

# EXTENSION NOTES



## CARING FOR ICE-DAMAGED WOODLOTS AND PLANTATIONS

Ice storms are common in southern Ontario and play an important role in the natural cycle of forest succession. Depending on the level of damage, trees can recover from ice damage within a few years. Severe ice storms accompanied by high winds can damage large areas of forests, creating gaps in the forest canopy where species of trees that need direct sunlight can grow.

This Extension Note provides information on how to assess ice damage and what to do to make the most of an ice-damaged woodlot or plantation. For more specific information on caring for ice-damaged sugar bushes, refer to the *Interim Guidelines for the Tapping and Restoration of Sugar Bushes Affected by the Ice Storm of January 1988*, which is available at offices of the Ontario Ministry of Agriculture, Food and Rural Affairs.

### DO YOU NEED PROFESSIONAL EXPERTISE?

Before you begin to assess the ice damage in your forest, consider your knowledge of forest management principles and practices. Do you have the general and technical knowledge you need to assess the damage or to carry out the required work? Depending on your training, experience and circumstances, you may need professional help. For information on finding forestry expertise, see Extension Note: *Caring for Ice-Damaged Trees*.

### SAFETY FIRST

Before taking any action, even an assessment, consider your safety. Be careful when approaching any damaged trees. Branches that appear to be well





wedged in the crown of a tree can fall without warning at any time and cause severe injuries. Wear a hard hat at all times. Don't go near any trees that are close to power lines. When it comes time to care for your trees, don't cut any large

branches or prune unless you have been trained to do so. In recognition of the dangers of these activities, anyone who operates a chain saw for commercial purposes in Ontario must be trained and certified.

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## CONSIDER YOUR GOALS

Whether or not you have a management plan for your woodlot or plantation, it's important to consider your long-term goals before you begin your assessment. For example, if you want to provide habitat for wildlife or places for recreation, you may only want to clear access points and walking trails — even in severely damaged stands. But if you're managing a stand for timber products, you may want to harvest trees over the next few years before they lose their commercial value.

You may also want to prune and take other steps to avoid future losses. The options available to you will depend on the site conditions, age of trees, species of trees and the extent of ice damage in your forest. Combined, these and other considerations will determine whether your long-term goals need to be modified, whether investment in work on your property will generate financial returns and, ultimately, what your plan of action should be to meet your goals.

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## ASSESS THE DAMAGE

In most cases, it's wise to wait one growing season before assessing your forest. Waiting this length of time will enable you to see the full effect of the storm without incurring any long-term financial losses. Red pine plantations are an exception, however. Assess them and take any required action as soon as possible.

Follow these steps to assess the damage in each stand on your property.

### 1. DEFINE STANDS

Determine what kind of stands you have. Look for areas with different kinds of species or ages of trees. You may find that you have some of the following kinds of stands.

## DEFINE YOUR STAND

Look at your stand, what are the majority of the trees, hardwoods or conifers?

### Hardwood

Most trees are hardwoods

**Immature** — most trees are less than 10 cm dbh

**Mature** — most trees are greater than 10 cm dbh

### Conifer

Most trees are conifers

**Young** — most trees are less than 3 m tall

**Maturing** — most trees are less than 15 cm dbh

**Mature** — most trees are greater than 15 cm dbh

## 2. GATHER TOOLS

You'll need the following:

- flagging tape or tree-marking paint
- clipboard
- pencil
- calipers or a yardstick and a string
- one tally sheet for every stand

## 3. SELECT SAMPLE PLOTS

Choose three sample “plots” or spots to assess in each stand. The damage in the plots should be typical of the damage in the stand.

## 4. MARK SAMPLE TREES

Mark 10 trees in each sample plot with flagging tape or tree-marking paint. Choose trees that are representative of all the different species and sizes of trees in the woodlot. In plantations, choose five trees in two adjacent rows. Use the tally sheet (Table 1) to record the information for each plot.

## 5. RECORD SPECIES

Record the species name for sample trees.

## 6. RECORD SIZE

Estimate the diameter at approximately 1.3 metres above the ground (dbh) of sample trees in hardwood stands. Using the table of “Hardwood Size Classification” on the tally sheet, determine a tree’s size class. Mark an “X” in the appropriate column under “Size Classification.” In plantations, record the approximate age of the stand and tree height.

