Manitoba Sustainable Development
Forest Practices
Guidebook

# PROTECTION
# of
# SOFTWOOD UNDERSTOREY

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**Developed by Manitoba Sustainable Development**

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The public is encouraged to send any comments and/or recommendations to forestguidelines@gov.mb.ca.

# *Preface*

## Manitoba Forest Practices

This guidebook has been developed as part of Manitoba Sustainable Development Forest Practices Initiative. Led by the Forestry and Peatlands Branch, this guide provides direction for resource managers, timber operators, natural resource officers and auditors when conducting or assessing forestry activities.

A primary goal of the initiative is to advance best practices using guidelines and standards for sustainable forest management activities in Manitoba. These guidelines present alternative procedures or standards that can be applied to satisfy principles the guidelines are based on. Guidelines are then used to develop prescriptions. Specific guidelines are enforceable when included as conditions of an Operating Permit and/or Work Permit. Forest practices guidebooks ensure all forest resource values are appropriately addressed for the full range of forest activities.

Forest practices guidebooks are references available for resource managers, timber operators, natural resource officers and auditors. Others include provincial guidelines, forest management plans, operating plans and standard operating procedures, which are developed independently by each forest industry company.

Committee membership consists of members from Manitoba Sustainable Development branches, one regional resource manager, one forest industry member from each Forest Management Licensees, Spruce Products Ltd and the Department of Fisheries and Oceans. Standing invitations have been extended to the Forest Industry Association of Manitoba (FIAM) representing quota holders, the Manitoba Model Forest and Ducks Unlimited. Committee members co-operate in a consensus seeking manner to develop forest practice guidebooks.

Each guidebook has a complete set of guidelines for a specific forest practice, pertinent references to science, legislation, policy, agreements and licences, as well as recommendations for the planning, implementation, monitoring and enforcement of this forest practice.

The recommendations, as much as possible, are:

- measurable
- practical
- based on scientific evidence, traditional knowledge and collective experience
- flexible and applicable in a variety of ecological conditions
- clearly presented for consistent interpretation and application
- supported by technical terminology and definitions

Forestry practices in Manitoba are continuously monitored and appropriately amended when necessary. Guidebooks are reviewed every five years or earlier, if required.

Guidebooks can be found on the Manitoba Sustainable Development and Forestry and Peatlands Branch website:
http://www.gov.mb.ca/sd/forestry/practices/guidelines.html

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# PROTECTION OF SOFTWOOD UNDERSTOREY

**Purpose**
The purpose of softwood understorey protection is to protect and release acceptable softwood understorey trees while harvesting merchantable trees from hardwood, mixedwood and softwood stands.

The goals of understorey protection are to:

- contribute to forest regeneration targets with natural regeneration
- conserve and maintain tree genetics and species diversity
- protect and enhance the softwood wood supply within the forest land base
- reduce the forest renewal costs and time to re-establish softwood trees
- contribute to wildlife objectives such as distance to cover

**Background**
Young softwood trees frequently occur beneath the overstorey in mature mixedwood forests. Understorey protection is required so harvesting will not jeopardize the survival and growth of understorey softwoods. Protecting young softwood trees in a hardwood or mixedwood stand may be a strategy used to maintain mixedwood forests.

Research, trials and harvest operations have focused primarily on protecting white spruce growing beneath trembling aspen, balsam poplar and white birch. Many of the trials have occurred in Alberta. Some have also taken place in Riding Mountain National Park and by the Manitoba Model Forest.

Understorey softwood trees will also occur beneath canopies of overmature stands and in lowland black spruce areas. These stands are often characterized by having a wide range of tree heights. Softwood understorey should be p conserved to contribute to the future forest.

Understorey protection strategies should be identified during the planning phase of the operating plan. Operators with the appropriate experience should be selected to successfully protect the understorey during harvest operations.

Discussions with Manitoba Sustainable Development field staff must occur, and Integrated Resource Management Team (IRMT) approval obtained, if there is a need to significantly alter approved understorey protection strategies and methods because of the forest conditions.

## Acceptable Advanced Softwood Understorey Trees

The softwood understorey trees growing in association with hardwood, mixedwood or softwood overstoreys may consist of white spruce, black spruce and balsam fir (Figure 1).

In Manitoba, white spruce and black spruce are considered acceptable commercial softwood understorey tree species and can be effectively managed to meet several of the goals of understorey protection. Understorey protection methods recommended in this document assume that the majority of the understorey is white spruce. If the understorey is dominated by black spruce, modifications may be required to achieve adequate protection and release.

