



**INTERIM GUIDELINES FOR THE TAPPING AND
RESTORATION OF SUGAR BUSHES AFFECTED BY
THE ICE STORM OF JANUARY 1998**

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Issued cooperatively by
the Ontario Ministry of Agriculture, Food and Rural Affairs
and the Ontario Ministry of Natural Resources

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NOTE: This document contains a revised tapping guideline for the 1999 season.

TABLE OF CONTENTS

Introduction	3
Response of Sugar Maple to Ice Storm Damage	4
Operational Guidelines for the Clean-up and Restoration of Sugar bushes Affected by Ice Accumulations	5
Assessing Ice Storm Damage in your Sugarbush	7
OMAFRA Tree Assessment Program-Crown Damage Reports.....	7
OMAFRA Tree Assessment Maple Crown Loss Report (Sugarbush) Table 1	8
OMAFRA Tree Assessment Maple Crown Loss Report (Compartment #1) - Table 2	9
OMAFRA Tree Assessment Program Maple Crown Loss Report (Compartment #2) - Table 3	10
OMAFRA Tree Assessment Program Maple Crown Loss Report (Map) - Figure 1	11
Assessing Ice Storm Damage in Your Sugarbush-A Quick Method	12
Tree Assessment Record Form-Quick Method-Table 4	15
Tapping Ice Damaged Sugarbushes	16
Tapping Guidelines for Healthy Trees (normal) and Stressed Trees (Conservative) - Table 5	17
Interim 1999 Tapping Guidelines for Ice Damaged Sugarbushes - Table 6.....	18
Ten Important Considerations When Tapping Ice Damaged Trees.....	19
References.....	20

INTRODUCTION

A guideline for the tapping and restoration of ice damaged sugarbushes was developed in 1998 through consultation with a team of maple and other forestry specialists from Ontario and the United States. Based on review of literature, consultation with maple specialists and the results of detailed assessments of ice-damaged sugarbushes, the guidelines have been amended somewhat for 1999. Conservative tapping and careful monitoring of ice-damaged maple trees is strongly recommended.

Comprehensive guidelines for the management of ice-damaged sugarbushes will be prepared once a complete review of the literature has been completed. These guidelines will be reviewed by an advisory committee with representation from both government and industry before they are issued.

Due to the severity of tree damage, both short-term and long-term losses in the production potential of sugar bushes damaged by ice are expected. However, it is anticipated that while some trees will be lost to mortality, many others will survive even in the moderate to severe damage classes. Survival of the damaged trees will depend on a number of factors:

1. The health and condition of the trees before and at the time of the ice storm.
2. The extent and type tree of damage suffered (e.g. condition of the bole, percent loss of live crown, size of branches lost, etc.)
3. The age and vigor of the trees.
4. The productivity of the site.
5. Weather conditions, especially over the next few years. For example, a prolonged summer drought could slow recovery and cause increased mortality.
6. Other future adverse biological and environmental conditions that could place further stress on the damaged trees (e.g. insect defoliation, grazing of cattle, over tapping, improper tapping, mechanical damage to root systems and stems, etc.)