## 7. ASSESS DAMAGE OF EACH TREE IN THE SAMPLE PLOT

The procedure for assessing damage varies according to the main kind of damage a stand has endured. Bending is the most common kind of damage in young hardwood stands. In these stands, assess the level of bending damage as shown in Figure 1. Broken branches and stems are the most common kinds of damage in older stands. This kind of damage is called “crown damage,” and it is assessed differently in hardwood and conifer stands. Assess crown damage as shown in Figure 2 and 3. Record the appropriate damage code for each tree on your tally sheet.

## 8. SUMMARIZE RESULTS

### Bending Damage

For stands of bent saplings and trees tally the number of trees in each “Bending Damage” category. Then calculate the percentage of trees in each category. If more than 75 per cent of the trees are in bending-category 1, consider the damage to be minimal. If more than 50 per cent are in category 3, consider the damage as severe. Consider all other conditions as moderate.

### Crown Damage in Hardwood Stands

Total the number of trees in each “Crown Damage” category. If more than 50 per cent of the trees are in category 4, consider the damage to the stand to be severe. If more than 75 per cent of the trees are in category 1, consider the damage to be minimal. Consider all other conditions to be moderate.

For example, if you sampled three plots in a mature hardwood stand and 25 of the 30 trees sampled (75 per cent) were in damage class 1 (0 to 25 per cent crown damage), damage to this stand is minimal. If 10 of the 30 trees were in crown damage category 1 (no damage) and 15 were in damage class 2, damage in this stand is minimal as well. However, if 15 of the 30 trees sampled were in damage category 3, damage is moderate.

### Crown Damage in Conifer Plantations

Total the number of trees in each “Crown Damage” category. If more than 50 per cent of trees are in category 4, consider the damage to be severe. If more than 75 per cent of the trees are in categories 1 and 2, consider the damage to be minimal. Consider all other conditions as moderate.

### Assess General Stand Condition

In natural hardwood woodlots, record your observations about smaller trees on the tally sheet. What species are present? Are they bent or broken? Are there many smaller trees (a sign of successful natural regeneration)? Also look for signs of insects or diseases. In oak stands, record whether there are large numbers of gypsy moth egg masses. Gypsy moth feeding can damage foliage, possibly killing trees that are already under stress. To learn how to identify gypsy moth egg masses, see Agriculture and Agri-food Canada’s publication *No Gypsy Moth Riders*.

In plantations, record observations about any other trees that are growing around the planted trees. What species are present? Are they bent or broken? Are there many? Look for signs of insects or diseases. Pay attention to white pines, which are susceptible to white pine blister rust.

# TABLE 1 — WOODLOT & PLANTATION STAND TALLY SHEET

Stand Number:   
 Stand Type:

Date:   
 Landowner name:

Tree #	Species	Size Class (hardwoods only)				Damage Classification				Bent		
		A	B	C	D	1	2	3	4	1	2	3
<b>Plot 1</b>												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
<b>Plot 2</b>												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
<b>Plot 3</b>												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
<b>Total</b>												
<b>%</b>												

### Hardwood Size Classification

- A 10 to 25 cm (4–9 in.)
- B 26 to 40 cm (10–16 in.)
- C 41 to 48 cm (17–19 in.)
- D over 50 cm (20 in.)

### Plantation Crown Damage

- 1 no damage
- 2 up to two year's growth broken
- 3 broken crown
- 4 < three live branches

### Hardwood Crown Damage

- 1 0–25 degree crown loss
- 2 26–50 degree crown loss
- 3 51–75 degree crown loss
- 4 > 75 degree crown loss

### Bent Classifications

- 1 < 20 degrees
- 2 20–60 degrees
- 3 > 60 degrees

Comments .....

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## FIGURE 1: BENDING DAMAGE

When bending is the most significant kind of damage in a stand, estimate the degree of bending in each sample tree according to the following categories and mark an "X" in the "Bending Damage" column on the tally sheet.

