantly reduce the potential for site and stand damage.

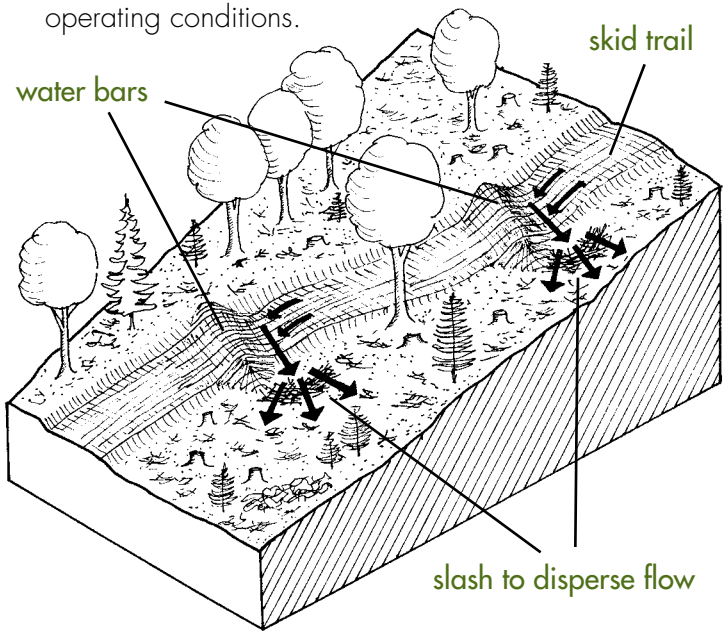
TIP

Landowners should require the logger to lay out the main skid trails before cutting begins. All trail locations should be subject to the landowner's review and approval.

Proper skid trail layout improves the efficiency of the logging operation, reduces the risk of damage to the residual stand and soil and minimizes the loss of productive forest in the woodlot.

Adopt the following CLPs when planning and laying out skid trails:

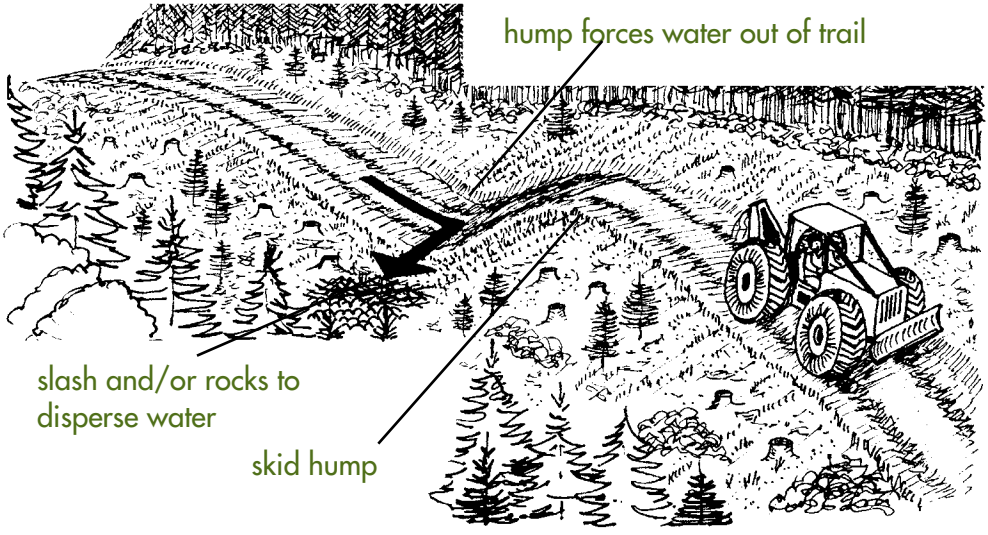
- Whenever practical, locate trails outside of the woodlot or use existing trails when they provide good access to the harvest area.
- Lay out skid trails to minimize the total number of trails, number of water crossings and skidding distances. If possible, place trails on the top of topographic contours. This will prevent erosion problems and provide safer operating conditions.



Install water bars to move water off the skid trail or access road. They are cost effective, and if properly placed and constructed, will provide adequate cross drainage and surface drainage. Construct dips deep enough to provide adequate drainage and wide enough to provide for the safe passage of vehicles and equipment. Placing gravel or crushed stone on the dip and mound is recommended to improve stability.

- Ensure that the location of main skid trails tie into any proposed or existing log landings and access roads.
- Before cutting begins, flag main trails and identify any areas where additional skid trails may be required or where skidding may be restricted or problematic.
- Lay out new trails to access the harvest area by the most direct route.
- Be sure tree marking is complete before laying out skid trails in the field. This will ensure that the skidder will access the cut in an efficient manner and minimize the potential for stand damage (by limiting machine travel through areas of unmarked timber).
- A good rule of thumb is to space skid trails at least 30 m apart. This spacing permits the winching of trees and reduces the amount of machine travel needed.
- Confine skid trails to where trees have been designated for harvest.
- Keep main trails straight or gently curving.
- Locate secondary and tertiary trails so they intersect main trails at angles of less than 45 degrees.
- Keep all trail widths to a practical minimum to avoid unnecessary timber losses, recognizing that trails that are too narrow will increase the potential for residual tree damage.
- Avoid steep grades. This will reduce site damage.
- When trail slopes are greater than five percent, plan to install drainage structures or water diversions and use soil stabilization practices (i.e., brush mats) to reduce erosion and runoff.