RESPONSE OF SUGAR MAPLE TO ICE STORM DAMAGE

1. Although trees have suffered loss of crowns, it should be remembered that a large proportion of the tree is represented by the root system which is still intact in all but uprooted trees.
2. Damaged trees have an altered root/shoot ratio in favour of roots because of the loss of branches. This should result in food reserves being available to compartmentalize or wall off and isolate damaged areas to prevent diseases from spreading from injuries to healthy areas.
3. Sugar maple has a moderate ability to regrow its crown after pruning. With the loss of live crown, dormant buds on the existing branches may be activated leading to the development of new branches. Healthy young trees growing on well drained fertile soils will have the greatest potential to re-establish their crowns, heal wounds and ward off insects and diseases. Careful monitoring of individual trees will be important over the recovery period.
4. Damaged branches and increased exposure to sunlight on large branches and the main stem has led to the development of epicormic branches on some trees in 1998. Further development of epicormic branches is expected over the next few years.
5. The increased exposure of the tree boles to sunlight and wind may result in sunscald damage on the bole of some trees.
6. The increased sunlight coming down through the main canopy will accelerate the growth of both desirable and undesirable understory vegetation. Retaining even severely damaged trees for 3 to 5 years will help to reduce the invasion of undesirable understory vegetation.
7. Broken branches and other freshly exposed wood are infection sites for decay fungi which may infect trees and contribute to tree decline. The extent of decay and decline will not be known for some time, therefore monitoring tree condition will be important.
8. The damage caused by ice is not expected to lead to serious insect infestations in sugar maple stands. However, populations of the most destructive pests (e.g. sugar maple borer, saddle prominent, forest tent caterpillar) should be closely monitored.
9. During the summer of 1998, tree growth and recovery of sugar maple was favoured by abundant rainfall. Many trees reacted to partial crown loss by producing larger than average leaves on remaining branches.
10. Do not graze livestock in ice damaged sugar bush as this places further stress on the trees.

OPERATIONAL GUIDELINES FOR THE CLEAN-UP AND RESTORATION OF SUGAR BUSHES AFFECTED BY ICE ACCUMULATIONS

1. For sugar bushes which are accessible to the public, post a sign to warn of potential dangers related to the condition of the trees (e.g. weak limbs, loose stems, broken branches, etc.)
2. Be aware of the danger posed by loose limbs and weak stems when working in the bush. Wear appropriate safety equipment (e.g. hard hats, steel toe boots, etc.). A reduction in the amount of snow and ice on the ground will lessen the safety hazards associated with working in the bush.
3. Consult with a forest resource professional (forest technician, forester, arborist, etc.) when completing damage assessments and deciding on a course of action. Where available reference should be made to the damage assessment completed as part of the OMAFRA Tree Assessment Program.
4. Restoring access into the sugar bush and repairing or replacing tubing systems must be completed before the sugarbush can be returned to full production. Care should be taken to ensure that the tubing system is restored following proper installation procedures.
5. In 1998 and 1999 emphasis should be placed on removing only the most severely damaged trees (e.g. those with entire loss of crown, uprooted trees and those which are safety hazards).

All but the most severely damaged trees as noted should be retained throughout the spring and summer of 1998 and 1999, since it is believed that many trees will survive including many of those with considerable crown loss.

Special emphasis should be placed on monitoring tree condition and growth response in 1998 and 1999.

By leaving the trees over several growing seasons, it will be possible to observe individual tree condition and response at the end of each growing season. Signs of declining health are cankers, conks, open wounds, early discolouration of foliage, and small leaf size.

6. Careful logging practices are recommended so that damage to tree stems and root systems is minimized. Logging and excessive traffic in the sugar bush during the spring break-up period should be avoided. In addition to the potential for damage to stems, rutting caused by tractors and skidders will damage root systems placing further stress on affected trees. Wounding of the stem and root systems will provide infection sites for decay fungi. This type of wounding could be more damaging than the ice storm because soil contact wounds are more susceptible to infection.

7. Consider individual tree damage level, individual tree age and vigor, site quality and other important stand and site factors in the decision making process leading to the restoration of sugar bushes affected by the ice storm.
8. Logging debris which is not merchantable and /or is not a barrier to access should be retained on site. Material larger than 10 cm (4 inches) in diameter should be lopped to within 60 cm (24 inches) from the ground. This debris will biodegrade over a period of time and will contribute to the productivity of the site.
9. If you are considering doing some pruning, be sure to use proper pruning techniques. These are described in the Landowner Resource Centre Extension Note entitled, "Caring for Ice Damaged Trees".