Balsam fir may be considered acceptable understorey trees if the primary management intent is to achieve goals of protecting wildlife habitat, maintaining genetic and tree species diversity and for medicinal and ceremonial purposes. Balsam fir should be protected in patches rather than single stems. When protected in patches, balsam fir suffers less physical damage during harvest and experiences less injury and mortality from exposure.

Balsam fir is a preferred food of spruce budworm and can encourage or sustain an outbreak. The amount of balsam fir in the understorey of mixedwood forests has increased in some parts of the province because of fire protection efforts and past forest management operations. The widespread protection of balsam fir will be discouraged because of the associated spruce budworm risks. It may be substituted with the planting of spruce seedlings.

Softwood understorey trees to be protected should be free of root and stem decay, stem cankers and dwarf mistletoe. If large areas of softwood understorey are diseased or infected, understorey strategies are not appropriate.

Figure 1 Acceptable softwood understorey

**Factors Influencing Understorey Protection Prescriptions**

One of the primary concerns when selecting a protection strategy is the potential windfirmness of the softwood understorey. Windfirmness is an indication of the ability of the softwood understorey to withstand significant winds after the overstorey has been removed. Determining windfirmness is very complex. Even though many of the influences on windfirmness are understood, the selection of the appropriate trees to protect and the strategies to employ will largely be based on experience.

The windfirmness potential of understorey trees can be influenced by several factors. Consideration should be given to the following characteristics when selecting softwood trees for protection.

**Rooting characteristics:**

- white spruce roots extend in several directions to a moderate depth
- black spruce is relatively shallow rooted

**Height:**

- white spruce trees should be less than 10 metres tall

- black spruce should be less than 6 metres tall,
- softwood understorey trees between 3 and 6 metres tall are ideally suited to protection
- softwood understorey trees between 3 and 6 metres tall may be supplemented with 1 to 3 metres and > 6 metres advanced growth with good windfirmness potential

**Proximity to other understorey trees:**

- single tree or patches of trees of the same or another species around understorey trees will offer protection from wind and harvest damage

**Crown length and its distance from the ground:**

- long crowns extending from the tree top to almost the ground are better than crowns only at the top portion of the trees

**Slenderness coefficient:**

- trees with slenderness coefficients of < 100 (height cm / dbh cm) will possess better windfirmness potential

Information on some of the previously listed characteristics will be collected during pre-harvest surveys. Experience with understorey protection and personal knowledge of the geographic area will be required for the forest planner to prescribe the appropriate prescription. The list above makes recommendations about the sizes and ages of softwood trees to be protected, but it may be appropriate to occasionally leave larger, older trees. Some of these softwood trees may survive and contribute to the main goals of shortening rotation ages and maintaining softwood wood supplies. Mortality and windthrow will contribute to other goals related to biodiversity and wildlife habitat.

**Understorey Protection Strategy Terms**

**Avoidance** – Avoid damaging advanced regeneration where possible. The avoidance strategy is used when there is approximately zero to 250 stems per hectare of softwoods as determined in the pre-harvest survey.

**Patch Retention** – Harvest and road location are planned to avoid clumps of advanced softwood understorey. The patch retention strategy is used when there are approximately 250 to 500 stems per hectare of softwoods as determined in the pre-harvest survey.

**Designated Trail** – This is a skid trail whose location has been predetermined as part of the harvest planning process. The location of the trail is predetermined to avoid softwood understorey. The designated trail strategy is used when there are greater than 500 stems per hectare of softwoods as determined in the pre-harvest survey. The recognition that these prescriptions are more costly both in operations and planning absorbed by the permit or license holder,

**Understorey Protection Strategies**

The following table indicates the understorey protection strategies currently available.

Table 1 Understorey protection strategies based on the number of acceptable understorey stems/ha as determined in a pre-harvest survey