Landowners can assist logging contractors when skid trails are being planned by providing a property map showing areas where trails should not be located (e.g., seeps and other wet areas).



Natural humps in the terrain (skid humps) can be used to help divert water from skid trails. The hump forces water out of the trail. The placement of rocks or slash at the lower end of the hump will assist in dispersing water onto the forest floor.

- Use low-value trees or trees that are marked for harvest as *bumper trees*. Bumper trees will cushion standing timber and regeneration from damage by skid loads that track off the centre of the trail.
- To avoid any misunderstandings about where machine traffic should not occur, it is recommended that landowners discuss skid trail locations with their forestry consultant and logger before harvesting begins.

CLPs for skidding operations

Refer to Section 8 for recommended careful logging practices for skidding.

CLPs for skid trail abandonment or retirement

When operations are finished, use the following CLPs to retire the trails:

- *Back-blade* and/or repair all trails as necessary.
- Install and/or maintain water bars or berms as necessary to control for erosion.
- Seed any disturbed areas that may be vulnerable to erosion. Allow other areas to regenerate naturally.

Landowners may elect to close or retire roads and/or trails after the harvest operations are completed. When retiring a road or trail areas of exposed soil should be stabilized and seeded to minimize erosion and sedimentation problems.

8.0 Logging Operations

Although some damage to the site and residual trees during logging is inevitable, it is possible, through careful logging practices, to minimize the amount of damage in your woodlot. Proper planning and care during operations can help minimize damage to soil, the residual stand and water quality.

Care and due diligence during operations also reduces safety risks and will leave the woodlot in better condition for other uses after logging is finished.

Harvest-related legislation in Ontario

Legislation affecting timber harvests on private land is summarized in Appendix 1. Landowners and loggers should be aware of all applicable legislation and regulations prior to starting logging operations. Legislation and regulations may include, but are not limited to, the following: *Fisheries Act*, local forest conservation bylaws, *Environmental Protection Act, Occupational Health and Safety Act, Endangered Species Act, Species at Risk Act, Migratory Birds Convention Act, Forest Fire Prevention Act* and the *Conservation Authorities Act*.

Recommended CLPs for logging operations

There is no substitute for carefully planned and conducted operations. Careful planning will help maximize safety, protect the residual stand, protect the environment and reduce costs. Before any cutting starts, plan the harvest according to the recommendations provided in Section 2.

If you plan to contract the logging or sell standing timber, meet with the logger on site before cutting starts. This will give you an opportunity to review your expectations

Know the laws and permit requirements that apply to your situation. Contact your local municipal office, CA or OMNR for information.

Safety is the legal obligation of both the landowner and the logger. Landowners may be held liable for logging accidents that occur on their property. Know your obligations when hiring a contractor.

with the logger and discuss any issues or logging-related concerns (e.g., damage guidelines, no-cut zones, etc.). Good communication before and during operations will lead to better results.

Once work starts, monitor operations on a regular basis for site and stand damage and adherence to the harvest plan and management plan. Monitoring should be done with the logging contractor.

Logging damage

Improper logging and skidding techniques can result in lasting damage to the stand and site. After logging, a minimum of 90 percent of the good-quality, *residual stems* should be free of major damage. Skilled loggers and operators can achieve a higher damage-free standard (e.g., 95 percent). Appendix 3 provides information and guidelines on how to conduct a logging damage assessment and determine the level of damage to residual trees in the woodlot.

Careless skidding can result in damaging good-quality, residual trees. Skilled loggers can achieve a damage-free standard of 95 percent during operations.

CLPs for felling timber

Professional training and competence is the key to reducing damage in the woodlot.

Loggers should use the following careful logging practices when felling timber:

- At the start of operations, remove hazard trees as a preliminary safety precaution.
- Use directional felling techniques to fell trees away from trees you wish to keep.
- Limb and top trees where they fall. This practice reduces residual damage during skidding, and the slash provides a source of nutrients as the materials decompose.
- Leave unmerchantable slash in the harvest area. This will help to maintain soil productivity, scatter seed for regeneration and provide cover and food for wildlife.
- Minimize the amount of debris and slash arising from operations by using all marketable wood. Cut stumps as low to the ground as possible.
- Remove severely damaged trees in the understorey to promote safety and woodlot health.
- Cutting should start at the back of the harvest block and proceed in an orderly fashion toward the landing.
- Trees should be felled, aligned with the direction of skidding (i.e., butts toward the skid trail and at angles no greater than 45 degrees).
- Ensure good communication between the cutter and skidder operator. This is a must for productive skidding and to ensure that all felled trees are utilized.

An excess of skid trails can damage residual trees and reduce the growth potential and the future value of timber. Too many trails also diminish aesthetics and may compromise the ecological functions of the woodlot.

CLPs for skidding operations

Loggers should use the following careful logging practices when skidding timber:

- Use low-value trees, stumps or boulders as bumpers to protect the residual crop.
- Remove large side branches from cut trees before skidding.

Directional felling (using a wedge) will fell trees away from regeneration and other valuable trees. It will also assist in aligning trees for skidding and will reduce swing damage to residual trees.