ASSESSING ICE STORM DAMAGE IN YOUR SUGARBUSH

Careful Assessment of ice-storm damage to sugar maple is important to provide the basis for operational activity in the sugarbush. Most commercial maple syrup producers affected by the ice storm have had a detailed damage assessment completed as part of the OMAFRA Tree Assessment Program. Maple producers may complete their own assessment using the methodology outlined in this guideline.

OMAFRA: Tree Assessment Program-Crown Damage Reports

In order to assess the level of crown loss to individual maple trees it is necessary to systematically place a representative sample of trees in crown damage classes. This has already been done for most of the commercial sugarbushes within the ice impact area by trained technical staff working within the OMAFRA Tree Assessment Program. Most of these maple producers will have received their crown loss reports for maple.

A sample crown loss report (by compartment) and for the sugarbush as a whole is included as:

Table 1 (Sugarbush)

Table 2 (Compartment 1)

Table 3 (Compartment 2).

These reports show the number of trees by size class and damage class. The block of trees which has reached recommended tapping size is highlighted.

Map (Figure 1) *Is included which shows compartment 1 and compartment 2.* Quite often, parts of the sugarbush are separated in space.

Table #1

Tree Assessment Program Official Assessment Summary for Ice-Damaged Sugarbushes

SAMPLE ONLY

Sugarbush Owner: Martin Arsenault

Sugarbush Total: 13.4 ha Plot Sizes Total: 0.7 ha


Township: Benson County: Frontenac

Lot: 13 Cone: I FlightLineNo: 4463

PhotoAtt: Yes Photo No: 87

Summary of the Hard Maple Trees by Damage Category

Size Class	Dia.	Crown Damage (%) Classification					Broken Stem	Uprooted Trees	Harvested Trees	Bent	
		<10	11-25	26-50	51-75	76-100				30-60°	>60°
Inches	cm										
2-3	5-9	96	153	0	0	19	0	0	0	134	211
4-9	10-24	0	77	57	0	38	19	0	0	38	77
Sub-Total	#	96	230	57	0	57	19	0	0	172	287
	%	10%	25%	6%	0%	6%	2%	0%	0%	19%	31%
10-15	25-40	0	38	77	153	230	19	0	0	0	0
16-19	41-49	0	19	77	153	230	0	0	0	0	0
20+	50+	0	0	134	172	268	19	0	0	0	0
Sub-Total	#	0	57	287	479	727	38	0	0	0	0
	%	0%	4%	18%	30%	46%	2%	0%	0%	0%	0%
Total	#	96	287	345	479	785	57	0	0	172	287
	%	4%	11%	14%	19%	31%	2%	0%	0%	7%	11%

 Trees large enough to tap

Average Crown Loss 71%

Table #2

Tree Assessment Program Official Assessment Summary for Ice-Damaged Sugarbushes

SAMPLE ONLY

Sugarbush Owner: Martin Arsenault

Compartment No: 1 Total Area Sizes Total: 0.20 ha No. of Plots: 2

Number of Compartments: 2 Township: Benson County: Frontenac

Lot: 13 Cone: 1 FlightLineNo: 4463

PhotoAtt: Yes Photo No: 87 Compart Area Size: 9.6

Summary of the Hard Maple Trees by Damage Category

Inches	Size Class	Crown Damage (%) Classification					Broken Stem	Uprooted Trees	Harvested Trees	Bent	
		<10	11-25	26-50	51-75	76-100				30-60°	>60°
2-3	5-9	0	0	0	0	0	0	0	0	0	0
4-9	10-24	0	0	0	0	0	0	0	0	0	0
Sub-Total	#	0	0	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10-15	25-40	0	19	19	19	19	0	0	0	0	0
16-19	41-49	0	0	0	0	0	0	0	0	0	0
20+	50+	0	0	57	57	19	19	0	0	0	0
Sub-Total	#	0	19	76	76	38	19	0	0	0	0
	%	0%	8%	33%	33%	17%	8%	0%	0%	0%	0%
Total	#	0	19	76	76	38	19	0	0	0	0
	%	0%	8%	33%	33%	17%	8%	0%	0%	0%	0%