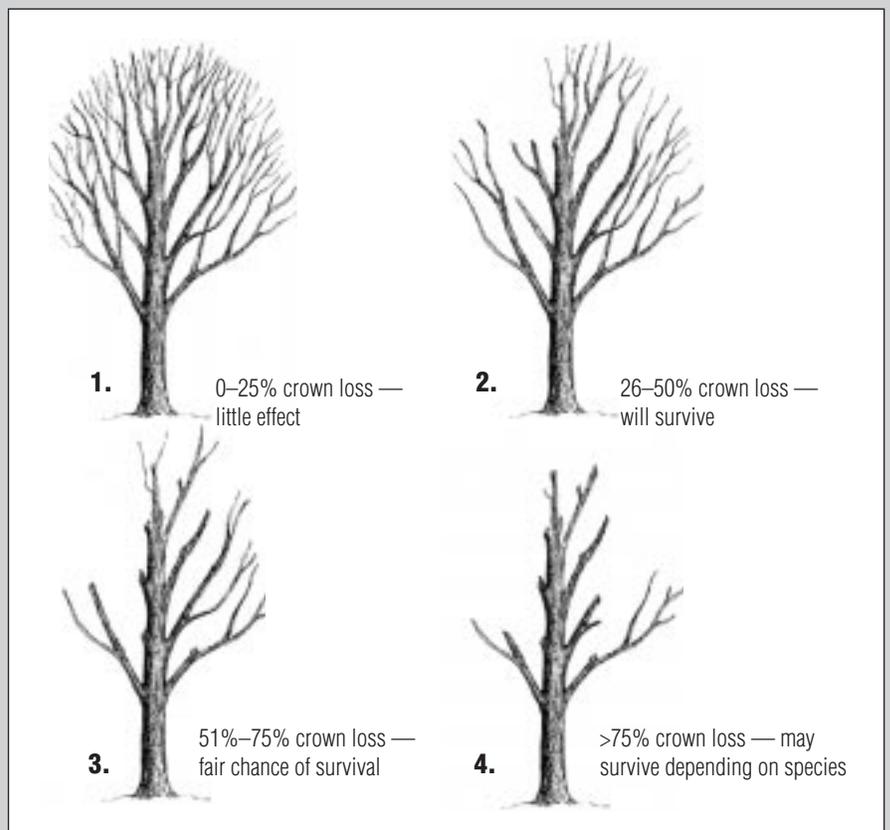
Category	Degree of Bending
1	less than 20 %
2	between 20 and 60%
3	over 60 degrees%



## FIGURE 2: CROWN DAMAGE IN HARDWOOD STANDS

Estimate the degree of damage to each sample tree's crown. Look at the places where branches have broken and try to estimate how big these branches were before the storm and how big the entire crown was. Then estimate the percentage of the crown that remains and subtract that number from 100 to get the percentage of the tree's crown that was lost. Don't worry about being precise. Instead, place the tree in one of the following categories and mark an "X" in the "Crown Damage" column on the tally sheet.

Category	Percentage Crown Lost
1	0 to 25%
2	26 to 50%
3	51 to 75%
4	greater than 75%