- Avoid unnecessary skidder travel within the stand and buffer zones by using a winch to collect felled trees. Use a winch to pull down *lodged trees* or to retrieve trees on steep slopes.
- Back the skidder toward the load on side trails, rather than circling around the load from behind to pick up wood.
- Avoid skidding when the soil is saturated. During periods of prolonged rain, stop operations until the soil dries.

Skidding during the early spring or late fall, when there is excessive moisture in the ground, can do irreparable damage to your woodlot.

CAUTION

When harvesting in a treed swamp a permit may be required under the *Conservation Authorities Act*. Contact your local CA for more information.

- Avoid skidding through wet spots.
- For winter operations, mark stream channels and existing culvert locations before snowfall.
- Use slash or brush mats on skid trails to minimize soil compaction and rutting and to disperse water on trails.
- To reduce equipment wear, extend machine life and reduce physical site damage, do not overload equipment.
- The winch cables on the skidder should have a minimum of 20–25 m (75 ft.) of *main line*.

CLPs for harvesting treed swamps and forested lowlands

Treed swamps and forested lowlands are sensitive ecosystems because of their high- or potentially high-water tables, shallow rooting depths and poor drainage. A rise

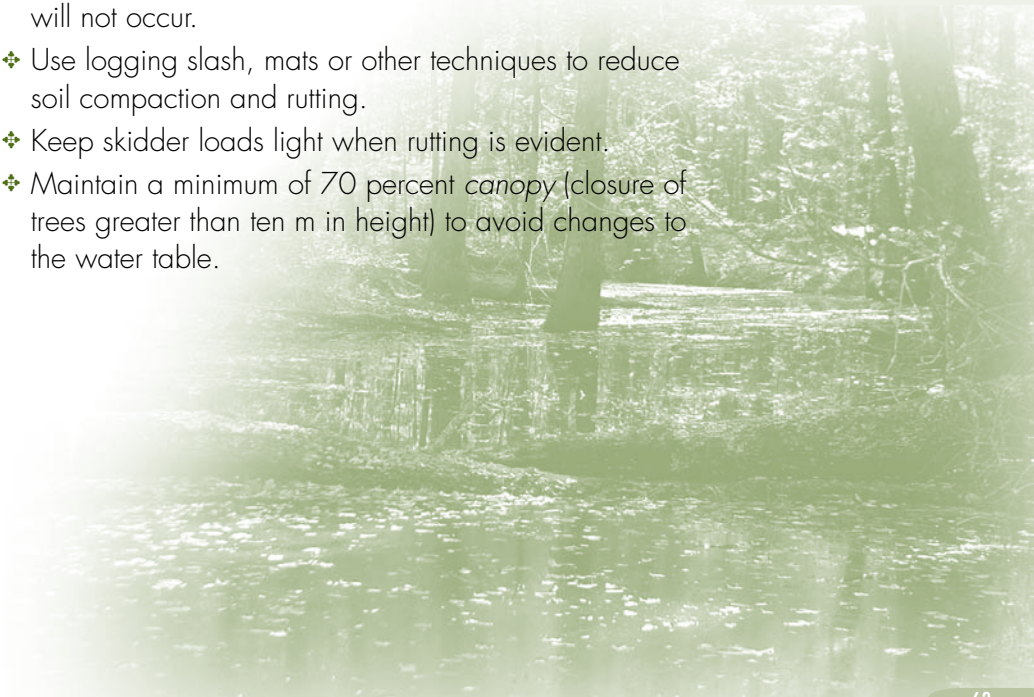
in the water table can occur after logging, which may negatively affect the residual stand (e.g., cause tree mortality or decline, *windthrow*, etc.).

The decision to log these sites should be carefully evaluated as these areas may provide important hydrological functions in the woodlot and important fish or wildlife habitat.

Should a decision be made to harvest, adopt the following CLPs to minimize site damage:

- Restrict timber harvesting to periods when the ground is frozen or dry.
- Contain skid trails to as small an area as possible and minimize the number of trails.
- Use low-pressure, high-flotation tires or wide tracks when possible so that excessive damage to the residual stand will not occur.
- Use logging slash, mats or other techniques to reduce soil compaction and rutting.
- Keep skidder loads light when rutting is evident.
- Maintain a minimum of 70 percent *canopy* (closure of trees greater than ten m in height) to avoid changes to the water table.

TIP Seek the advice of a forestry consultant or your local CA to determine whether logging in a treed swamp or lowland is ecologically appropriate.



Harvesting when the ground is frozen and placing slash on skid trails will help minimize soil disturbance.

CLPs for woodlot aesthetics

Landowners can take several steps to ensure that logging operations maintain or enhance aesthetic values and wildlife habitat in their woodlots. To soften the visual impact of the cut, adopt the careful logging practices outlined below:

- Lop tops and slash down to 1m or less in height in high visibility areas of the woodlot.
- Leave primary skid trails free of debris.
- Harvest highly damaged trees (i.e., broken tops, excessive bark loss, *leaners*). Leave other damaged trees for wildlife.

CAUTION

Make sure that all terms and conditions are clear at the time of the timber sale. There may be additional costs associated with some measures needed to improve the aesthetics of the harvest site.

CLPs for wildlife habitat protection or enhancement

Small woodlots are habitat for many species of plants and animals. Harvesting operations that are well-planned and -conducted can result in greater diversity of habitat through a better mix of older and younger trees and the retention of a diversity of tree species. This will result in your woodlot being more attractive to many wildlife species.