| | **Avoidance**<br>0-250 stems/ha | **Patch Retention**<br>250-500 stems/ha | **Designated Trails**<br>>500stems/ha |
|---|---|---|---|
| **Required protection methods for softwood stands** | Avoid damaging advanced regeneration where possible. | Plan road location and skid trails to avoid clumps of advanced softwood understorey.<br><br>Merchantable softwood trees within leave patches and beyond reach of harvesting equipment are to be left standing. | Skidding restricted to harvest trails.<br><br>Where topography allows, trails to be perpendicular to prevailing winds.<br><br>Rub stumps and rub trees to be left along, and at the ends, of trails.<br><br>Limbing to be done at the roadside. |
| **Required protection methods for hardwood or mixedwood stands** | Leave scattered single softwood trees throughout the harvest area. | Plan road location, skid trails and harvesting to avoid clumps of advanced softwood understorey.<br><br>Leave patches of hardwood around clumps of softwood understorey for windfirmness. | Option #1 - Leave as wildlife patch if approximately 1 ha in size.<br><br>Option #2 - Harvesting overstorey:<br><br>Skidding is preferred to designated skid trails perpendicular to prevailing winds and topography.<br><br>Must leave unharvested strips between skid trails to provide additional windbreak when understorey averages over 6 metres tall.<br><br>Rub stumps and rub trees must be left along and at ends of trails. |
| **Optional protection methods** | Rub stumps and rub trees may be strategically left throughout the block as required.<br><br>May leave single softwood trees without standing hardwood protection. | Manitoba Sustainable Development may waive the limbing at the stump requirement to prevent interference with regeneration of harvested areas and skid trails due to potential amounts of excessive slash. | May restrict harvest to daytime operations only in parts of block with high amounts of understorey.<br><br>Manitoba Sustainable Development and may waive the limbing at the stump requirement. |

Figure 2 Example of avoidance of understorey trees

Figure 3 Example of avoidance strategy

Figure 4 Patch retention strategy

Figure 5 Understorey protection using operator-selected designated trails

## Management of Forest Stands with Softwood Understorey

Blocks should be subdivided into unique treatment units using pre-harvest survey results, leaf-off photographs and other detection methods.

The most appropriate understorey protection strategies for each unique treatment unit will be prescribed based on the number and distribution of acceptable softwood understorey trees. An **example** of the composition of treatment units and the prescribed understorey protection strategy is shown in Table 2.

Table 2 Composition of treatment units and the understorey protection strategy prescribed

| **Treatment Unit** | **Forest stand description as determined from the pre-harvest survey** | | **Understorey protection strategy** |
|---|---|---|---|
| | **Overstory** | **Understorey** | |
| 1 | trembling aspen 100 % | Understorey 219 stems/ha in clumps | **Avoidance** |
| 2 | trembling aspen 90%, white spruce 10% | Understorey 270 stems/ha | **Patch** |
| 3 | trembling aspen 60%, white spruce 40% | Understorey 600 stems/ha distributed throughout | **Designated Trails** |
| 4 | black spruce 100% | Understorey 270 stems/ha | **Patch** |

The assignment of understorey protection strategies (avoidance, patch, designated trails) will be based on several factors which reflect the understorey tree's ability to respond, such as tree species, age, health, distribution and windfirmness. The assignment of the appropriate strategy will also take into consideration the specific goals for each site.

## Operations Supervision

Supervisors of timber harvest operations must be fully aware of the understorey protection strategy including the forest renewal prescription and protection methods to be employed on each site. More frequent and direct supervision may be required when patch and designated trail understorey protection methods are employed or when operators have less than adequate experience with understorey protection.

On sites where understorey protection is prescribed, operations supervisors will conduct inspections before logging starts and regularly during operations to reassess site conditions and operator performance. Patches of understorey softwood trees that are significant because of the values they offer should be delineated and specific instructions for their protection communicated to operators.

## Anticipated Results

### Protection and Mortality

Within the net area where understorey protection is implemented (excluding skid trails) 40 to 60 per cent (Sauder 1992) of understorey stems are expected to be maintained. Additional losses of 15 to 25 per cent, (Navratil *et. al.* 1994) during the first three to five years post harvest, can also be expected due to wind throw and other causes of mortality.

### Damage

Some wounding of the protected softwood understorey should be anticipated during harvesting practices (Table 3). Unacceptable damage on understorey stems during the harvest phase should be noted and communicated to the operator for the continual improvement of harvesting for understorey protection. The Canadian Forest Service (CFS) research Project 1480 (Brace Forest Services 1992, Sauder, E.A. 1992) incorporated the use of many damage codes to describe wounds. Subsequent reports (Navratil *et. al.* 1994) and staff at the CFS (Lux 1998 personal communication) recommended the use of fewer general damage descriptions.

Table 3 Harvesting damages incurred during understorey protection

| ACCEPTABLE DAMAGES | | UNACCEPTABLE DAMAGES | |
|---|---|---|---|
| a) | broken or lost leader < 2 m from top | a) | broken stem > 2 metres from top |
| b) | broken branches | b) | cambium scrape > 1/3 of stem circumference |
| c) | cambium scrape < 1/3 of stem circumference | c) | any single cambium/bark scrape > 400 centimetre |
| | | d) | gouge into sapwood |
| | | e) | up-rooted |
| | | f) | leaning > 45°from vertical |
| | | g) | supporting root within 1 metre of tree stem damaged |

During active timber harvest operations fallen or damaged merchantable trees which assisted the implementation of the understory strategy may be taken (joint decision). The merchantable value and ecological benefits of the fallen trees, the risk of damage to protected trees and other values will be considered in the final decision regarding salvage.