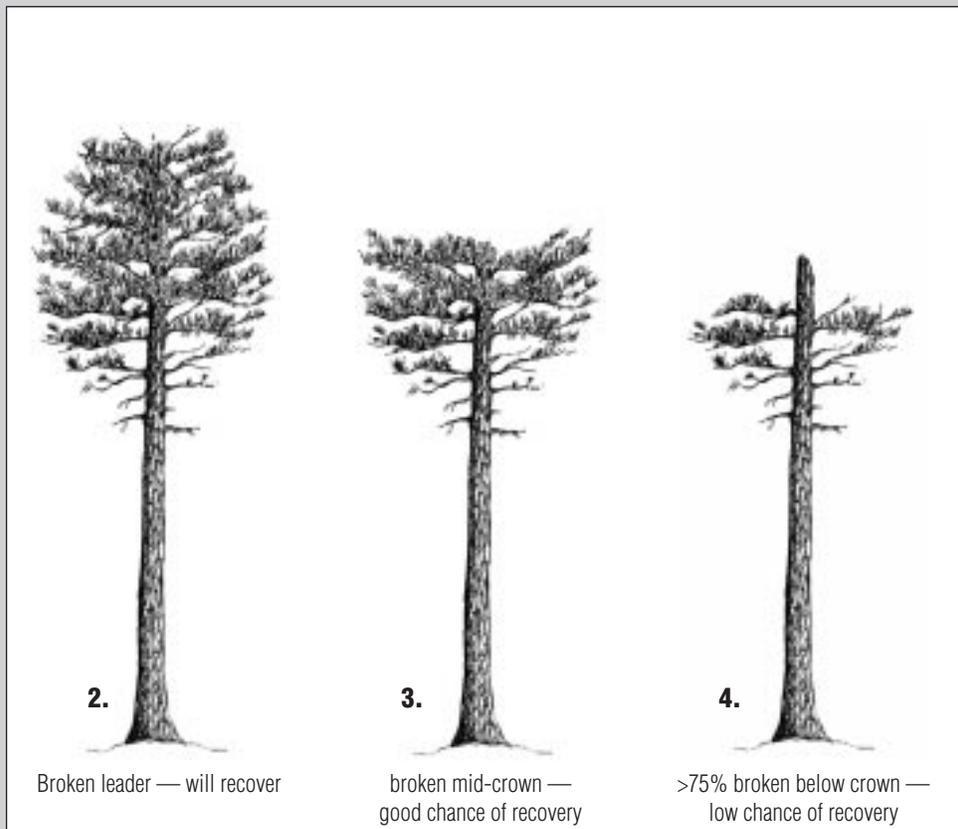


## FIGURE 3: CROWN DAMAGE IN CONIFER PLANTATIONS

The procedure for assessing damage in plantations is the same for stands of all ages and species (conifer and hardwood). Look for damage to a tree's crown and determine which of the following categories best describes a sample tree's condition. Then mark an "X" in the "Crown Damage" column on the tally sheet.

### Category    Crown Condition

- |   |  |
|---|--|
| 1 | no damage                              |
| 2 | leader and up to 2 years growth broken |
| 3 | broken in the middle of the crown      |
| 4 | less than 3 live branches remaining    |



## DETERMINE WHAT TO DO

After you have assessed the damage, consider the general recommendations below and the specific instructions in Table 2 to determine how to care for each stand.

### STRAIGHTENING BENT TREES

Don't pull trees to an upright position when they are still frozen. If you do, you could harm the tree. Gentle straightening or pulling in the spring when the trees are more flexible can be successful with smaller trees. Staking a tree to straighten it is not economically viable in most cases.

Scattered bent trees in mature forests are not a major concern. Almost all trees that are bent less than 20 degrees will straighten on their own. Most trees that are bent between 20 and 60 degrees will likely straighten. Few trees bent more than 60 degrees will straighten. If a tree has not straightened on its own by June, it most likely will not do so.

Bent trees that have straightened may have internal damage that can affect their future commercial value.



### HARVESTING TREES

When damage to a stand is minimal, little action is required. In moderate to severely damaged stands, consider harvesting individual trees or groups of trees that have category 4 crown damage. This level of damage can eliminate species or age groups from the stand. You may need expert advice to help you assess the implications of severe damage for the long-term health and value of your stand. An expert can also help you determine if there are markets for the kinds of wood products you have. For more information on marketing wood products, consult the Landowner Timber Marketing Package, which is available through the LandOwner Resource Centre.

### CONSIDER THE VALUE OF CONIFERS TO WILDLIFE

Living conifers, no matter how severely damaged, provide habitat for wildlife. If damaged conifers are not safety hazards, you may want to leave them alone. You can also leave some conifers standing for wildlife habitat and cut others to the ground to encourage faster decomposition. To prevent fires, remove large piles of broken trees and branches that are within 150 metres of buildings and 30 metres of public roads.

### ENCOURAGE SPROUTING

Many damaged trees will produce ground-level sprouts that can regenerate the forest. Species that sprout readily are red maple, silver maple, cherry, basswood, willow, oaks and poplars. To encourage sprouting, cut the tree down close to the ground before the leaves come out in the spring.



## KEEP AN EYE ON THE FOREST — MONITOR

It will take a few years before you will be able to determine the extent of the damage caused by a major ice storm. During this time, keep a close eye on the forest. Many different stresses can combine to cause serious damage. Check to see whether there are insect infestations or diseases. Look at leaf size, shape and color. Watch for resin or gum on the bark and signs of insect feeding, egg masses, conks and other fruiting bodies.

Look at the trees you marked during the assessment for signs of change. This is best done in mid- to late summer before the leaves change color.