Wildlife management objectives are typically identified in the woodlot management plan and in the stand management prescription. On the ground, wildlife values are protected by the proper delivery of tree-marking guidelines and/or the establishment of buffers or no-cut zones.

Some habitats may be enhanced by cutting strategies that promote the regeneration of species that provide food or cover. Slash from the logging operation may also be an important source of food and cover for many wildlife species (e.g., food for white-tailed deer during winter).

Stick nests are an important feature for wildlife because they may be used repeatedly.

TIP

The Ontario Ministry of Natural Resources' website features an extensive series of wildlife management guidelines and a list of endangered species (see Appendix 2).

Some wildlife species are highly sensitive to disturbance and require the establishment of buffers or timing restrictions during the nesting and breeding season to ensure breeding success. It may also be important to avoid logging in or around sensitive habitats. Landowners should be aware of vulnerable wildlife living in their woodlot.

To protect and/or enhance the wildlife potential of the woodlot, consider adopting the following CLPs:

- Try not to schedule harvests during the critical breeding/nesting season of raptors and songbirds (generally from early spring to late July).
- To provide critical habitat for a number of wildlife species, retain a minimum of six quality cavity trees, eight berry or nut-bearing trees and ten conifers per ha. Additional guidelines for retaining super canopy trees, conifers in a hardwood stand, hardwoods in a conifer stand, etc., are available in the ***Ontario Tree Marking Guide*** (see Appendix 2).

Cavity trees are living, dying or dead trees that contain one or more holes or cavities. Cavity trees are used by wildlife for a variety of purposes: nesting and raising young, denning, roosting, resting, feeding, caching food, escaping predators and hibernating.

- Retain a diversity of species and age classes in the woodlot for wildlife habitat, cover and food.
- Rehabilitate areas prone to erosion by seeding or planting shrubs that wildlife can use for food and cover.

CLPs for handling and disposing of hazardous materials

The proper storage, handling and use of oils, fuel, lubricants and other hazardous materials during logging is critical for the protection of human health and the environment.

Use the following careful logging practices when dealing with hazardous materials:

- Designate specific areas for equipment fueling and maintenance. When selecting these sites, choose areas that are level and situated well away from water or wetlands.
- Have a spill kit on site at all times and ensure that all workers know how to use it. At a minimum, the kit should contain a shovel, plugs and clamps to control leaks in hydraulic lines, a container to catch leaking fluids and absorbent material to soak up fuel leaks.
- In the event of a lubricant or fuel spill, place any contaminated earth in a sealed container and dispose of it at an approved facility.
- Ensure that waste lubricants and their containers are stored in leak-proof containers until they can be transported off site for reuse, recycling or disposal at an approved site.
- When possible, use biodegradable oils and lubricants in your equipment to reduce risks to the environment.

Know the laws for using, transporting, handling and disposing of hazardous materials, their containers and wash waters.

For assistance with spills of hazardous materials, call the Ontario Ministry of the Environment's Spills Action Centre Hotline at 1-800-268-6060.

Stabilize exposed soils by seeding grasses to minimize erosion. Native, non-invasive grass species are preferable. When selecting a seed mixture, consider factors such as site condition, soil moisture, time of year, degree of shading and how quickly the soil needs to stabilize.

9.0 Post-Harvest

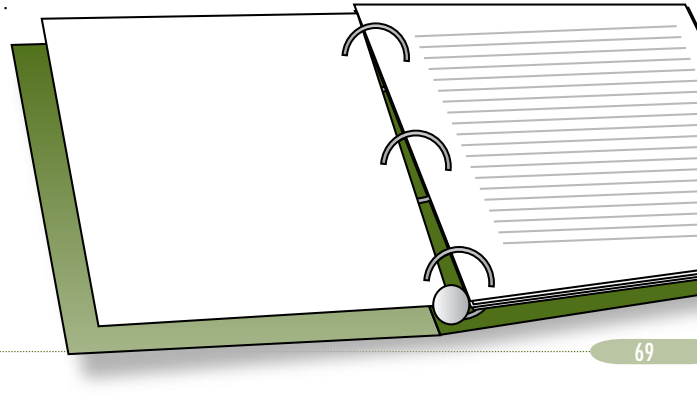
After harvesting operations, it is important for the landowner or logging contractor to leave the woodlot in the best condition possible.

At the end of harvest operations, the following careful logging practices will help to ensure that future problems will not develop.

CLPs for closing out harvest operations

Take the following steps to close out harvest operations:

- Remove all garbage from the harvest area.
- Stabilize any exposed soil (i.e., on landings, road cuts, trails, etc.), that may be prone to erosion, with seed or mulch.
- Smooth or fill in any ruts and install water diversions (water bars) on skid trails, roads and landings where erosion may be a problem.
- Remove all temporary water crossings and stabilize banks as required.
- If your woodlot is used by the public, post signs warning of alterations to trails and roads.
- Inspect the harvest site periodically to ensure that your erosion control measures remain effective. Maintain these controls as required.
- Update your woodlot management plan (new inventory) and monitor the effectiveness of the treatment.



Specialized cut-to-length mechanical harvesters are often used in conifer plantation thinning operations.

Appendix 1: Legislation and Regulation

This section describes some of the relevant federal and provincial legislation and regulations affecting harvesting operations on private forestland in Ontario. It is not a complete list and is intended for information purposes only.