 = Trees large enough to tap

Average Crown Loss 57%
(Compartment #1)

Table # 3

Tree Assessment Program Official Assessment Summary for Ice-Damaged Sugarbushes

SAMPLE ONLY

Sugarbush Owner: Martin Arsenault

Compartment No: 2 Total Area Sizes Total: .50 ha No. of Plots: 5

Number of Compartments: 2 Township: Benson County: Frontenac

Lot: 13 Cone: I FlightLineNo: 4463

PhotoAtt: Yes Photo No: 87 Compart Area Size: 3.8

Summary of the Hard Maple Trees by Damage Category

Dia Size Class	Crown Damage (%) Classification	Crown Damage (%) Classification					Broken Stem	Uprooted Trees	Harvested Trees	Bent	
		<10	11-25	26-50	51-75	76-100				30-60°	>60°
Inches	cm.										
2-3	5-9	96	154	0	0	19	0	0	0	134	211
4-9	10-24	0	77	58	0	38	19	0	0	38	77
Sub- Total	# %	96 10%	230 25%	58 6%	0 0%	58 6%	19 2%	0 0%	0 0%	173 19%	288 31%
10-15	25-40	0	19	58	134	211	19	0	0	0	0
16-19	41-49	0	19	77	154	230	0	0	0	0	0
20+	50+	0	0	77	115	250	0	0	0	0	0
Sub- Total	# %	0 0%	38 3%	211 15%	403 30%	691 51%	19 1%	0 0%	0 0%	0 0%	0 0%
Total	# %	96 4%	269 12%	269 12%	403 18%	749 33%	38 2%	0 0%	0 0%	173 8%	288 13%

= Trees large enough to tap

Average Crown Loss 69%
(Compartment #2)

OMAFRA TREE Assessment Program Maple Crown Loss Report
(MAP) Figure 1.