If you don't already have one, consider developing a management plan. Forests are complex ecosystems that contain many interdependent forms of life. If you want to take wood from the forest over the long term or to develop a haven for wildlife and recreation, a management plan will help you achieve your goals and revitalize your woodlot. To find out more about developing a plan, see the following publications:

- *A Woodlot Management Plan*
- *Making Your Woodland Pay*
- Extension Note: *A Business Approach to Owning Rural Property*

## TABLE 2 — EXPECTATIONS AND RECOMMENDED ACTIONS

### MATURE HARDWOOD STANDS

#### Minimal Damage

- most trees will survive and grow a new crown within 10 years
- harvest only those trees that have severely damaged stems or, if economic value is important, damaged or deteriorating trees that could lose their future potential for wood products
- leave some damaged or deteriorating trees to provide snags and cavity trees for wildlife
- monitor stand's health over several years

### MATURE HARDWOOD STANDS

#### Moderate Damage

- most trees with 26% to 75% crown damage will survive but their growth rate may be reduced
- most trees with more than 75% crown damage will not survive, except for basswood, beech, ash, poplar and willow
- wait until the end of the first growing season to decide which trees to harvest
- consider getting expert advice to determine which trees should be harvested to improve the long-term health of the forest
- retain uncommon species, even if severely damaged, to maintain the diversity of species in the stand

### MATURE HARDWOOD STANDS

#### Severe Damage

- up to one quarter of the trees with more than 75% crown loss will survive
- it may take several years for severely damaged trees to decline and die
- extensive crown damage could open up the forest canopy allowing more sunlight to reach the forest floor, which will encourage the growth of species that need sunlight to become established and change the species composition of the future forest
- wait until the end of the first growing season to decide which trees to harvest
- harvest trees in damage category 4
- leave some severely damaged trees to provide snags and cavity trees for wildlife
- retain uncommon species, even if severely damaged, to maintain the diversity of species in the stand
- consider getting expert advice on the potential and necessity of a commercial harvest, the implications of future changes in species composition and the best courses of action

### IMMATURE HARDWOOD STANDS

#### Minimal Damage

- most trees will recover
- trees bent less than 20 degrees will straighten
- most trees bent 20 to 60 degrees will likely straighten
- trees bent more than 60 degrees are not likely to straighten
- allow bent trees until mid-summer to recover before taking action
- cut broken trees to the ground before they get their leaves in the spring to encourage sprouting from the stumps

### IMMATURE HARDWOOD STANDS

#### Moderate Damage

- cut broken trees to the ground before they get their leaves in the spring to encourage sprouting from the stumps
- allow bent trees until mid-summer to recover before taking action
- consider regenerating areas of the stand that do not recover by mid-summer by cutting all trees to the ground before the leaves come out the following spring

### IMMATURE HARDWOOD STANDS

#### Severe Damage

- bent trees are likely to survive but will remain bent
- cut broken trees and trees that are bending more than 60 degrees to the ground before they get their leaves in the spring to encourage sprouting from the stumps
- consider regenerating areas of the stand that do not recover by mid-summer by cutting all trees to the ground before the leaves come out the following spring

### YOUNG HARDWOOD PLANTATION

#### Minimal Damage

- trees will survive and crowns are likely to recover
- allow bent trees until mid-summer to recover before taking action
- if future timber value is important, apply corrective pruning to trees in damage categories 1 and 2

## TABLE 2 — EXPECTATIONS AND RECOMMENDED ACTIONS *CONTINUED*

### YOUNG HARDWOOD PLANTATION

#### Moderate Damage

- broken trees will probably produce sprouts
- allow bent trees until mid-summer to recover before taking action
- if future timber value is important, apply corrective pruning to trees in damage categories 1 and 2
- if the planted species sprouts easily, consider cutting stems in damage category 3 to the ground to encourage new growth from the stumps

### YOUNG HARDWOOD PLANTATION

#### Severe Damage

- trees broken mid-stem may sprout
- if the species sprouts easily, cut all stems to the ground to regenerate the stand

### HYBRID POPLAR PLANTATIONS

#### Minimal Damage

- allow bent trees until mid-summer to recover before taking action
- consider cutting to the ground trees that do not recover by mid-summer to encourage regeneration through sprouting
- leave some trees as potential cavity trees for wildlife

### HYBRID POPLAR PLANTATIONS

#### Moderate Damage

- allow bent trees until mid-summer to recover before taking action
- cut to the ground trees that have broken stems and no living crown to encourage regeneration through sprouting
- consider planting coniferous species under trees in heavily damaged areas
- trees with broken branches but intact stem may regrow a crown
- monitor trees over the growing season

### HYBRID POPLAR PLANTATIONS

#### Severe Damage

- allow bent trees until mid-summer to recover before taking action
- if trees are more than 15 centimetres dbh, get expert advice about the potential of a commercial harvest
- leave damaged trees alone if they have conifers growing under them
- monitor to see if trees are sprouting from the stems and remaining branches
- assess the stand frequently in coming years