Detailed information and copies of the legislation and regulations outlined in this guide are available online at http://laws.justice.gc.ca (federal government) and at http://www.e-laws.gov.on.ca (provincial government) websites.

Federal laws

Fisheries Act – Under the Act, it is illegal to alter or destroy fish habitat. In southern Ontario, conservation authorities (CAs) may be responsible for administering the Act.

Migratory Birds Convention Act – Under the Act, it is illegal to damage, destroy, remove or disturb migratory bird nests without authorization. The intent of the Act is to provide regulations for the protection and conservation of migratory bird populations, individuals and their nests.

Navigable Waters Protection Act – Under the Act, an approval (permit) is required to construct a bridge over a navigable watercourse. The bridge must not interfere with or endanger navigation of the watercourse.

Species At Risk Act (SARA) – Under the Act, it is illegal to destroy flora or fauna species that are designated as species at risk. The Act was created to protect flora and fauna species from becoming extinct by ensuring sound management of species at risk and protecting their habitats.

Provincial laws

Conservation Authorities Act – Under Section 28 of the Act, conservation authorities may require landowners to obtain a permit to change or interfere in any way with existing channels of a river, creek, stream, watercourse or wetland. A permit may also be required to develop (i.e., construct any structures such as culverts, bridges or roads) in or adjacent to river or stream valleys, the shorelines of large inland lakes, watercourses, hazardous lands and wetlands to confirm that the control of flooding, erosion, dynamic beaches, pollution or the conservation of land, are not affected.

Beds of Navigable Waters Act – Under this Act, the Crown retains ownership and rights to the beds of navigable streams, rivers and water bodies.

Boundaries Act – A legislative mechanism to confirm, certify and register with local land registry offices the location of property boundaries.

Bridges Act – Approval (permit) from the Ontario Ministry of Transportation is required to build, replace or alter a bridge over a river or stream.

Crown Forest Sustainability Act – Under the CFSA, timber on private land may be reserved for the Crown for harvesting and disposition.

Endangered Species Act (2007) – Provides for the protection and recovery of species at risk and their habitat in Ontario.

Environmental Protection Act – This Act requires that spills of hazardous materials be reported to the Ontario Ministry of the Environment and that spill sites be promptly cleaned up and the environment restored.

Fish & Wildlife Conservation Act – This Act provides for the protection and conservation of "specially protected" wildlife species and migratory birds.

Forestry Act – Section 10 of the Act specifies that trees growing on boundary lines between properties are the common property of the adjacent landowners. Mutual consent is required to cut such trees.

Forest Fire Prevention Act – This Act and its regulations have requirements aimed at reducing forest fires and ensuring public safety. The Act and its regulations permit the OMNR to restrict activities within restricted fire zones and specifies fire equipment requirements for logging.

Lakes and Rivers Improvement Act – This Act requires that a permit be obtained for any activity that increases the flow of, holds back or diverts water.

Municipal Act (2001) – Municipalities may prohibit or regulate the destruction or injuring of trees in woodlands designated in bylaws. Sections 135–140 deal specifically with tree cutting. When developing bylaws, municipalities shall have regard to good forestry practices as defined in the *Forestry Act*. They can require a permit for the destruction or injuring of trees. Permits may impose conditions including how trees are cut and qualifications of persons authorized to cut. Bylaw officers can order cutting to stop. Not all municipalities have forest conservation bylaws.

Occupational Health and Safety Act – The main purpose of the Act is to protect workers from health and safety hazards. It sets out the rights and duties of all parties in the workplace or on the work site.

Occupiers' Liability Act – This Act requires that the owner of a property do what is reasonable to ensure persons entering property are not injured or endangered.

Professional Foresters Act – This Act establishes the Ontario Professional Foresters Association as the professional body that regulates and governs the profession of professional forestry in Ontario. The Act sets out the scope of practice for professional foresters and establishes a complaint committee to deal with issues, such as complaints of professional misconduct or unskilled practice.

Public Lands Act – This Act requires that a permit be obtained before any work is done that may impact the beds of lakes, rivers and streams. Activities such as dredging and filling in near-shore areas on private land may require a permit.

Surveys Act – Only members of the Association of Ontario Land Surveyors may offer legal boundary surveying services to the public in Ontario.

Appendix 2: Sources of Information and Assistance

1. Aerial Photography, Maps and Forest Resource Inventory

National Air Photo Library

The National Air Photo Library in Ottawa has a collection of aerial photographs and maps available for purchase.
615 Booth Street,
Ottawa, Ontario K1A 0E9
1-800-465-6277
www.airphotos.nrcan.gc.ca

Ontario Ministry of Natural Resources

The Information Centre in Peterborough sells an extensive line of maps and related products and information, including Ontario Base Maps, aerial photos and Forest Resource Inventory Maps.
Address listed under organizations.
1-800-667-1940
http://themnrstore.mnr.gov.on.ca

Conservation Authorities

Many conservation authorities have maps and aerial photographs for lands within their watershed. Check your local telephone directory or visit the Conservation Ontario website www.conservationontario.ca.