Canada

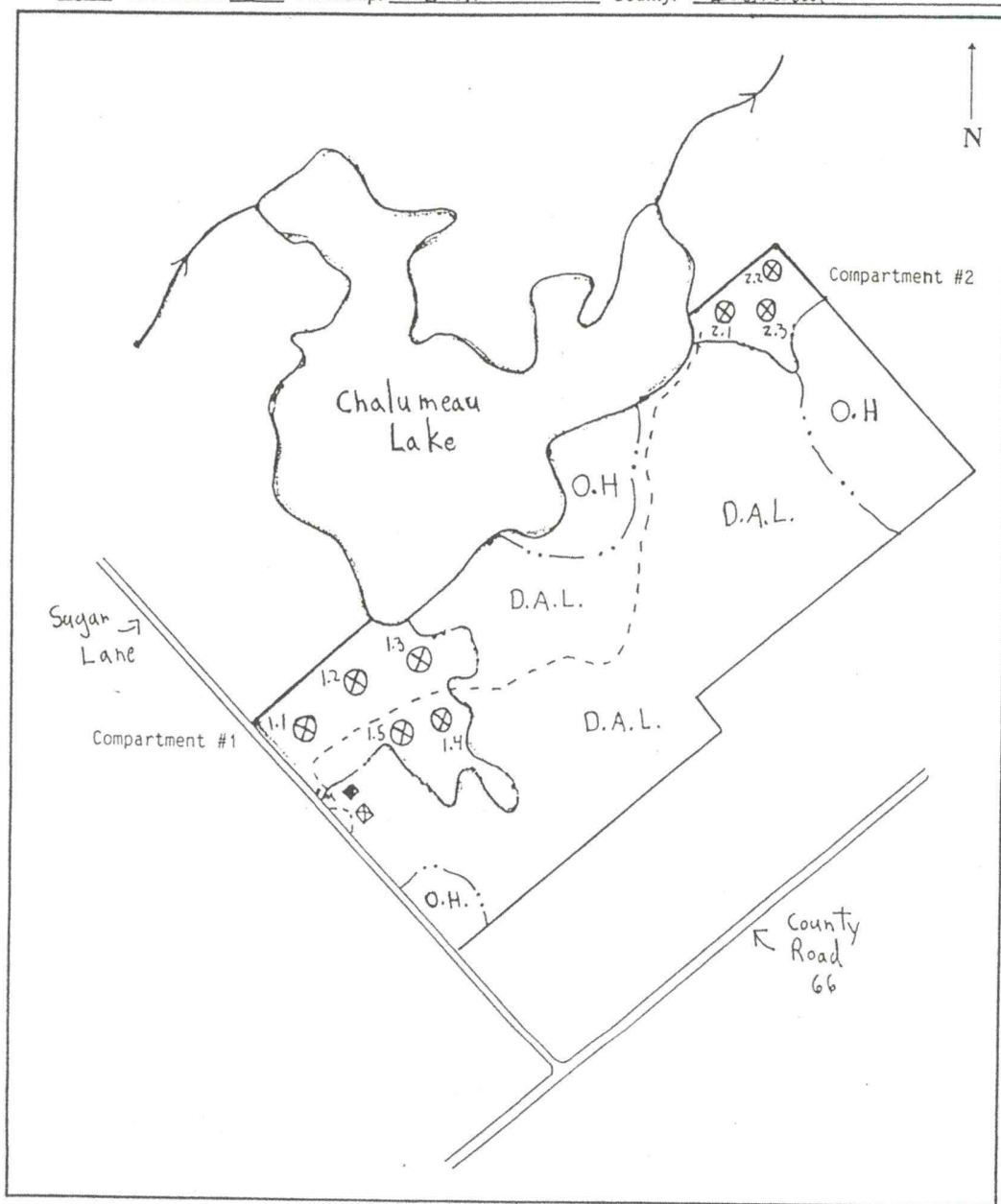
Ontario

TREE ASSESSMENT PROGRAM

Maple Syrup Production Areas

Owner's Name: Clarence McMaple Assessors: Harry Tap Gary Acer

Lot: 6 Concession: 6 Township: Brix County: Ironwood



Scale: 1 to 10,000

Date: Sept 28, 98

Assessment to Determine Damage and Tapping Potential of Sugar Bush for 1998 and 1999:

Step 1. Mapping Compartments

If you have a map of forest compartments, use this as a reference to record damage. If you do not have a forest compartment map, draw a simple map that shows areas that differ in species, composition, age, stocking and vertical stand structure as separate compartments. If the sugar bush is relatively uniform, it can be treated as one compartment.

Step 2. Sample three locations (plots) in each compartment

Repeating the assessment of a sample of trees in three locations (plots) distributed within the compartment will give a more reliable estimate.

Step 3. Assessing a sample of trees - a plot

Select a point to begin your assessment. It should not be near a road or close to the edge of the stand since these areas tend to have more damage and will give a biased assessment of the whole bush.

Try to select a point that is representative of the conditions in a majority of the compartment you are assessing.

From your starting point select the closest maple that is greater than 25 cm (10 inches) DBH. Record the crown damage class as described in the individual tree assessment section. Select the next closest maple. Continue in this manner until you have assessed 10 trees. Repeat the procedure for two additional plots for a total of three plots in a compartment. (See Table 4, page 15).

Step 4. Maple Bush Summary

If you had more than one compartment the next step would be to total the Normal Taps and Adjusted Taps over all compartments.

	Normal Taps	Adjusted Taps
Compartment 1 (see example p.15)	52	34
Compartment 2 (no example)	48	30
	100	64

Step 5. Calculating the percent of original taps remaining

$64/100 * 100 = 64\%$. Using the level of damage in the example bush above and the tapping recommendations for ice damaged trees you would have 64% of the original number of taps for the bush (before the storm).