### MATURE AND MATURING CONIFER PLANTATIONS

#### Minimal Damage

- there is little that can be done to protect the commercial value of trees that are damaged above the height of 5 metres
- consider harvesting dead trees to decrease risk of insect infestation

## FIGURE 4: CORRECTIVE PRUNING IN HARDWOODS

### DAMAGE TO LARGE BRANCHES

#### Cut A

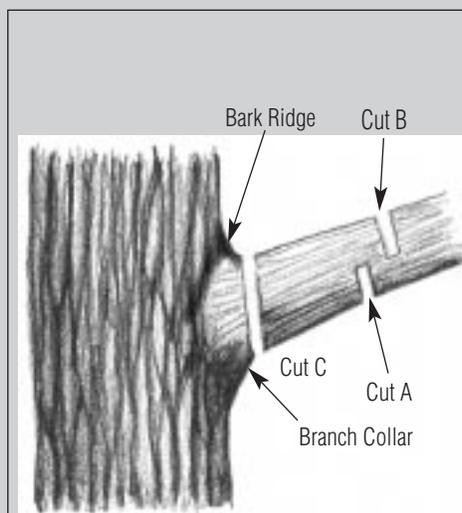
Make your first cut two feet from the trunk. Cut half way through the branch, moving from the bottom up.

#### Cut B

The second cut is one-third to half the diameter of the limb away from the first cut. Cut half way through the branch. At this point, the limb should fall from its own weight.

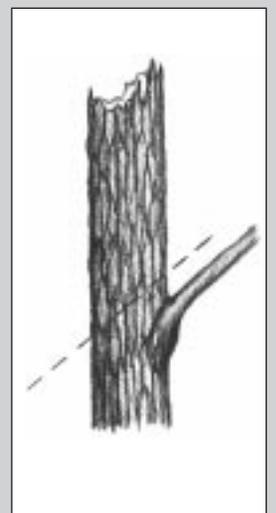
#### Cut C

The final cut is next to the trunk. Cut outside the branch collar with the lower edge being further away from the trunk of the tree.



### DAMAGE AT THE TOP OF THE TREE

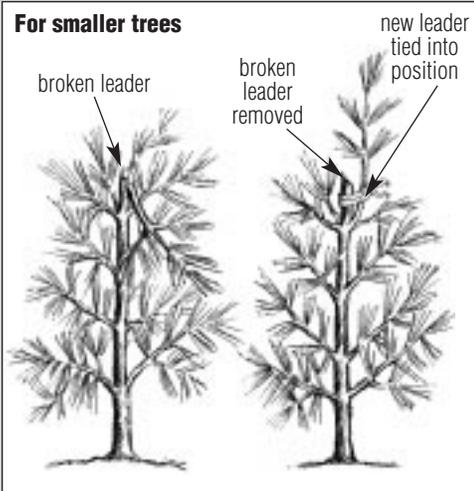
A clean, 45 degree cut at the top of the tree will prevent water from pooling and rotting the trunk. Make the cut below the break and above the next live branch that is at least one-third the size of the stem.



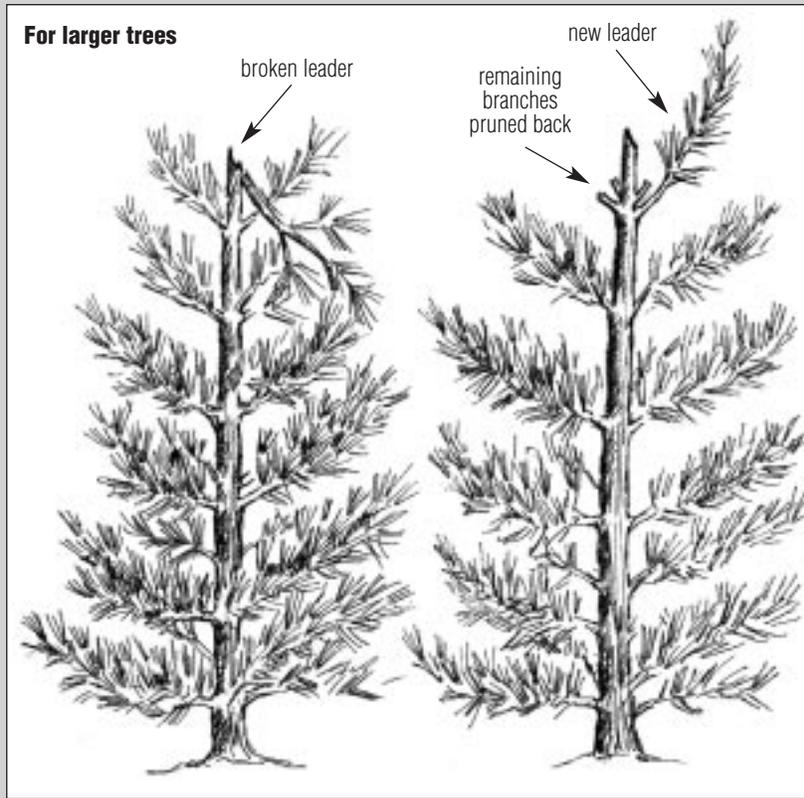
## FIGURE 5: CORRECTIVE PRUNING IN CONIFERS