2. Organizations

Conservation Authorities (Conservation Ontario)

www.conservationontario.ca

Eastern Ontario Model Forest

P.O. Bag 2111
Kemptville, Ontario K0G 1J0
www.eomf.on.ca
(613) 258-8241

LandOwner Resource Centre
3889 Rideau Valley Drive, Box 599
Manotick, Ontario K4M 1A5
http://www.lrconline.com
(613) 692-3571

Ontario Forestry Association
200 Consumer Road, Suite 701
North York, Ontario M2J 4R4
www.oforest.on.ca
1-800-387-0790

Ontario Forestry Safe Workplace Association
690 McKeown Avenue
North Bay, Ontario P1B 9P1
www.ofswa.on.ca
(705) 474-7233

Ontario Professional Foresters Association
P.O. Box 91523, 5 Wesleyan St. #201
Georgetown, Ontario L7G 2E2
www.opfa.ca
(905) 877-3679

Ontario Ministry of Agriculture, Food and Rural Affairs
Information Contact Centre
1 Stone Road
Guelph, Ontario N1G 4Y2
www.omaf.gov.on.ca
1-877-424-1300

Ontario Ministry of Natural Resources
Information Centre
Box 7000, 300 Water Street
Peterborough, Ontario K9J 8M5
www.mnr.gov.on.ca
1-800-667-1940

Ontario Stewardship
www.ontariostewardship.org

Ontario Woodlot Association
275 County Road 44
Kemptville, Ontario K0G 1J0
www.ont-woodlot-assoc.org
1-888-791-1103

Forest Services Directory and the Woodlot Marketplace
www.ontariowoodlot.com

3. Recommended Reference Material for Careful Logging Practices and Woodlot Management

Ontario Ministry of Natural Resources (OMNR)

- *A Silvicultural Guide to Managing Southern Ontario Forests*
- *A Silvicultural Guide for the Tolerant Hardwood Forest in Ontario*
- *A Silvicultural Guide for the Great Lakes-St. Lawrence Conifer Forests in Ontario*
- *Forest Management Guidelines for the Protection of the Physical Environment*
- *Guide to Stewardship Planning for Natural Areas*
- *Ontario Managed Forest Tax Incentive Program (MFTIP) Guide*
- *Ontario Tree Marking Guide*
- *Timber Management Guidelines for the Protection of Fish Habitat*

Extension Notes Series: User-friendly fact sheets on a variety of resource management topics including agroforestry, financial aspects, forests, insects and pests, water and wetlands and wildlife.

The OMNR also has a series of guides on forest practices to protect and improve wildlife habitat, watersheds and other values. See the publications section on their website.

Ontario Ministry of Agriculture, Food and Rural Affairs

- *A Guide to Improving and Maintaining Sugar Bush Health and Productivity*
- *Buffer Strips*
- *Best Management Practices Agroforestry Series – Volume 1 Woodlot Management*
- *Farm Forestry and Habitat Management*
- *Fish and Wildlife Habitat Management*

Canadian Model Forest Network

Copies of the following documents are available online at www.modelforest.net/cmfn/en/ (under publications).

- *Best Management Practices: Contractors Working in Nova Scotia*
- Eastern Ontario Model Forest: *Code of Forestry Practice*
- Fundy Model Forest: *Best Management Practices: A Practical Guide for New Brunswick's Private Woodlots*
- Lake Abitibi Model Forest: *Manual for Environmentally Responsible Forestry Operations in Ontario: A Practical Guide Towards Sustainable Forestry Operations*

Ontario Woodlot Association

- *A Landowner's Guide to Selling Standing Timber*

The OWA website www.ont-woodlot-assoc.org has a series of articles and information related to woodlot management. The Forest Services Directory on the website www.ontariowoodlot.com lists consultants and contractors providing forestry services.

4. Recommended U.S. Reference Material and Sources of Information

- *A Guide to Logging Aesthetics. Practical Tips for Loggers, Foresters, and Landowners*
  www.nraes.org/publications/nraes60.html
- *Best Management Practices for Forestry: Protecting Maine's Water Quality*
  http://maine.gov/doc/mfs/pubs/bmp_manual.htm
- *Landowner's Guide to Building Forest Access Roads (NA-TP-06-98)* http://www.na.fs.fed.us/SPFO/pubs/stewardship/accessroads/accessroads.htm
- *New York State Forestry Best Management Practices for Water Quality*
  http://www.dec.ny.gov/lands/37845.html
- *Temporary Stream and Wetland Crossing Options for Forest Management (General Technical Report NC-202)*
  http://www.ncrs.fs.fed.us/epubs/gtr202/ncgtr202pt1.pdf
- *A Forest Landowner's Guide to Internet Resources: States of the Northeast*
  This guide (updated biannually) is a compendium of websites and online publications, fact sheets and brochures covering just about every topic on forest stewardship a woodlot owner may require. Although this is an American publication, it also provides links to online resources in Canada and Ontario. Some of the topics covered include: recreation, wildlife, forest health, management planning, silviculture, timber sales, etc. This guide can be downloaded from the USDA's website at http://www.na.fs.fed.us/pubs/misc/flg/.

The forwarder seen in this photograph is equipped with wide tracks to provide better floatation and minimize site damage (e.g., compaction).

Appendix 3: Logging Damage Guidelines

After logging, a minimum of 90 percent of the good-quality residual stems should be free of major damage. Skilled loggers and operators can achieve a higher damage-free standard (e.g., 95 percent) during operations. Table 2 presents recommended guidelines for assessing logging damage to residual trees.

Walk through the harvest area to get a preliminary indication of the level of logging damage. If there is no damage or only minor occurrences, then there is no need to conduct a more formal damage appraisal.