## Site Specific Follow up Assessments

### Final Manitoba Sustainable Development Timber Inspection

Manitoba Sustainable Development final timber inspection will confirm the implementation of understorey protection strategies. The first time the understorey protection strategy **designated trail** is used by a contractor, a joint inspection by the Supervising Officer, a company representative and the contractor involved should occur to assess the success of the strategy.

## Forest Renewal

Forest companies are required to assess sites to confirm that forest renewal prescriptions have been effective. If the forest renewal prescription has not been effective, other measures may have to be prescribed to ensure the softwood component of mixedwood forest stand is re-established. Site preparation and/or planting of acceptable softwood seedlings may be required to supplement or replace understorey protection. Every effort must be taken during forest renewal activities to maintain the understorey protection achieved during harvest operations. Site preparation must avoid the rooting zones of protected understorey trees.

## Assessing the Success of Understorey Protection

The intent is to acquire evidence that understorey protection strategies and methods promoted in this guidebook are successful. Forest companies and Manitoba Sustainable Development will assess the success of applied understorey protection strategies to meet forest renewal requirements. With this information, and the experience developed in the intervening period, we will be able to develop practices through adaptive management.

**Glossary of Terms**

**Advanced regeneration** – The young trees growing under an existing stand before it is logged. If advanced regeneration survives the logging operation it may form an initial part of the new stand (Dunster 1996).

**Block** – The geographic area of trees scheduled for harvest or other treatment (Ex: cut block, spray block) (Dunster 1996).

**Ecological conditions** – A variety of conditions including climate, soil and topography that influence the vegetative composition of a forest.

**Forest Management License (FML)** – An area-based agreement between the province and a company that provides a long-term fibre supply to a wood using industry in exchange for accepting many forest management responsibilities including planning, allocating, supervising and administrating of both timber depletions and forest renewal activities.

**Forest practices** – Activities conducted during all stages of forest management. Examples are surveys, harvesting, road construction and silviculture.

**Forest renewal prescription** – A detailed plan for returning a harvested area to productive forest.

**Guidebook** – A collection of policies, guidelines, procedures and standards related to a specific forest practice.

**Guideline** – Alternative procedures or standards that can be applied to satisfy the principle on which the guidelines are based. Specific guidelines are enforceable when included as conditions of a Work Permit.

**Hardwood** – Trees belonging to the botanical group angiospermae having broad leaves that are usually shed annually. Also, stands of such trees and the wood produced by them.

**Integrated Resource Management Team (IRMT)** – A regional team organized to review natural resource issues and comprised of members of Manitoba Sustainable Development

**Mitigation** – Actions taken during the planning, design, construction and operation of works and undertakings to alleviate potential adverse effects on the land base.

**Operating Plans (OPs)** – Plans prepared and submitted annually by timber operators describing how, where and when to develop roads, harvest timber and renew the forest. They describe the integration of operations with other resource users, the mitigation of the impacts of logging, the reclamation of disturbed sites and the reforestation of harvested areas.

**Policy** – A set of decisions, methods or actions designed to fulfil predetermined objectives. (Dunster 1996) A deliberately chosen course of action. Policy in this document refers to governing principles and corresponding procedures and standards of the provincial government.

**Procedures** – A step or a series of steps taken to put into practice a policy or guideline.

**Standards** – Descriptions of targets or goals used to measure the success of procedures. They may be general or specific.

**Softwood** – Cone-bearing trees with needle or scale-like leaves belonging to the botanical group gymnospermae. The term softwood also includes stands of such trees and the wood produced by them.

**Softwood understorey protection** – Harvesting techniques that protect and release acceptable softwood understorey trees while harvesting merchantable trees from hardwood and mixedwood stands.

**Sustainable forest management** – Management that maintains and enhances the long-term health of forest ecosystems for the benefit of all living things while providing environmental, economic, social and cultural opportunities for the present and future generations (CCFM 2000).

**Slenderness coefficient –** The ratio of height to diameter a breast height. Used to estimate windthrow and breakage potential of a stand.

**Understorey trees** – The trees growing under the canopies of the other larger adjacent trees (Dunster 1996).

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