Choose the strongest branch in the highest whorl as a future leader. Prune back the broken leader until it's about 10 centimetres long. Use tape or other biodegradable material to tie the new leader into position. With larger trees where it is not possible to tie up a branch, choose a new leader and prune back the remaining branches to one-third the length of the chosen leader.

### For smaller trees



### For larger trees



## TABLE 2 — EXPECTATIONS AND RECOMMENDED ACTIONS *CONTINUED*

### MATURE AND MATURING CONIFER PLANTATIONS

#### Moderate Damage

- there is little that can be done to protect the commercial value of trees that are damaged above the height of 5 metres
- harvest as few trees as possible to retain the density of trees in the stand and to encourage damaged trees to grow new leaders
- harvest red pine and white pine trees with commercial value (generally larger than 15 centimetres dbh) that are in damage categories 3 and 4 before June to reduce risk of blue stain fungus
- cut to the ground the remaining trees that are in damage category 4, as well as severely bent trees, to encourage decomposition
- leave a few damaged trees as potential cavity trees for wildlife

### MATURE AND MATURING CONIFER PLANTATIONS

#### Severe Damage

- trees in damage category 4 are likely to die
- harvest red pine and white pine with commercial value (generally larger than 15 centimetres dbh) that are in damage categories 3 and 4 before June to reduce risk of blue stain fungus

- cut to the ground the remaining trees that are in damage category 4, as well as severely bent trees, to encourage decomposition
- leave a few damaged trees as potential cavity trees for wildlife
- consider restoring the site to a hardwood forest if hardwood regeneration is present (see Extension Note: *Managing Regeneration in Conifer Plantations to Restore a Mixed Hardwood Forest*)

### YOUNG WHITE PINE AND RED PINE PLANTATIONS

#### Minimal Damage

- trees with broken tops will survive and a new leader will take over
- allow bent trees until mid-summer to recover before taking action
- consider applying corrective pruning to trees with damaged leaders

### YOUNG WHITE PINE AND RED PINE PLANTATIONS

#### Moderate Damage

- consider corrective pruning of crop trees to maintain their commercial value
- if you have not chosen crop trees, select up to 500 evenly spaced trees per hectare (200/acre) as crop trees, including as many undamaged trees as possible

**TABLE 2 — EXPECTATIONS AND RECOMMENDED ACTIONS** *CONTINUED*

- do not choose as crop trees those in damage class 3 or those that are infected with white pine blister rust
- harvest as few trees as possible to retain the density of trees in the stand and to encourage damaged trees to grow new leaders

**YOUNG WHITE PINE AND RED PINE PLANTATIONS**  
**Severe Damage**

- trees in category 3 and 4 are likely to respond to corrective pruning
- cut dead trees to the ground to encourage decomposition
- harvest as few trees as possible to retain the density of trees in the stand and to encourage damaged trees to grow new leaders
- consider harvesting and replanting heavily damaged areas (see Extension Note: *Planning for Tree Planting*)

**YOUNG WHITE SPRUCE, NORWAY SPRUCE AND TAMARACK PLANTATIONS**  
**Minimal Damage**

- trees that have lost their leaders will likely recover because these species have many lateral buds that can form new leaders