Should an appraisal be warranted, do a random sample using a strip cruise sampling technique. Ensure your sample covers all areas where logging harvest operations occurred. Take measurements where damage occurs along the sample line (including areas where your survey line intersects with skid trails). Do not sample along skid trails, in landings, on roads or outside of the cut area.

To conduct the assessment, walk a straight line through the harvested area and count all trees (greater than ten cm in diameter at breast height) on either side of your line (e.g., a ten-m strip). To calculate the percent damage, count all trees in the strip and note trees that are damaged. Based on this tally, calculate the percent damage (i.e., for a 50-tree count with five damaged trees, the percent damage is ten percent. Therefore, 90 percent of the sample was free of damage).

During the assessment, take note if some of the damaged trees were used as bumper trees, whether damage is confined to lower-quality trees (this sometimes happens if the logger felled or skidded trees towards these trees

in order to protect those of higher value) or if damage is concentrated on higher-quality stems (unscrupulous loggers may damage better quality trees in order to harvest them).

Additional information on how to conduct a logging damage survey is provided in ***A Landowner's Guide to Selling Standing Timber.*** A good reference for general information on planning and conducting forest sampling is ***Making Cents out of Forest Inventories: A Guide for Small Woodlot Owners***, available from the LandOwner Resource Centre (see Appendix 2).

Table 2: Guidelines for Assessing Logging Damage

Type of Injury	A wound or injury is considered major when:
Bark scraped off:	Trees 10-31 cm diameter at breast height (DBH) Any wound greater than or equal to the square of the DBH (i.e., for a 10-cm tree a major wound is greater than 100 cm^2) Trees 32+ cm DBH Any wound greater than 1,000 cm^2 Note: Wounds on yellow birch (or ground contact wounds on other species) are considered to be major at 60% the size of the above for all size classes (i.e., 60 cm2 for a 10 cm DBH tree or 600 cm2 for any tree 32+ cm DBH).
Broken branches	More than 33% of the crown is destroyed.
Root damage	More than 25% of the root area is destroyed or severed.
Bole of tree broken off	Any tree.
Bent over	Any tree tipped noticeably.

Source: OMNR. 1998. ***A Silvicultural Guide for the Tolerant Hardwood Forests in Ontario***. Ontario Ministry of Natural Resources. Queen's Printer for Ontario, Toronto. 500 pp.

Glossary of Terms

Agricultural drains. Man-made drainages, which may include sections of natural streams. These drainages may support fish populations and require care and consideration in forest management planning and operations.

Back-blade. To grade level a landing, road, skid trail, etc. so they are smooth and free of ruts.

Basal area. The area, in square metres, of the cross-section of a tree measured 1.3 metres above the ground. For a stand of trees, the basal area is the sum of all the individual tree basal areas on a given area of land.

Basal scarring. Small or large tree wounds (bark abrasions) found at the base of a tree caused by poor felling and skidding operations.

Berm. A low mound or bank of earth constructed in the path of flowing water to divert its direction.

Blazes. To mark a tree by cutting the bark. Forest properties often are delineated by blazing trees along the boundary lines.

Broad-based dip. A surface drainage structure specifically designed to drain water away from an access road, while allowing vehicles to maintain normal travel speeds.

Brush mat. Material placed on soft ground to minimize rutting or compaction when heavy machinery is used.

Buffer. A designated zone or strip of land of sufficient width used to shield one area from another. Commonly used around a stream or water body to minimize the entrance of sediments into the water body.

Bumper tree. A low-value tree used to protect standing timber and regeneration from damage by skid loads tracking off the skid trail centre.

Canopy. The layer or multiple layers of foliage at the top or crown of the trees in a forest stand.

Canopy closure. The degree to which the canopy blocks sunlight from the forest floor in a given area.

Certified tree marker. The Ontario Ministry of Natural Resources provides tree marking certification training. Participants are field tested and successful trainees are issued a certificate endorsing their skills as a certified tree marker. To maintain certification, a tree marker must attend and successfully complete a refresher course every five years.

Clearance certificate. A document issued by the Workplace Safety Insurance Board (WSIB) that provides verification that a business, contractor or subcontractor is registered with and has an account in good standing with the WSIB.

Clear-cutting harvest/cutting system. The removal of all the trees in one harvest; usually regenerates to an even-aged forest.

Contour line. A line drawn on a map connecting points with the same elevation. The steeper the slope, the closer the contour lines.

Corduroy. Logs placed side by side transversely over a wet area to reinforce the natural root mat for the purpose of minimizing the risk of settlement.

Crown. A convex road surface that allows runoff to drain to either side of the road. Or, the branches and foliage of the upper portion of a tree.

Culvert. A buried metal, plastic or concrete pipe that allows water to flow under a road or trail.

Cut and fill. Earth-moving process that entails excavating part of an area and using the excavated material for adjacent embankments or fill areas.

Cutter-Skidder Operator Program. In accordance with the *Occupational Health and Safety Act* all cut-and-skid loggers must complete and be registered in the Cutter-Skidder Operator Program.

Cut trespass. Unapproved cutting of trees on a neighbouring property.

Directional felling. Felling trees so that they fall in a predetermined direction that will cause the least damage to standing timber or the site.

Drainage structure. Any device or land form constructed to intercept and/or aid surface water drainage.