Step 6. To calculate the number of taps for the bush:

Percent taps for damaged bush * number of taps for bush before storm = number of taps for storm damaged maple bush

Therefore, if you had 3000 taps in the bush before the storm

$$.64 * 3000 = 1920 \text{ taps}$$

This assessment indicates that you will have 1920 taps based on this degree of damage and the application of the tapping recommendations for ice damaged maple trees.

Table 4. Tree Assessment Record Form

Compartment 1

*For each tree assessed record the following information:

	DBH (in.)	Taps	Crown Damage Class	Adjusted Taps
Plot #1				
1	16	2	mod	1
2	16	2	mod	1
3	18	1	mod	0
4	18	1	light	1
5	8	0	light	0
6	18	1	light	1
7	24	3	mod	2
8	24	3	mod	2
9	8	0	-	0
10	24	3	mod	2
Plot #2				
1	16	1	light	1
2	24	3	mod	2
3	22	3	mod	2
4	16	1	light	1
5	16	1	light	1
6	16	2	mod	1
7	24	3	mod	2
8	22	2	light	2
9	16	2	mod	1
10	16	2	mod	1
Plot #3				
1	18	1	light	1
2	24	3	mod	2
3	24	3	mod	2
4	8	0	-	0
5	24	3	mod	2
6	16	2	mod	1
7	16	2	mod	1
8	18	1	mod	0
9	18	1	light	1
10	8	0	light	0
Total Taps		52	Total Adjusted Taps	34

TAPPING ICE DAMAGED SUGARBUSHES

Tapping Guidelines for healthy trees (normal guide) and stressed trees (conservative guide) are included as Table 5 in this report. These guidelines recommend a maximum number of taps per tree depending on its diameter.

In the 1998 Interim Tapping Guidelines for the Restoration of Ice Damaged Sugarbushes, conservative tapping was recommended. It was recognized that the ice damaged trees will be diverting limited energy reserves to the healing of ice-created wounds. This means that taphole closure in the critical sapwood zone may be delayed resulting in the development of more stain and eventual decay in the sapwood zone.

In 1999, a conservative approach to tapping is still advocated. However, trees exhibiting less than 25% crown loss, if healthy, should recover quickly from the effects of the storm. Normal tapping of these trees is seen as appropriate. Conservative tapping is recommended for trees with 26-50% crown loss. Conservative tapping or no tapping is recommended when the trees have from 51-75% crown loss depending on the health of the stand and the availability of replacement trees. The Interim 1999 guideline for tapping ice damaged sugarbushes is summarized as Table 6 in this report.

Tapping Guidelines for Healthy Trees (Normal) and Stressed Trees (Conservative) Table 5.

GUIDELINE 1: TAPPING GUIDELINES FOR HEALTHY TREES (NORMAL)

Diameter of tree measured outside bark, 4 1/2 feet above the ground	Number of Tap holes per Tree
less than 10"	0
10" - 14"	1
15" - 19"	2
20" - 24"	3
25" and larger	4

GUIDELINE 2: TAPPING STRESSED TREES (CONSERVATIVE)

Diameter of tree measured outside bark, 4 1/2 feet above the ground	Number of Taps
less than 12"	0
12" - 18"	1
18" +	2

1. Following proper tapping procedures is important to the recovery process.
2. Tapping in accordance with the guidelines should reduce the overall tapping injury in a sugar bush and minimize the extent of stain columns produced in the sap wood above and below tap holes.