**YOUNG WHITE SPRUCE, NORWAY SPRUCE AND TAMARACK PLANTATIONS**  
**Moderate Damage**

- trees that have lost their leaders will likely recover because these species have many lateral buds that can form new leaders
- harvest as few trees as possible to retain the density of trees in the stand and to encourage damaged trees to grow new leaders
- cut dead trees to the ground to encourage decomposition

**YOUNG WHITE SPRUCE, NORWAY SPRUCE AND TAMARACK PLANTATIONS**  
**Severe Damage**

- harvest as few trees as possible to protect the plantation's density and encourage trees to grow new leaders
- cut dead trees to the ground to encourage decomposition
- consider harvesting and replanting heavily damaged areas (see Extension Note: *Planning for Tree Planting*)

**YOUNG JACK PINE STANDS**  
**Minimal Damage**

- damaged trees will enrich the soil, protect soil from erosion and provide habitat for wildlife and a cover crop for hardwood regeneration
- no action required

**YOUNG JACK PINE STANDS**  
**Moderate Damage**

- consider corrective pruning of damaged trees if timber value is important
- cut trees in damage category 4 and severely bent trees to the ground to reduce the risk of forest fires
- retain some damaged trees as potential cavity trees for wildlife

**YOUNG JACK PINE STANDS**  
**Severe Damage**

- cut trees in damage category 4 and severely bent trees to the ground to reduce the risk of forest fires
- consider restoring the site to a hardwood forest if hardwood regeneration is present (see Extension Note: *Managing Regeneration in Conifer Plantations to Restore a Mixed, Hardwood Forest*)
- consider harvesting and replanting heavily damaged areas (see Extension Note: *Planning for Tree Planting*)

**CEDAR STANDS**  
**Minimal Damage**

- most cedars will grow new crowns
- consider harvesting severely damaged trees

**CEDAR STANDS**  
**Moderate Damage**

- some cedars will grow new crowns
- consider harvesting patches of severely damaged trees
- cut dead trees to the ground to encourage decomposition

**CEDAR STANDS**  
**Severe Damage**

- consider harvesting patches of severely damaged trees
- cut dead trees to the ground to encourage decomposition
- if the cedar stand is part of a deer yarding area remove fallen branches and debris from deer trails

## FOR MORE INFORMATION

For more information on caring for ice-damaged trees, contact your nearest office of the Ministry of Natural Resources. For specific information on sugar bushes or nut trees, contact the Ministry of Agriculture, Food and Rural Affairs.

The following Extension Notes will help you care for your woodlot or plantation:

- *Cavity Trees are Refuges for Wildlife*
- *Managing Regeneration in Conifer Plantations to Restore a Mixed, Hardwood Forest*
- *Managing Young Hardwood Stands for Sawlog Production*
- *Planning for Tree Planting*
- *Selling Standing Timber*

Further reading:

- *A True Picture Taking Inventory of Your Woodlot*, Eastern Ontario Model Forest, 1997
- *Diagnosing Injury to Eastern Forest Trees: A Manual for Identifying Damage Caused by Air Pollution, Pathogens, Insects, and Abiotic stresses*. Penn State College of Agriculture, Penn State University, 1987
- *Field Guide to Tree Diseases of Ontario*, C. Davis and T. Meyers, NODA/NFP Tech Report TR-46, 1997
- *Interim Guidelines for the Tapping and Restoration of Sugar Bushes Affected by the Ice Storm of January 1998*. MNR and OMAFRA, 1998
- *Landowners Timber Marketing Package*, Resource Stewardship of S.D. & G, 1997
- *Making Cents out of Forest Inventories: A Guide for Small Woodlot Owners*, 1998
- *No Gypsy Moth Riders*, Agriculture and Agri-Food Canada pamphlet, publication number 1516B

## DEFINITIONS

### DBH (diameter at breast height)

Diameter of a tree trunk measured 1.3 metres above the ground.

### Leader

Shoot growing at the top of a tree's stem or principal branch.

### Regeneration

Young trees and the process of establishing young trees.

### Succession

Succession is the natural process of change that occurs in a forest over time as one community of living organisms replaces another. In southern Ontario, the cycle of succession usually begins when an ice storm, high wind or fire creates gaps in the forest cover. This event launches a cycle of succession which may include several different kinds of ecosystems. The cycle can take hundreds or thousands of years.

### Whorl

Ring of branches around the stem of a plant.

For more information contact:

### LandOwner Resource Centre

P.O. Box 599, 5524 Dickinson Street  
Manotick, Ontario K4M 1A5

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