Erosion. The incorporation and transportation of soil particles by wind, water or ice.

Felling. The act of cutting down a standing tree.

Ford. A low-water crossing where you ford or drive through the watercourse. Fords are an alternative to culverts on roads and trails and are only used in limited, specific circumstances.

Grubbing. Removal of stumps, roots and vegetable matter from the ground surface after clearing and prior to excavation.

Harvest. The process of cutting and removal of trees from a forested area.

High-water mark. The point on the bank or shore up to which the presence of water is so continuous that it leaves a distinct mark, either by erosion, destruction of vegetation or other easily recognized characteristic.

Inslope. A road design feature that slopes the road surface toward the inner or uphill side of the road to facilitate drainage.

Intermittent stream. A stream that, under average precipitation conditions, only flows a part of the year. These streams may or may not have a defined bed and banks of a permanent nature.

Landing. The area where timber is collected, cut up and sorted into various products prior to loading for transport.

Leaner. A tree that leans excessively.

Lodged tree. A tree leaning against another tree which prevents it from falling to the ground.

Main line. A braided wire or a synthetic fibre cable that is attached to the winch on the skidder, used to pull trees from where they were felled to the main skid trail for skidding to the landing.

Mulch. A natural or artificial layer of plant residue or other materials covering the soil that conserves moisture, holds soil in place, aids in establishing plant cover and minimizes temperature fluctuations.

No-disturbance zone. A strip of vegetation left intact along a lake, stream, wetland, etc. during and after logging.

Outslope. A road design feature to shape the road surface to cause drainage to flow toward the outside shoulder (opposite of inslope).

Peak water flow. The highest flow level of a watercourse which will recur with a stated frequency.

Prescription (stand prescription). A stand prescription is a planned treatment of a forest site designed to change the current stand structure or condition to one that meets forest management objectives.

Residual tree/stem. Individual trees retained after a harvest.

Rip rap. A layer of rock or other large aggregate that is placed over soil to protect it from the erosive forces of flowing water (e.g. to protect stream banks, bridge abutments, inflow end of a culvert, etc.).

Rutting. A depression made by the passage of a vehicle or equipment.

Riparian area. The area where land and water meet. It is a transition zone containing upland and aquatic vegetation, soils and a variety of wildlife habitat unique to these areas.

Sediment. Solid material, both mineral and organic, that is in suspension and being transported from its site of origin by forces of air, wind, water, gravity or ice.

Seeps/seepages. Typically found along lower slopes, they are small areas where groundwater discharges slowly; the soil will remain saturated for much of the growing season. The water flowing from a seep is true groundwater, not surface runoff.

Selection harvest/cutting system. Individual trees or groups of mature and/or unhealthy trees are harvested on a selective basis. Most trees are retained, and a variety of age classes are present in the forest following harvest. An uneven-age stand results.

Shelterwood harvest/cutting system. A harvesting method in which trees are harvested in two or more successive cuts to provide seed or protection for regeneration. An even-age stand results.

Silt fence. A temporary barrier used to trap sediment-laden runoff from small areas.

Silviculture. The art and science of controlling the establishment, growth, composition and quality of forest vegetation for a full range of forest management objectives.

Silvicultural System. Described by the harvest method used, the systems consist of a planned series of treatments for tending, harvesting and re-establishing a forest stand. The three main systems used in Ontario are selection, shelterwood and clear-cutting.

Skidding. The process of moving (skid/drag) logs or felled trees from the stump to a landing.

Skid humps. A small natural bump (hump) in a skid trail that diverts surface water runoff from the trail to minimize soil erosion.

Skid trail. A temporary nonstructural trail for logging equipment to drag or carry felled trees or logs to the landing.

Slash. Any tree tops, limbs, bark and other wood debris left after a timber harvest.

Slope/grade. Degree of deviation of a surface from the horizontal, measured as a numerical ratio, as a percent or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second number is the vertical rise.

Spill kit. An emergency kit that contains an assortment of absorbents designed to absorb oil, coolants, solvents hydraulic fluids, etc, as well as repair putty and plugs, used to contain and clean up small leaks and minor spills.

Stand. An aggregation of trees that is uniform enough in species composition, age or condition to be distinguishable from other parts of the forest in adjoining areas.

Stream. A watercourse that flows year-round, has a defined channel and banks and is relatively continuous and connected with larger surface water.

Treed swamps. Are wet, wooded areas where standing water occurs for at least part of the year. Swamps tend to have more woody plants than are found in a marsh.

Tree marking. The careful process of selecting trees to be cut under a shelterwood or selection cutting system, based on good forestry practices and a prescription.

Water bar. A shallow transverse trench or mound of earth (berm) constructed across a trail or road to divert surface water flow towards the roadside ditch or into a dispersion area.

Wedge. A small plastic or metal device inserted into the saw cut to prevent a tree from falling backwards, used in directional felling and to prevent the chainsaw bar from being pinched.

Wetland. Land that is permanently covered by shallow water or land where the water table is at or near the surface. Swamps, fens, bogs, marshes and seeps are all considered wetlands in this guide.

Windthrow. A tree pushed over by wind.

Woodland pools. Are temporary pools of water that generally appear in the spring (vernal pools) from snowmelt or heavy spring rains and sometimes also form in the fall of the year (autumnal pools). They are found in small depressions in the forest and generally have no defined inlet or outlet.