*Interim Guidelines For Tapping Spring 1999
For Ice Damaged Sugarbushes Table 6.*

Amount of Crown Loss	Damage Class	Guidelines	Rationale
0-25%	light	Tap as usual using traditional or general tapping guidelines	Normal tapping recommended as the extent of damage is minimal and unlikely to affect the tree's survival. Tree survival should be good
26-50%	moderate	Tap using the conservative guidelines for stressed trees	The more conservative tapping rule is recommended to minimize further stress on trees. Depending on nature of damage, growing conditions etc. the trees should survive.
51-75%	heavy	Tap using the conservative guidelines for stressed trees if they were healthy at time the time of the ice storm. You may choose not to tap the more seriously damaged trees in this class particularly those trees you want to retain in the sugar bush. Option: To help maintain sap production tap less damaged trees located elsewhere if available.	Trees in this class should survive but not necessarily all of them. Their survival will depend on a number of factors including age, tree health and condition before the ice storm and the occurrence of adverse biological and environmental conditions over the next few years. During the summer of 1998, tree growth and recovery of sugar maple was favoured by abundant rainfall and the absence of wide spread stressors such as sever defoliation by insects. Based on this it is felt that easing tapping restrictions to using conservative tapping guidelines for stressed trees in this class for 1999 is warranted for previously healthy sugar bushes. If the sugar bush was not healthy previous to the ice injury consideration should be given to not tapping
Over 75%	severe	Tapping is not recommended unless trees are identified for removal . Trees deemed most unlikely to survive can be tapped as usual. These are the trees likely to be removed because of severe crown damage or breakage on the main stem. Option: To help maintain sap production tap less damaged trees located elsewhere if available.	Trees with severe crown loss may survive. Their survival will depend on a number of factors such as age, site, growing conditions and the occurrence of adverse biological and or environmental conditions over the next few years. If there is a high percentage of trees in your sugar bush in this category, serious considerations should be given to not tapping your sugar bush in 1999.

1. The guidelines are based mainly on the percentage of crown loss and the probability of tree survival in the different damage classes.

TEN IMPORTANT POINTS TO CONSIDER WHEN TAPPING ICE DAMAGED SUGARBUSHES IN 1999

1. **Carefully consider each tree and decide if it should be tapped.**
2. **Except in situations where the crown loss is 25% or less the conservative guidelines for stressed trees when tapping are recommended.**
3. **Tap 2 - 2 ½ inches deep when using the conservative tapping guidelines.**
Tapping less deep helps minimize the stain wood columns that develop above and below the tapholes following tapping. Angle the tap holes slightly upward about 10 degrees. Because they drain better they do not collect water or sap that will freeze and crack tissues or encourage the buildup of bacteria, yeast or fungi in the tap holes.
4. **Do not tap into stained wood.**
There is less chance of striking an old tap hole if the new tap holes are located in a spiral pattern six inches to eight inches away from the previous tap holes. When tap holes are drilled into stained wood areas deeper in the tree, the stained wood areas will coalesce creating larger stained wood areas within the bole of the tree which increases the incidence of decay.
5. **Use sharp drills only.**
Using sharp drills will cut a clean-edged hole through the bark reducing the occurrence of cambial dieback around the tap hole.
6. **Tap trees on all sides of the bole.**
Research has determined that there is no significant difference in tapping on specific aspects. Tapping on all sides spreads out the stain columns resulting from the tap holes.
7. **Be cautious in setting spiles.**
Driving spiles too deep into the tap hole can severely damage the tree by splitting the bark and increasing cambial damage thus delaying tap hole closure.
8. **Tap when temperatures are above -5° Celsius.**
Tap holes drilled into frozen maple wood often remain open longer than tap holes drilled into trees that are not frozen. Frozen bark splits easily when the spouts are driven.
9. **Use existing tubing and vacuum systems.**
The use of high vacuum above 10 inches of mercury at the tap hole will influence the volume production of sap particularly during sap seasons when weather conditions are less than optimal for natural flow. Vacuum influences sap volume production but not sap sugar content.
10. **Do not tap small trees.**
That is trees under 10" dbh when tapping using the Traditional or General Tapping Rule under 12" dbh when using the Conservative Tapping Guidelines for stressed trees. Small trees may be tapped only when they will be removed due to extensive ice damage.

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